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ORIGINAL RESEARCH

Gains and losses in agricultural food production: implications for the twenty-first century - Review of evidence

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1. ABSTRACT

The study analyzed is a narrative review on changes in modern agricultural and food systems. The authors argue that crop simplification, processing technologies, and the pursuit of more palatable foods may reduce fiber, complex carbohydrates, micronutrients, and certain classes of phytochemicals, i.e., biologically active plant molecules. The full text is not available in the provided material; therefore, detailed methods and results not reported in the abstract cannot be reconstructed.In the section "The Choice to Live in Health or Illness" by Dr. A. Colonnese and R. Panzironi, the publication contributes to the statement that many bitter and astringent compounds have been reduced through varietal selection and industrial de-bittering processes to make foods sweeter and more acceptable. Independent research documents the genetic selection of less bitter fruits in cucumber, melon, and watermelon and shows that some de-bittering processes remove phenolic compounds. However, the effects depend on the species, the molecule, and the method used; it is not proven that the reduction of bitterness always equates to an overall nutritional loss.

ONLINE ARTICLE

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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 modern agricultural and food supply chains have produced benefits, such as greater food availability, but also significant losses in agricultural diversity, nutritional composition, and public health. The hypothesis discussed is that the progressive standardization of crops and foods has reduced certain components considered important for diet quality, including dietary fiber, complex carbohydrates, micronutrients, and phytochemicals.The relevance to the section "The Choice to Live in Health or Illness" by Dr. A. Colonnese and R. Panzironi concerns a specific segment of the narrative: the orientation of production toward more easily accepted flavors may favor the reduction of bitter or astringent substances. Bitter and astringent do not automatically indicate beneficial or harmful substances: they describe sensory characteristics that can depend on very different molecules, including plant defense substances and phenolic compounds.The analyzed study can therefore support the general context of the loss of certain phytochemicals in modern supply chains. However, it cannot, on its own, prove that every commercial variety is less rich in bioactive compounds than every traditional variety, nor that reduced bitterness causes a deterioration in human health.

3. MATERIALS AND METHODS OF THE ORIGINAL STUDY

The publication is a narrative review of the literature on agri-food systems. Based on the available abstract, the authors discussed the reduction in agricultural biodiversity, changes in dietary composition, and potential innovations in food production, monitoring, processing, and distribution.The available material does not report a detailed bibliographic search strategy, databases consulted, inclusion and exclusion criteria for studies, the number of selected publications, methodological quality assessment protocols, or aggregate statistical analyses. This information is not provided in the available material. There are no human participants, intervention groups, clinical follow-ups, or directly measured health endpoints.

4. RESULTS

The abstract states that, over the last century, agricultural and food processing advancements have contributed to reducing hunger and poverty, yet without adequately addressing sustainability goals. The authors describe an erosion of agricultural biodiversity and balanced diets, alongside the progressive loss, in modern supply chains, of dietary fiber, complex carbohydrates, micronutrients, and various classes of highly bioactive phytochemicals.Regarding the passage cited in the book, the most relevant result is conceptual: food selection and processing may prioritize sensory and commercial characteristics, including reduced bitterness and astringency. The abstract does not provide quantitative data on specific plant varieties, concentrations of individual phytochemicals, industrial de-bittering methods, or direct comparisons between modern and traditional foods. These data are not reported in the available material.The available text does not report statistical significance values, confidence intervals, sample sizes, or effect sizes. For this reason, the publication does not allow for a quantitative estimate of how frequent or significant the loss of bitter and astringent compounds is across different crops.

5. INTERPRETATION

In simple terms, plants produce many molecules that influence flavor. Some make a fruit bitter, while others cause astringency, which is that dry or rough sensation in the mouth. These substances can discourage insects and herbivores or contribute to the sensory characteristics of the product. If farmers, breeders, and industries prioritize sweeter or less bitter fruits, the quantity of some of these molecules may decrease.The segment documented by the publication subject to the Evidence Review is therefore: modern agricultural and food supply chains loss or reduction of certain classes of phytochemicals. The book's paragraph extends this idea to the more specific case of intentional selection against bitterness and astringency. This extension is biologically plausible and finds independent confirmation in specific crops, but it should not be transformed into the general claim that all eliminated compounds are protective or that all modern foods are nutritionally

inferior.The distinction is also important because some bitter compounds, such as cucurbitacins in fruits of the cucurbit family, are defense molecules and can be undesirable or even problematic at high concentrations. Selecting a less bitter food can therefore have a sensory and safety-related motivation, not just a commercial one.

6. INDEPENDENT CONFIRMING EVIDENCE

Direct confirmation of the agricultural part of the narrative comes from a genetic and biochemical study on the cucumber. Researchers identified nine genes involved in the synthesis of cucurbitacin C, a triterpene responsible for bitterness, and two distinct genetic regulators for leaves and fruits. Analyses of genomic selection signatures indicated that, during domestication, selection on the fruit bitterness regulator favored the emergence of non-bitter cucumbers from bitter ancestors [1]. The study concerns one crop and a specific family of molecules: it demonstrates a mechanism of selection against bitterness, not a universal loss of phytochemicals in all vegetables.A second study extended the same observation to cucumber, melon, and watermelon. Through comparative genomics, biochemical analyses, and experimentation on regulatory genes, the authors showed that the loss of fruit bitterness in the three species occurred through convergent modifications of fruit-specific regulators. This arrangement allows for the reduction of cucurbitacins in the edible part without necessarily eliminating the plant's entire defensive system [2]. It is a robust mechanistic confirmation of the direction described in the book: selection can reduce bitter compounds to make the fruit more palatable.Further confirmation comes from a study on wild, cultivated, and domesticated watermelons. Metabolomic analysis—the measurement of many small molecules produced by the plant—revealed negative selection of cucurbitacins and flavonoids during the evolution and domestication of the watermelon, while sugars and carotenoids were positively selected during domestication. Functional experiments linked specific genetic variants to lower synthesis of cucurbitacins in cultivated watermelons [3]. The data confirms a reduction in compounds associated with bitterness, but does not allow for attributing a single nutritional or clinical significance to the negatively selected flavonoids.The industrial component of the book's statement finds an example in table olives. In a laboratory comparison between conventional and ultrasound-assisted debittering, the accelerated procedure increased the removal of phenolic compounds responsible for bitterness and reduced the time required for treatment by 37.8% in water and 38.6% in brine [4]. This shows that debittering can modify or reduce phenols. The result concerns olives and a specific procedure; it does not authorize extending it indiscriminately to fruit, vegetables, or grains.

7. CONFLICTING EVIDENCE

No directly conflicting evidence of sufficient relevance has been identified; this does not prove the absence of contrary results. The available evidence, however, requires a contextual interpretation. In the case of cucurbits, the loss of bitterness does not automatically equate to the loss of all the plant's defense systems: genetic modifications may be limited to the fruit while leaving other functions active in tissues not intended for consumption [2].Furthermore, the study on olives shows that ultrasound treatment, while increasing the removal of phenols associated with bitterness, maintained higher antioxidant activity compared to conventional debittering [4]. This does not contradict the reduction of specific phenols, but indicates that the effects of processing on product quality depend on the method, the food matrix, and the indicator used. It is therefore incorrect to consider every debittering process as synonymous with an identical biological or nutritional loss.

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

The table distinguishes the publication subject to the review from the independent research used to verify the specific passage in the book.

Quadro comparativo

Reference	Study type	Population or model	Main result	Direction of evidence	Strength of evidence
Original study	Narrative review	Agricultural and food systems; no unique experimental population	Describes the progressive loss of certain classes of phytochemicals in modern supply chains	biologically consistent evidence	moderate
[1]	Plant genomics and biochemistry	Cucumber, genes and lines with different bitterness	Selection during the domestication of the fruit bitterness regulator favored non-bitter cucumbers	direct confirmation	moderate
[2]	Comparative genomics and plant functional study	Cucumber, melon, and watermelon	Convergent mutations of fruit regulators are associated with the loss of bitterness in three cucurbits	direct confirmation	moderate
[3]	Metabolomics, genomics, and plant functional experiments	Wild and cultivated watermelon accessions	Cucurbitacins and flavonoids were negatively selected; sugars and carotenoids positively	direct confirmation	moderate
[4]	Experimental food technology study	Table olives treated in water or brine	Ultrasound-assisted debittering increases the removal of phenols responsible for bitterness	indirect confirmation	low

9. SINTESI EDITORIALE E CONCLUSIONI

CONCLUSIONS

The passage from the book is moderately supported regarding the intentional reduction of specific bitter or astringent compounds through plant domestication and food processing. The evidence is particularly strong in cucurbits, where genetic mechanisms favoring less bitter fruits have been identified. It is also documented that certain debittering treatments for olives reduce phenolic compounds.However, the conclusion must remain circumscribed. Bitterness, astringency, phytochemical content, and overall nutritional value are not synonymous. The data do not demonstrate that all modern varieties are less nutritious, that every industrial process inevitably reduces protective substances, or that such variations automatically produce clinical consequences in humans.

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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