UNIVERSITY OF LIFE SCIENCES "KING MIHAI I" FROM TIMISOARA
"YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH IN APPLIED LIFE SCIENCES"

05-06 November 2026



AMLA (*PHYLLANTHUS EMBLICA* L.) POWDER AS A FUNCTIONAL INGREDIENT IN FLOUR-BASED PRODUCTS: COMPOSITION, BIOACTIVE POTENTIAL, AND TECHNOLOGICAL EFFECTS

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Abstract: Demand for foods that combine sensory quality with health benefits has encouraged the incorporation of fruit-derived ingredients rich in bioactive compounds into cereal-based products. This review synthesizes published data on the chemical profile and bioactive potential of amla powder, as well as its performance as an ingredient in flour-based products. Amla, also known as Indian gooseberry, is the fruit of *Phyllanthus emblica* L., a tree native to India and Southeast Asia. The fruit is processed into powder by sun drying, oven drying, or freeze drying, followed by milling. Dried amla powders are an important source of ascorbic acid (641–1601 mg/100 g) and phenolic compounds (113–161 mg gallic acid equivalents (GAE)/g), including gallic acid and tannins. Potassium is the predominant mineral (approximately 2544 mg/100 g), followed by phosphorus, calcium, and magnesium. Powder obtained from the amla pomace remaining after juice extraction contains up to 41.7 g/100 g of dietary fibre. Powder composition and the effects of its incorporation into dough vary depending on the drying method, incorporation level, and product formulation. The addition of 0.25–0.5% amla powder to wheat flour pan bread increased specific loaf volume, with the best results obtained using freeze-dried powder. At incorporation levels of up to 1%, increases in phenolic compound and vitamin C contents, as well as antioxidant capacity, were reported. In another study, amla powder incorporated at 5% yielded bread with acceptable sensory quality, whereas a 10% level was associated with a sour taste and lower acceptability. In biscuits, replacing up to 20% of wheat flour with amla pomace powder increased crude fibre content from 0.97% to 3.80%, while incorporating 7.5–15% amla pomace powder alongside germinated finger millet flour also increased vitamin C content. These findings highlight the potential of amla fruit powder as a source of ascorbic acid and polyphenols, and of amla pomace powder as a source of fibre. The use of these ingredients in flour-based products requires optimization of incorporation levels according to their composition, acidity, and the characteristics of the food matrix, to improve the nutritional profile while maintaining technological quality and sensory acceptability.

Keywords: amla, *Phyllanthus emblica*, flour-based products, ascorbic acid, polyphenols

• Introduction

The demand for foods that combine sensory quality with health benefits has encouraged the incorporation of fruit-derived ingredients rich in bioactive compounds into cereal-based products.

Amla is the fruit of *Phyllanthus emblica* L. (Indian gooseberry), a tree native to India and Southeast Asia. Polyphenols and vitamin C are its central bioactive components and confer significant antioxidant activity; anti-hyperlipidemic, antidiabetic, anti-inflammatory and neuroprotective effects have also been reported (Gul et al., 2022).

The fruit is converted into powder by sun-drying, oven-drying or freeze-drying followed by grinding, and the drying method influences powder composition (Alkandari et al., 2019).

The aim of this review was to summarize data on the chemical profile and bioactive potential of amla powder and on its behaviour as an ingredient in flour-based products.

• Material and method

Scientific articles were identified through online searches using the keywords amla, *Phyllanthus emblica*, *Emblica officinalis*, bread, biscuits and cake.

- **Inclusion criterion:** studies on amla fruit powder, amla pomace powder or amla seed extract used in flour-based products.

• Results and discussions

- **Composition:** dried amla powders contain 641–791 mg/100 g ascorbic acid and 113–161 mg GAE/g phenolic compounds (Alkandari et al., 2019), up to 1601 mg/100 g ascorbic acid and ~8100 mg/100 g tannins (Pamidighantam et al., 2023), ~3000 mg/100 g gallic acid and ~2544 mg/100 g potassium (Mishra & Mahanta, 2014). Amla pomace powder contains up to 41.7 g/100 g dietary fibre (Raju et al., 2025).
- **Antioxidant capacity:** TEAC values of 6.6–7.6 mM/g for dried powders (Alkandari et al., 2019).
- **Bread:** 0.25–0.5% amla powder increased specific loaf volume (best with freeze-dried powder); up to 1% raised phenolics from 0.32 to 1.16 mg GAE/g, TEAC from 0.06 to 0.14 mM/g and vitamin C from 3.80 to 31.98 mg/100 g (Alkandari et al., 2019). At 5% replacement, acceptability was similar to the control; 10% gave an acidic taste and lower acceptability (Rajeswari et al., 2018).
- **Biscuits:** up to 20% amla pomace increased crude fibre from 0.97% to 3.80% (Thorat et al., 2011; Figure 1); 7.5–15% pomace with germinated finger millet increased fibre and vitamin C (26.28–49.15 mg/100 g) (Kohli et al., 2019).
- **Oxidative stability:** amla seed extract limited lipid oxidation in biscuits and sponge cakes as effectively as BHT and TBHQ, without affecting sensory quality (Lankanayaka et al., 2025).

• Conclusions

- Amla fruit powder is a valuable source of ascorbic acid and polyphenols, while amla pomace provides dietary fibre.
- Low inclusion levels improve the nutritional and antioxidant profile of flour-based products.
- The incorporation level must be optimized according to acidity, product matrix and sensory acceptability.

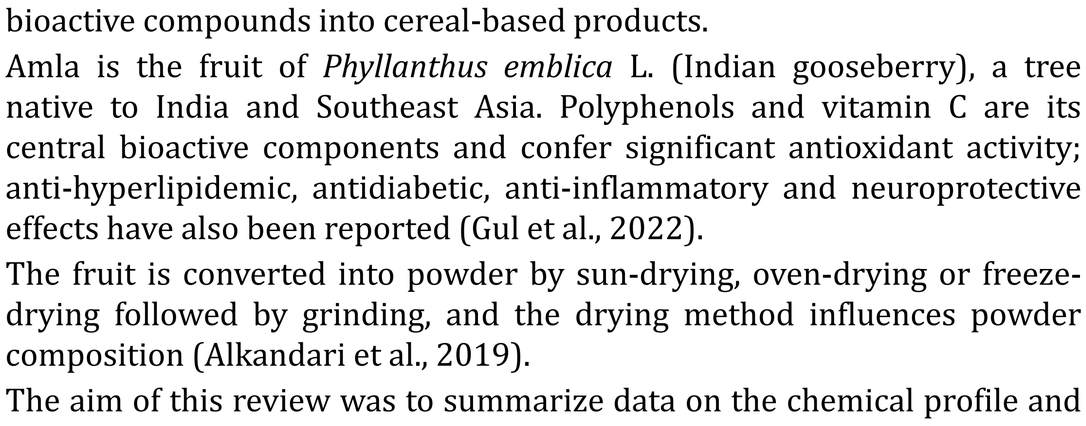


Figure 1. *Crude fibre of biscuits with 0–30% amla pomace replacing wheat flour; 20% gave the best overall acceptability (data from Thorat et al., 2011).*



Figure 2. *(a) Amla fruits and (b) amla pomace powder (Raju et al., 2025); (c) biscuits and (d) bread with amla powder (AI-generated illustrations).*

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