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Cinnamomum verum: a review of the composition and identity of Ceylon cinnamon

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1. ABSTRACT

The review by Singh and colleagues brings together current knowledge on *Cinnamomum verum*, the species known as Ceylon cinnamon. It describes its botanical classification, the main compounds present, and experimental studies that have examined its biological activities, food uses, and safety data.The authors' summary presents *Cinnamomum verum* as an aromatic plant whose bark and essential oils contain many molecules, rather than a single active substance. Simply put, the aroma, composition, and potential effects observed in the laboratory depend on the combination of compounds and the specific part of the plant studied. Among the most frequently reported substances are cinnamaldehyde, eugenol, caryophyllene, cinnamyl acetate, and cinnamic acid. Cinnamaldehyde contributes to the typical intense aroma; eugenol is an aromatic compound found primarily in certain parts of the plant. The authors also collect studies on antioxidant, antimicrobial, anti-inflammatory, and metabolic activities. These labels, however, encompass very different types of evidence: experiments on cells, microorganisms, animal models, and human studies do not carry the same weight. The publication is therefore primarily useful for understanding why the botanical species and the analyzed material are essential when discussing cinnamon. It does not offer clinical proof that the spice prevents or treats diseases. Furthermore, it is not a direct experimental comparison between *Cinnamomum verum* and *Cinnamomum cassia*; such a distinction requires dedicated analytical data.

VIDEO ARTICLE

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2. WHAT THIS RESEARCH ANALYZED

For the reader, the initial message is simple: Ceylon cinnamon is not just a trade name, but corresponds to a specific plant species, *Cinnamomum verum* J. Presl. Singh and colleagues in 2021 reviewed the literature on this species, including its classification, traditional and culinary uses, identified substances, and studies on its biological activities. Scientifically, the publication describes a phytocomplex, which is a set of molecules present in the same plant material. Among those mentioned are cinnamaldehyde, eugenol, caryophyllene, cinnamyl acetate, and cinnamic acid. The work considers both bark and essential oils, but these matrices are not equivalent: the part analyzed and the extraction method can change what is measured. This point prepares the reader to interpret the reported results with caution.

3. WHAT RESULTS EMERGE FROM THE STUDY

The most robust finding of the review is descriptive: *Cinnamomum verum* possesses a complex chemical composition, and certain aromatic molecules appear frequently in its essential oils. In practical terms, it is incorrect to attribute the identity of Ceylon cinnamon to a single substance. The authors identify cinnamaldehyde and eugenol as characteristic compounds, along with caryophyllene, cinnamyl acetate, and cinnamic acid. They also summarize studies that have observed antioxidant, antimicrobial, anti-inflammatory, and metabolic activities. However, an activity observed in a test tube means that an extract or molecule has shown an effect in that specific model; it does not prove that the same response occurs in a person consuming the spice. The review does not provide a single quantitative estimate of clinical efficacy. For this reason, its results guide research but do not define certain therapeutic benefits.

4. WHY THIS STUDY IS RELEVANT

This publication is relevant because it clarifies an often-overlooked step: before discussing properties or safety, one must know which species and which part of the plant were studied. The botanical species acts as an identity document for the plant material. If two products sold as cinnamon come from different species, they may have different chemical profiles and are not automatically interchangeable. Singh and colleagues (2021) therefore provide a basis for linking Ceylon cinnamon to *Cinnamomum verum* and its main constituents. The limitation is equally important: the review does not, on its own, establish which markers allow for the identification of every commercial product, nor does it prove that a chemical profile corresponds to a specific health effect. Targeted authenticity analyses and separate biological studies are required.

5. STUDY LIMITATIONS AND WHAT IT DOES NOT DEMONSTRATE

As this is a review, Singh et al. (2021) are dependent on the quality and heterogeneity of previously published studies. The synthesis brings together results obtained with different materials, such as extracts, essential oils, and individual compounds, as well as non-comparable experimental models. Therefore, it does not allow the reported pharmacological activities to be translated into treatment recommendations. Furthermore, the summary of the publication does not report a quantitative meta-analysis, an overall clinical effect, or criteria that would allow for the estimation of an effective dietary dose. The presence of cinnamaldehyde or eugenol does not prove that they are the sole agents responsible for the observed responses, nor that they are present in the same quantity in all products. Finally, the work focuses on *Cinnamomum verum*: the difference compared to cassia is plausible from a botanical and chemical standpoint, but requires specific experimental confirmation.

6. INDEPENDENT SUPPORTING EVIDENCE

The distinction between species is confirmed by independent analytical studies. Wu and colleagues compared the bark of *Cinnamomum cassia* and *Cinnamomum verum* using metabolomics, which is an extensive analysis of the small molecules present. They identified distinct profiles and proposed markers, including proanthocyanidins and alkaloids; the number of samples is not reported in the accessible report. This directly supports the transition from species to chemical profile, with moderate confirmation because it concerns bark samples analyzed in the laboratory, not all commercial products [1].Farag and colleagues extended the comparison to four *Cinnamomum* species. The

experimental study annotated 74 secondary metabolites and 51 primary metabolites; it found a higher abundance of cinnamates in *C. verum* and coumarin in *C. cassia*. The result converges with the review's narrative, showing that the difference does not depend on a single compound. The confirmation is direct but limited to defined samples and analytical methods [2].An investigation of 52 commercial products then showed that the identity declared on the label may not coincide with the analyzed material. Ghidotti and colleagues used elemental profiles, confirmed with other analyses, to identify substitutions or irregularities. This provides practical support for the importance of botanical identification, even without measuring biological effects in humans [3].

7. CONFLICTING EVIDENCE

The available evidence does not deny the average difference between species, but shows that there is no immutable profile for every specimen. Xavier and colleagues analyzed nine samples of *Cinnamomum verum* leaves, five cultivated and four commercial. The percentages of eugenol, benzyl benzoate, cinnamyl acetate, and cinnamaldehyde varied widely. This indicates that even within the same species, there can be chemotypes, meaning groups with different chemical compositions. This finding reduces the validity of classifications based on a single marker, especially because it concerns leaves and not bark [4].A second experimental study on 71 accessions of *Cinnamomum cassia* detected phenotypic, chemical, and genetic variations, with three groups identified by population analyses. The authors also evaluated 12 bark samples for certain volatile oil constituents. This suggests that the origin of the material and internal variability can influence the profile of cassia. It does not contradict the distinct identity of *C. verum*, but it suggests that cassia should not be treated as having a unique and constant composition [5].

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

The following studies compare or contextualize the botanical and chemical distinction described in the 2021 publication by Singh and colleagues.

Quadro comparativo

Publication	Model and main data	Key finding	Relationship to the reference study
Wu et al., 2021 [1]	Metabolomic analysis of C. cassia and C. verum bark; sample size not available in the accessible report.	Clearly separable metabolic profiles and candidate markers.	Direct confirmation of compositional differences between the two species.
Farag et al., 2022 [2]	Experimental study on four species; 74 secondary and 51 primary metabolites annotated.	Cinnamates more abundant in C. verum; coumarin more represented in C. cassia.	Direct confirmation that composition varies between species.
Ghidotti et al., 2023 [3]	52 commercial products: 29 Ceylon, 8 cassia, and 15 with no declared variety.	Irregularities or non-compliance detected in 58% of samples.	Indirect confirmation of the importance of verifying product identity.
Xavier et al., 2022 [4]	Nine C. verum leaf samples: five cultivated and four commercial.	Wide variability of main volatile compounds within the same species.	Contextual evidence: a single marker does not always identify every sample.
Han et al., 2024 [5]	71 C. cassia accessions; morphological, chemical, and genetic analysis.	Internal variability and three population groups detected.	Contextual evidence: even cassia does not have a uniform profile.

9. SINTESI EDITORIALE E CONCLUSIONI

EDITORIAL CONCLUSION

The 2021 review by Singh and colleagues describes *Cinnamomum verum* as a botanically defined and chemically complex species. Its main contribution is explaining that Ceylon cinnamon contains a set of molecules, including cinnamaldehyde and eugenol, and that composition, the part of the plant used, and the extraction method influence what is detected. However, the biological activities collected by the authors come from heterogeneous evidence and do not equate to proven clinical benefits. Subsequent laboratory studies confirm that *C. verum* and *C. cassia* can be distinguished through chemical and analytical profiles. At the same time, the variability observed within each species shows why it is not prudent to use a single compound as an absolute criterion. Overall, the evidence supports the importance of botanical identity for interpreting research, labels, and the composition of cinnamon, without allowing for therapeutic conclusions based solely on the species.

Aggiornato al 05/11/2026. 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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