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Beetroot extract powder as a nutraceutical: Insights into its chemical composition and phenolic profile

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Abstract

Beetroot (*Beta vulgaris L.*) has recently gained considerable recognition as a nutraceutical owing to its high content of bioactive compounds and their related health benefits. In the present study, the chemical composition and bioactive ingredients of beetroot extract powder were investigated to explore its potential as a nutraceutical ingredient. The extract was analysed for proximate composition, total polyphenols and tannins using established *in vitro* assays. The beetroot extract powder contained 3.61 mg gallic acid equivalents (GAE)/g of total polyphenols and 2.08 mg tannic acid equivalents (TAE)/g of tannins. Proximate analysis of beetroot extract powder revealed that it contained 94.14 percent dry matter, 90.74 percent organic matter, 10.81 percent crude protein, 4.02 percent crude fibre, 0.89 percent ether extract, 9.26 percent total ash, 1.76 percent acid insoluble ash and 75.02 percent nitrogen free extract. These findings indicate that beetroot extract powder contains appreciable levels of phenolic compounds and exhibits significant antioxidant and anti-inflammatory activities. The results highlight its potential as a functional nutraceutical ingredient.

Keywords: Nutraceutical, beetroot extract powder, tannins, polyphenols, proximate composition

Introduction

The link between diet and disease has long been acknowledged as a fundamental principle of preventive nutrition. Although functional foods are often presented as a modern innovation, the concept traces back to ancient Indian Vedic literature and traditional Chinese medicine. The modern pursuit of functional foods is rooted in the Eastern belief that food and medicine stem from the same source. The initiative to develop functional foods originated in Japan in the 1980s as a response to increasing healthcare costs (Henry, 2010)^[1]. Growing attention toward functional foods can be attributed to three main factors: the rising cost of healthcare, new regulatory developments, and advancements in scientific research. Establishing strong scientific evidence supporting the health benefits of functional foods and their bioactive compounds has become a major area of interest (Milner, 2000)^[2]. Nutraceuticals have their roots in ancient medicinal practices and have gradually developed into modern dietary supplements, with the term first coined by Stephen DeFelice in 1989. Nutraceuticals originate from various food sources, including superfoods, dietary supplements, phytochemicals, fortified foods, and genetically engineered products. They provide health advantages that go beyond basic nutrition, including boosting immunity, promoting overall well-being, and aiding in the prevention and management of diseases (Chavan *et al.*, 2025)^[3]. Since ancient times, humans have utilized plants for both nutrition and medicinal purposes.

Beetroot (*Beta vulgaris*) is a highly nutritious vegetable increasingly valued for its phytonutrient-rich composition and health-enhancing potential. It is abundant in bioactive compounds, including betalains, dietary nitrates, polyphenols, and flavonoids, which impart significant antioxidant, anti-inflammatory, and cardioprotective effects (Kumar *et al.*, 2011)^[4].

This study was conducted to evaluate the potential of beetroot extract powder as a nutraceutical. Therefore, the present study evaluated the properties of beetroot including total phenolic content, total tannin content and proximate composition.

Materials and Methods

Preparation of beetroot extract powder

Fresh beetroot (*Beta vulgaris* L.) roots were procured from a local market, washed thoroughly to remove dirt, and peeled. The roots were sliced into thin pieces and shade dried at ambient temperature (25-30 °C) with adequate air circulation for 5-7 days until completely dried. The dried slices were then ground into a fine powder, sieved through a 60-mesh sieve, and stored in airtight containers at 4 °C until further analysis.

Proximate analysis

The proximate composition of beetroot extract powder sample was done as per the standard procedure (AOAC, 2023) [5].

Estimation of Tannins

Total tannin content of the beetroot extract powder was estimated using the Folin-Denis method as described by Polshettiwar *et al.*, (2007) [6]. Briefly, 0.5 ml of the sample extract was mixed with 0.5 ml distilled water and 0.5 ml Folin-Denis reagent, followed by addition of 4.5 ml of 2 percent sodium carbonate solution. The mixture was incubated and the absorbance was measured at 725 nm using a spectrophotometer. Tannic acid was used as the standard and the results were expressed as mg tannic acid equivalents per ml of extract (mgTAE/g).

Estimation of total polyphenol

Total polyphenol content of beetroot extract powder was determined using the Folin-Ciocalteu method described by Mallick and Singh (1980) [7]. Briefly, 0.5 ml of the sample extract was mixed with 800 µl of Folin-Ciocalteu reagent and 2 ml of 2 percent sodium carbonate solution. The mixture was diluted with distilled water and incubated in the dark for 2 h. Absorbance was measured at 765 nm using a spectrophotometer. Gallic acid was used as the standard for calibration, and the results were expressed as mg gallic acid equivalents (GAE) per ml of extract.

Results and Discussions

Proximate composition of beetroot extract powder

The percent chemical composition of Beetroot extract powder on dry matter basis used in the experimental diet is presented in Table 1.

Table 1: Proximate composition of beetroot extract powder

Parameters (%)	Values
Dry matter	94.14±0.092
Organic matter	90.74±0.160
Crude protein	10.81±0.050
Crude fibre	4.02±0.017
Ether extract	0.89±0.011
Total ash	9.26±0.047
Acid insoluble ash	1.76±0.011
Nitrogen free extract	75.02±0.106

(Values are expressed on dry matter basis; Mean value based on six replicates with standard error).

Beetroot extract powder contained 94.14±0.092 percent dry matter. The crude protein, crude fibre, ether extract, total ash, nitrogen-free extract and acid insoluble ash contents were 10.81±0.050, 4.02±0.017, 0.89±0.011, 9.26±0.047, 75.02±0.106 and 1.76±0.011 percent, respectively. The results of the present study are in close agreement with

Ahmed *et al.* (2025) [8], who reported that beetroot powder contains 86.82 percent dry matter and 76.06 percent organic matter. They also observed that it comprises 14.92 percent crude protein, 19.84 percent crude fibre, 0.92 percent crude fat and 40.38 percent nitrogen-free extract. Similar results were reported by Shuaibu *et al.* (2021) [9] on proximate analysis of beetroot peel. They reported that Beetroot peel contains 44.17 percent carbohydrates, 4.10 percent protein, 6.98 percent fibre, 3.29 percent fat and 30.88 percent moisture. It is also a good source of minerals, especially Iron (26.46 percent), Potassium (13.82 percent), Sodium (4.17 percent) and Phosphorus (11.57 percent). The proximate analysis of different genotypes of beetroot has showed average values of 10±1 percent dry matter, 11.6±0.7 percent crude protein, 5.72±0.53 percent fibre, 8.31±0.56 percent ash (Vaitkeviciene *et al.*, 2022) [10].

Total polyphenol and tannin content in beetroot extract powder.

The total polyphenol and tannin content of beetroot extract powder are given in the table 2

Table 2: Total polyphenol and tannin content of beetroot extract powder

Parameters	Concentration
Polyphenol	3.61± 0.12 (mg GAE/g sample)
Tannin	2.08± 0.08 (mg TAE/g sample)

(All assays were performed in triplicate (n = 3), and the results were expressed as mean ± Standard deviation).

The total phenolic content was measured to be 3.61 mg GAE/g of the sample. This result was comparable with Yasaminshirazi *et al.* (2020) [11] who reported that the total phenolic content of the red-colored genotypes of beetroot varied between 3.52±0.28 mg GAE g⁻¹ DW and 4.89±0.28 mg GAE g⁻¹ DW. Similarly, Guine *et al.* (2018) [12] found that the total phenolic content in the fresh beetroot varied from 1.45 to 2.70 mg GAE/g. In accordance with this Kaur *et al.* (2021) [13] reported that beetroot powder produced by steam blanching showed a total phenolic content of 4.16 mg GAE/g. Comparable results were also reported by Guldiken *et al.* (2016) [14] who found that dried beetroot had total phenolic content of 3.47±0.23 mg GAE/g beetroot powder. The tannin content was found to be 2.08 mg TAE/g sample. This finding is consistent with the report of Mahmood *et al.* (2022) [15] who conducted the phytochemical analysis of ethanolic extract of beetroot and found that it contains total phenolic (133.5 mg Gallic acid /100 g), total tannin (2.14 mg/100 g). Whereas El-Beltagi *et al.* (2018) [16] found that the total tannin content is 5.13±0.085 (mg Tannic acid /g DW) in beetroot. Whereas Omogbai, and Omoregie, (2016) [17] reported that ethanolic extract of beetroot contains only 6 mg/100 g tannins.

Conclusion

The present study demonstrated the proximate composition, tannin content and total phenolic content of beetroot extract powder emphasizing its nutritional and functional properties. The findings substantiate that beetroot extract powder contains significant amount of essential nutrients along with notable levels of phenolic compounds and moderate tannin content. The presence of these bioactive compounds suggests considerable antioxidant potential for beetroot extract powder which provide preliminary evidence

supporting the potential of beetroot extract powder as a functional nutraceutical. However further *in vivo* studies are necessary to validate its effect in enhancing health and metabolic functions.

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Conflict of Interest

The authors declare that they have no conflict of interest.

References

- Henry CJ. Functional foods. *European Journal of Clinical Nutrition*. 2010;64(7):657-659.
- Milner JA. Functional foods: the US perspective. *The American Journal of Clinical Nutrition*. 2000;71(6):1654S-1659S.
- Chavan PP, Nemade LS. The evolution of nutraceuticals: from ancient medicine to modern dietary supplements. *J Pharm Sci Comput Chem*. 2025;1(2):135-153.
- Kumar T, Pal SL, Saini H. Phyto-nutraceuticals importance of beet root: a review. *Journal of Pharmacognosy and Phytochemistry*. 2024;13(1):122-128.
- AOAC. Official methods of analysis. 22nd ed. Rockville: Association of Official Analytical Chemists International; 2023. p. 188.
- Polshettiwar SA, Ganjiwale RO. Spectrophotometric estimation of total tannin in some ayurvedic eye drops. *Indian Journal of Pharmaceutical Sciences*. 2007;69(4):574-576.
- Mallick CP, Singh MB. Plant enzymology and plant histoenzymology. New Delhi: Kalyani Publishers; 1980. p. 286.
- Ahmed M, Das K, Hossen M, Ataher MS, Momu JM, Aktaruzzaman M, *et al*. Dietary inclusion of beetroot (*Beta vulgaris*): impacts on egg production, egg quality, and physiological status of commercial laying hens. *Veterinary and Animal Science*. 2025:100559.
- Shuaibu BS, Aremu MO, Kalifa UJ. Chemical composition and antioxidant activities of beetroot peel. *Afr J Eng Environ Res*. 2021;2:62-73.
- Vaitkevičienė N, Sapronaitė A, Kulaitienė J. Evaluation of proximate composition, mineral elements and bioactive compounds in skin and flesh of beetroot grown in Lithuania. *Agriculture*. 2022;12(11):1833.
- Yasaminshirazi K, Hartung J, Fleck M, Graeff-Hoenninger S. Bioactive compounds and total sugar contents of different open-pollinated beetroot genotypes grown organically. *Molecules*. 2020;25(21):4884.
- Guine RP, Goncalves F, Lerat C, El Idrissi T, Rodrigo E, Correia PM, *et al*. Extraction of phenolic compounds with antioxidant activity from beetroot (*Beta vulgaris* L.). *Current Nutrition & Food Science*. 2018;14(4):350-357.
- Kaur S, Kaur N, Aggarwal P, Grover K. Bioactive compounds, antioxidant activity, and color retention of beetroot (*Beta vulgaris* L.) powder: effect of steam blanching with refrigeration and storage. *Journal of Food Processing and Preservation*. 2021;45(3):e15247.
- Guldiken B, Toydemir G, Nur Memis K, Okur S, Boyacioglu D, Capanoglu E. Home-processed red beetroot (*Beta vulgaris* L.) products: changes in antioxidant properties and bioaccessibility. *International Journal of Molecular Sciences*. 2016;17(6):858.
- Mahmood SK, Askar SJ. Study the hepatoprotective effects and oxidant-antioxidant status of beta vulgaris roots ethanolic extract in hepatotoxic rats induced by acetaminophen. *International Journal of Health Sciences*. 2022;5:1385-1403.
- El-Beltagi HS, Mohamed HI, Megahed BM, Gamal M, Safwat G. Evaluation of some chemical constituents, antioxidant, antibacterial and anticancer activities of *Beta vulgaris* L. root. *Fresenius Environmental Bulletin*. 2018;27(9):6369-6378.
- Omogbai BA, Omoregie IA. Chemical analysis and biological activity of natural preservative from beet root (*Beta vulgaris*) against foodborne pathogens and spoilage organisms. *African Scientist*. 2016;17(2):115-122.