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Cinnamomum genus: phytochemical diversity, biological activities, and limitations of the evidence

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1. ABSTRACT

The review by Wang and colleagues examines twelve species of the *Cinnamomum* genus, known for aromatic plants used as spices, traditional plant materials, and sources of essential oils. The work demonstrates a wide variety of compounds and experimental activities, but also cautions against treating all species as if they were equivalent.The authors' synthesis collected studies published primarily between 2015 and 2019 on the traditional uses, isolated substances, and pharmacological evidence of twelve *Cinnamomum* species. A total of 306 compounds were cataloged, obtained from bark, leaves, roots, stems, buds, and fruits. The most represented categories are terpenes (often aromatic molecules found in essential oils), phenylpropanoids, lignans, and flavonoids. The research considered reports antimicrobial, antioxidants, anti-inflammatory, metabolic, and other biological activities. However, most of the evidence is derived from experiments in test tubes, on cells, or on animals, and often concerns complex extracts rather than a single molecule. The authors also note that studies focus primarily on a few species, such as *C. cassia*, *C. camphora*, and *C. subavenium*. The review highlights deficiencies in quality control, the identification of the actual active principles, and direct clinical verification. The central message is therefore botanical and methodological: the common name is not enough to transfer chemical or biological data from one species, plant part, or extract to another product.

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2. WHAT THIS RESEARCH ANALYZED

To understand why two products labeled as cinnamon may not be interchangeable, Wang and colleagues in 2020 examined the entire *Cinnamomum* genus, rather than just a single commercial spice. The review included twelve species and gathered data on botanical names, the parts of the plant used, traditional uses, isolated molecules, and activities observed in the laboratory.The scientific detail is important: the substances were not derived solely from the bark, but also from roots, stems, twigs, leaves, buds, and fruits. The authors classified 306 chemical constituents, including terpenes and phenylpropanoids, two families of molecules that contribute to the aromatic profile and experimental biological activity, respectively. However, this inventory does not imply that all these molecules are present in common culinary cinnamon, nor that they act in the same way within the human body.

3. WHAT RESULTS EMERGE FROM THE STUDY

The most useful takeaway for the reader is that *Cinnamomum* does not refer to a single material. Different species, and even different parts of the same plant, can have different compositions. Among the twelve species considered, *C. cassia*, *C. camphora*, and *C. subavenium* were among the most studied, while information for many others was much more limited.The review describes antimicrobial, antioxidants, anti-inflammatory, antitumor, and metabolic activities. In simple terms, these results indicate that extracts or molecules from certain species have modified bacteria, cells, enzymes, or laboratory animals. The limitation is decisive: an activity observed in a cell or an animal model does not demonstrate clinical efficacy, safety, or a useful dose in humans. The authors themselves point out that the component responsible for the effect had often not been identified with certainty.

4. WHY THIS STUDY IS RELEVANT

This review is relevant because it avoids a common oversimplification: attributing results obtained with a specific species, plant part, or extract to the word "cinnamon" in general. From a biological perspective, the botanical species is the first factor that helps determine which molecules may be present; processing, the origin of the sample, and the extraction method can further modify the final profile.This step is also essential for interpreting health research. An essential oil is a concentrated aromatic fraction; an aqueous or alcoholic extract may contain different proportions of substances; a food-grade powder is yet another matrix. Therefore, the activities reported for the genus are not evidence that can be automatically transferred to every product sold as cinnamon. The review offers a map of the literature, not a unified clinical demonstration.

5. STUDY LIMITATIONS AND WHAT IT DOES NOT DEMONSTRATE

As a narrative review, the 2020 study by Wang and colleagues depends on the quality, heterogeneity, and completeness of the available studies. It does not provide a single quantitative estimate of efficacy, does not directly compare all species, and does not apply a meta-analysis protocol—that is, a combined statistical analysis of comparable studies.Furthermore, the count of 306 compounds describes substances identified in the literature, not the composition of a single package or a single sample. The presence of a compound does not prove that it is absorbed, that it reaches a target organ, or that it produces a benefit in people. The authors themselves report the absence of direct clinical evidence for the genus considered as a whole. Consequently, the work does not demonstrate that all *Cinnamomum* species have the same effects, nor that they can replace medical treatments.

6. INDEPENDENT CONFIRMATORY EVIDENCE

The need to distinguish between species is confirmed by an experimental study on 50 authentic samples of four economically important species. Chen, Sun, and Ford used flow injection mass spectrometry, a technique that detects the chemical fingerprint of a sample, to separate *C. burmannii*, *C. verum*, *C. cassia*, and *C. loureiroi*. The result supports shifting from species to chemical profiling: botanically different samples did not have overlapping compositions. This is direct confirmation, but it concerns analytical authentication rather than health effects [1].A second experimental study examined the physical and functional properties of four species using

multivariate analysis, a method that evaluates multiple characteristics simultaneously. The model separated the groups and achieved correct predictions in the verification sample. This reinforces the idea that multiple variables, rather than just the trade name, help to identify the material. The confirmation remains limited to the samples and the model analyzed [2].An independent review then gathered data on biodiversity, compounds, safety, and preclinical and clinical research for various species. It confirms that the genus includes heterogeneous plant materials and that biological indications depend on the species, preparation, and experimental context. Its limitation is that it shares the descriptive nature of the sources considered, without transforming them into equivalent clinical evidence [3].

7. CONFLICTING EVIDENCE

No directly conflicting evidence sufficiently relevant to the central observation that different *Cinnamomum* species may have different chemical profiles has been identified; this does not prove the absence of contradictory results. However, there is data that complicates the identification process. In an analysis of 14 commercial products, Wang and colleagues found metabolic differences between four species, but DNA barcoding—that is, identification using short genetic sequences—did not reliably distinguish between *C. cassia* and *C. loureiroi* using the available database. Furthermore, some labels were ambiguous or inconsistent with the results. This limits the use of a single method as definitive proof [4].A further study on barks and commercial preparations showed that species, geographical origin, processing, and product form influence chemical fingerprints. The authors identified 74 secondary metabolites and had to combine multiple analytical techniques to characterize the samples. This data does not contradict the original review, but it indicates that the composition does not depend solely on the species name and that the results from one method or one batch are not automatically generalizable [5].

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

Independent publications support variability between species, but also show the limitations of identification based on a single method or a single label.

Quadro comparativo

Publication	Model and sample size	Main result	Relationship to the Wang study
Chen, Sun, and Ford, 2014 [1]	Experimental study; 50 authentic samples of four species	Mass spectrometry fingerprints distinguished the four examined species.	Direct confirmation of chemical differences between commercially relevant species.
Rana et al., 2021 [2]	Experimental study on four species; statistical model with verification set	Physical and functional characteristics separated the analyzed groups.	Direct confirmation that identification benefits from multiple variables measured together.
Sharifi-Rad et al., 2021 [3]	Literature review; sample size not applicable	Brings together heterogeneous data on species, compounds, experimental activities, and safety.	Indirect confirmation of the botanical and pharmacological complexity of the genus.
Wang et al., 2020 [4]	Experimental study on 14 commercial products of four species	DNA did not reliably separate two species, and some labels were ambiguous.	Contextual evidence: a single authentication method may be insufficient.
Farag et al., 2022 [5]	Experimental study on barks and four commercial preparations	Complementary analytical techniques were needed to describe complex profiles.	Contextual evidence: species, origin, and processing influence the chemical profile.

9. SINTESI EDITORIALE E CONCLUSIONI

EDITORIAL CONCLUSION

The review by Wang and colleagues describes the *Cinnamomum* genus as a broad collection of aromatic plants, rather than a uniform ingredient. The main value of this work is demonstrating that the species, the part of the plant used, and the preparation method alter the substances present, making any generalization unwise. The 306 cataloged compounds document a remarkable chemical richness, but they do not equate to 306 substances present in every product, nor do they constitute proof of efficacy in humans. The reported activities primarily include preclinical results, which are useful for formulating biological hypotheses but insufficient for therapeutic indications. Independent research confirms that the main commercial species can be differentiated through targeted analysis. At the same time, studies on real-world products reveal ambiguous labeling and the limitations of individual tests. To correctly interpret information about cinnamon, the starting point remains the verifiable botanical identity of the material studied.

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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