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Coffee varieties in India: Nutritional value and role in human health

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Abstract
Coffee is one of the most significant plantation crops in India, contributing substantially to rural livelihoods, export earnings, and agroecological sustainability in high rainfall regions. India cultivates a diverse range of coffee varieties, mainly Arabica (*Coffea arabica*) and Robusta (*Coffea canephora*), each with unique attributes in terms of agronomy, flavor profile, and nutritional content. Coffee beans are rich sources of bioactive compounds such as caffeine, chlorogenic acids, diterpenes, and antioxidants, which have been extensively linked to various human health benefits, including reduced risk of chronic diseases, neurodegenerative disorders, and improved metabolic health. This review highlights coffee varieties cultivated in India, their agronomic and biochemical characteristics, nutritional composition, and potential role in promoting human health. Emphasis is given to existing research gaps and opportunities for further studies on genotype-nutritional profile-health linkages to improve value chain development and consumer awareness.

Keywords: Coffee varieties, arabica, robusta, nutritional value, antioxidants, human health, India

Introduction
Coffee cultivation in India dates back to the 17th century and has evolved into a significant agro-economic activity concentrated in the southern states of Karnataka, Kerala, and Tamil Nadu, with expanding pockets in Andhra Pradesh, Odisha, and the Northeast. India is known for shade-grown coffee systems that sustain biodiversity while producing high-quality beans. The primary species grown are Arabica and Robusta, each comprising multiple improved and indigenous varieties developed for disease resistance, yield stability, and cup quality. In parallel, coffee consumption is rising domestically, with increasing interest in its nutritional benefits and functional attributes. Understanding the nutritional composition and health impacts of coffee grown in India is crucial for breeders, growers, policy makers, and consumers.

Material and Methods
This review article is based on secondary data collected from published scientific journals, technical bulletins from the Coffee Board of India, books, and credible online databases such as PubMed and Scopus. Studies on varietal descriptions, agronomic traits, biochemical composition, and health benefits were collated. Recent nutritional studies on coffee bean components, in *vitro* and in *vivo* investigations on human health impacts, and global meta-analyses were reviewed. Data synthesis focused on identifying varietal differences in biochemical attributes and correlating them with documented health outcomes.

Results
Coffee Varieties in India India cultivates over 20 recognized commercial coffee varieties. Among Arabica, prominent varieties include S.795, Cauvery, Selection 5, Selection 6, Chandragiri, and Sln. 9 (Selection 9). Robusta varieties include S.274, CxR, and RRII 4. These varieties differ in yield potential, bean size, resistance to rust and berry borer, and biochemical attributes such as caffeine and chlorogenic acid content.
Nutritional Composition Coffee beans are low in fat and protein but are rich in polyphenols, particularly chlorogenic acids (CGA), which constitute up to 10% of bean dry weight. Caffeine content ranges from 0.8-1.4% in Arabica to 1.7-2.5% in Robusta. Other components include diterpenes (cafestol and kahweol), trigonelline, micronutrients (potassium, magnesium, niacin), and amino acids.
Health Benefits Several studies show coffee consumption is associated with reduced risks of Type 2 diabetes, Parkinson's disease, Alzheimer's disease, certain cancers, cardiovascular diseases, and liver conditions. Bioactive compounds in coffee exhibit antioxidant, anti-inflammatory, and neuroprotective effects. Moderate coffee intake has been linked to improved cognitive function, mood, and metabolic parameters.

Discussion
Coffee varieties in India present substantial diversity in agronomic traits and nutritional profiles. Arabica beans generally have lower caffeine and higher perceived cup quality, while Robusta beans exhibit higher caffeine and CGA content, contributing to stronger flavor and higher antioxidant potential. Studies suggest varietal differences in biochemical profiles can influence the health benefits of coffee consumption. In India, limited research exists on linking specific varieties or growing conditions with health-promoting compounds.
Additionally, coffee processing methods (wet vs. dry), roasting levels, and brewing techniques significantly alter the final nutritional composition and bioavailability of health-beneficial compounds. Increased focus on varietal characterization, breeding for bioactive compounds, and consumer education on optimal preparation could enhance both domestic consumption and export value.
Future research should examine genotype-environment interactions influencing coffee bean nutritional quality and their long-term effects on human health using well-designed cohort and intervention studies.

Conclusion
India's coffee sector is poised to expand further with

growing domestic demand and export potential. Understanding the diversity of coffee varieties, their nutritional properties, and potential health benefits offers an opportunity to strengthen coffee value chains, promote sustainable cultivation, and enhance public health outcomes. More targeted research is needed to fully characterize the varietal biochemical profiles and to harness them in promoting coffee as a functional food crop.

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