Review article

A review on marketing and supply chain of medicinal plants using PRISMA

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ABSTRACT

Medicinal plants represent a valuable source of drug discovery for many modern medicines. Yet very little reported work has been done on the marketing and supply chain of medicinal plants in India. This study aimed to investigate the marketing and supply chain dynamics with various stakeholders involved for medicinal plants in India. A systematic literature review was conducted using Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) framework, with data extracted from the Google Scholar database. The topic was formulated using the Population, Intervention, Control, and Outcome (PICO) technique. The study identified influential papers and authors, providing valuable insights into research trends and highlighting the need for further investigation into specific areas within this domain. This study contributes to a better understanding of the research landscape surrounding the marketing and supply chain of medicinal plants in India.

Keywords: Systematic Literature Review, PRISMA, PICO, medicinal plants, marketing, supply chain

INTRODUCTION

Medicinal plants are fundamental to numerous modern medicines. Approximately 80% of developing nations' populations rely on herbal remedies, with traditional practices deeply embedded in their cultures (Mukherjee, 2002). These plants are studied across diverse scientific fields: agricultural scientists develop improved cultivars, Ayurveda practitioners assess therapeutic efficacy, and biotechnologists explore molecular compounds for drug discovery. In India, thousands of enterprises rely on these plants for traditional medicine formulations (Ved and Goraya, 2007). The increasing global demand for high-quality, certified organic herbal products necessitates expanded commercial cultivation of medicinal herbs to bridge the supply gap (Gaurav *et al*., 2018). There is a significant discrepancy between the availability and demand for medicinal plants used to manufacture the nation's Ayurvedic medications (Anonymous, 2017). India can lead the global herbal medicine market by ensuring the quality of its traditional Ayurvedic, Siddha, and Unani drugs, allowing them to compete with modern medicine through lower costs and fewer side effects (Sharma *et al.*, 2008). This systematic literature review, utilizing the PRISMA guidelines, aims to provide a comprehensive analysis of the existing body of research focusing on the marketing and supply chain dynamics of medicinal plants. The specific objectives includes, identifying and synthesizing key findings, assessing the

quality and relevance of existing studies and highlighting gaps in the current literature that warrant further investigation.

METHEDOLOGY OF REVIEW WORK

This Google Scholar-based study used the PICO framework to examine medicinal plant marketing and supply. It focused on research context, marketing challenges, and stakeholder roles, addressing the question: "What is the context of the articles and what are the problems with the marketing aspect of medicinal plants with various stakeholders involved?

The study analyzed research articles, book chapters, and conference papers published between 1995 and 2024. After initial screening, 17 duplicates and 11 irrelevant articles were removed. A manual review of 135 titles and abstracts further excluded 85 articles that did not focus on the marketing and supply chain of medicinal plants, including prescribed medicines, herbal products, OTC products, and consumer behavior. The final analysis included 51 research papers.

PRISMA flow diagram for selecting the studies

This study employed a systematic literature review adhering to PRISMA-ScR guidelines. namely: (1) identification of literature, (2) screening questions and (3) eligibility criteria

Identification of literature

The literature search, conducted primarily on Google Scholar, employed various keyword combinations using Boolean operators (or and) and phrase search methods. Synonyms, related terms, and variations of core keywords were used, including: "marketing" OR "supply chain" OR "raw materials" OR "medicinal plants" OR "herbs", "prescribed medicines" OR "herbal products", "Over The Counter products" OR "consumer behavior" OR "prescription" OR "ayurveda".

Screening questions

The initial screening process involved reviewing titles, abstracts, and keywords. Subsequently, selected articles underwent further evaluation based on these questions:

1. Do any studies discuss about raw material quality of medicinal plants and where it can be traded?

2. Is there any study done to assess the opinions of doctors and consumers?

3. Have any kind of marketing channel study been done?

Eligibility assessment

The following inclusion criteria were then applied-

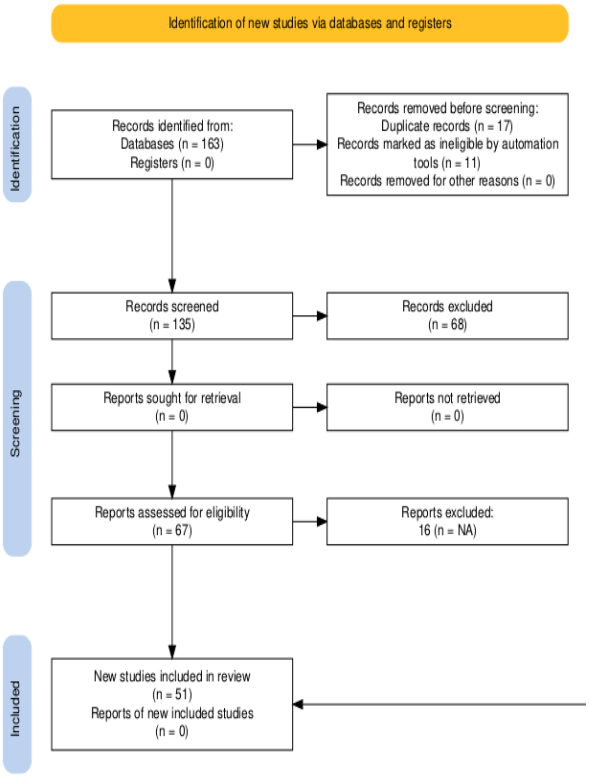
1. Does the study discuss in detail traders' opinions on the raw material of medicinal plants?

2. Does the study cover the work of various stakeholders involved in the supply chain?

3. Does the study discuss about consumers buying decisions, purchasing intentions etc?

The following study done at the Institute of Agri Business Management between October 2024 till January 2025.

Figure 1. PRISMA flow diagram describing inclusion and exclusion of studies



Supply chain of raw materials of medicinal plants

The poorly coordinated and obscure medicinal plant market chain is attributed to several factors: limited market access and transaction difficulties, information gaps, a scarcity of reliable buyers, and discriminatory and unfair pricing practices (Van de Kop and Ghayur 2006), The decentralized medicinal plant system exposes collectors and contractors to exploitation. Limited market access allows local traders to control information, financing, and marketing, driving prices down. This highlights significant power imbalances in Uttarakhand's supply chain, hindering contractors and collectors from securing fair prices and improving their financial outcomes (Van de Kop *et al.* 2006). Choosing the best raw material sources for herbal products is complex. The Analytic Hierarchy Process (AHP), a Multiple Criteria Decision Making (MCDM) tool, provides a structured approach to evaluate suppliers based on sustainability, quality, price, and reliability (Kulshrestha *et al.* 2007). Similar research studies are mentioned in the form of Table 1..

Marketing of medicinal plants

Limited market access and reliance on middlemen distort the medicinal plant product market. Price discrepancies and local oversupply negatively impact producers. Dominant traders can manipulate prices, and farmers selling to middlemen lose all control over price and volume (Shiva 1995). The medicinal plant marketing system is unregulated and unfair, harming poor farmers and laborers. Its top-down structure limits information and benefits to local levels, leaving many, especially those at the supply chain's base, unaware of market demands and opportunities (Kala *et al.*, 2006). The Asgandh market shows a tiered structure: larger farmers have more direct market access, reducing middleman reliance, while smaller farmers engage in smaller, more localized sales (Mishra and Kotwal 2011). Similar studies are presented in the Table 2.

Herbal products of medicinal plants

The 1991 WHO guidelines, endorsed by the 6th International Conference of Drug Regulatory Authorities, mandate a thorough evaluation of herbal medicines. This evaluation includes: rigorous quality assessment of raw plant materials, preparations, and final products and efficacy assessment supported by traditional use documentation and/or animal and human studies. (Kamboj, 2000). Combined spending increases on herbal supplements from 2017 to 2019 were less than the $1.659 billion increase in US consumer spending from 2019 to 2020. Ashwagandha (*Withania somnifera*) experienced the largest sales growth in mainstream retail, jumping 185.2% to $31.7 million in 2020. Entering the top 40 best-selling herbs in 2018 at 34th place, ashwagandha's sales have since quadrupled, reaching 12th position in 2020, demonstrating its rapid mainstream

popularity (Smith *et al.*, 2021). Effective quality regulation in India's herbal medicine industry requires a multifaceted strategy. Despite hurdles like limited awareness and the costs of implementing GACP and GSP, the industry recognizes the importance of standardized documentation and clear QC/QA guidelines (Sarmah, 2022). Similar studies are presented in the Table 3.

Consumer perception towards herbal products

Trust and satisfaction significantly increase consumer preference for Ayurvedic products, while price negatively impacts it. Statistical analysis using t-tests and ANOVA revealed demographic differences in trust, perceived reasonable price, and satisfaction, which are key factors influencing consumer choice of Ayurvedic products (Misra *et al.*, 2022). Sentiment analysis, using supervised machine learning with the Text2Vec package, was conducted on 28,713 English tweets related to Complementary, Alternative, and Integrative Medicine (CAIM). The analysis, utilizing labeled data for individual tweet evaluation, found the most frequent hashtags to be #vitamin and #ayurveda. The overall sentiment distribution was 54% positive, 31% neutral, and 15% negative. (Ng *et al.*, 2022). Consumer buying decisions for Ayurvedic products are significantly influenced by health consciousness, social influence, product price, perceived value, and trust. (Suriyage and Jude Leon 2023). Similar studies are presented in the Table 4. This study aimed to investigate the marketing and supply chain dynamics of medicinal plants in India through a systematic literature review. The analysis revealed several key findings:

India's medicinal plant sector struggles with supply chain and marketing issues, impacting producers. Consumer trust is vital. Solutions require policy improvements in market access, value chains, and R&D, alongside industry efforts in branding, quality, and innovation.

CONCLUSION

This study provides a comprehensive overview of the research landscape surrounding the marketing and supply chain of medicinal plants in India. The findings highlight the critical importance of addressing the challenges faced by the sector to ensure the sustainable and equitable development of the herbal industry. Key challenges include limited market access, information asymmetry, power imbalances, and inadequate marketing strategies. To address these challenges, policy interventions are crucial, focusing on improving market access, strengthening value chains, empowering stakeholders, and promoting research and development. The herbal industry also needs to focus on developing strong brands, adopting good agricultural and collection practices, and investing in research and innovation. Further research is needed to investigate specific aspects of the marketing and supply chain, develop innovative solutions to address the identified challenges, and inform effective policy intervention.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table 1: Findings on Supply chain of MAPs by various authors

Author	Parameter studied	Key Findings
Hamilton (2004)	Stakeholders, Value Chain & Market System	• Found that the structure of the value chain is poorly integrated, with no or nominal vertical links, and it is usually secretive.
Singh *et al*. (2005)	Participatory Rural Appraisal (PRA) tech.	• MAP farmer education and support increased cultivation interest.
Ved and Goraya (2007)	Grey reporting of raw material produce and documented	• Record-keeping in the medicinal plant sector is hampered by insufficient procedures and a lack of tracking systems in some states.
Madhavan (2008).	Supply and demand imbalances in the medicinal plant industry	• Information gaps and asset specificity hinder new medicinal plant suppliers. • Price setting is exploitative, favoring downstream actors over producers.
Lubbe and Verpoorte (2011)	Buyer expectation for MAPs	• **Supply:** Consistent availability of quality raw materials.

		• **Demand:** Understanding evolving consumer needs for medicinal and aromatic plants (MAPs).
Dejouhanet (2014)	Quality of material in supply chain of MAPs	• Ayurvedic supply chains lack traceability and transparency, quality and increasing dependence on unregulated sources.
Varshney *et al.* (2021)	lack of market transparency	• Traders need more than price for assessments; standardized production builds trust and meets quality standards.
Dadhich *et al.* (2024)	Promotion of MAPs by NMPB	• An ashwagandha marketing campaign promoted it as a "Health Promoter," using information, education, and communication (IEC) initiatives.

Table 2: Findings on marketing of MAPs by various authors

Author	**Parameter studied**	**Key Findings**
Singh (2006)	Commerce of MAPs	• Lack of reliable data on traded medicinal plant species, volumes, and prices stems from inadequate systematic data.
Mishra *et al.* (2009)	necessity of sustainable harvesting methods	• Medicinal plant collection suffers from collector competition, poor harvesting knowledge, and inadequate training.
Guleria *et al.* (2014)	major challenges faced to market the produce	• Major issues include insufficient processing, lack of price supports, and limited access to regulated markets.
Roosta *et al.* (2017)	Relative Market Advantage (RMA)ra	• Singapore, Japan, Germany, and Malaysia are identified as the most promising target markets for MAPs exports, based on a weighted average of indices.
Rathore and Mathur (2018)	Marketing channel, Value addition of MAPs	• MAPs offer production, distribution, and processing opportunities. Value-added products & contract farming are profitable.
Gularia & Gupta (2020)	Challenges in production and marketing of MAPs	• Medicinal plant cultivation is hindered by high costs, poor planting material, limited subsidies, and inadequate irrigation.
Chen *et al.* (2021)	Geographical authentication	• Safer environment for raw materials can be achieved by geographic authentication and protection of raw materials.
Rathore (2024)	Production and marketing of medicinal and aromatic plants	• Unregulated markets and poor production technology are major obstacles.

Table 3: Findings on herbal products of MAPs by various authors

Author	Parameter Studied	Key Findings
Busse (2000)	Consistent and sufficient quality of raw material	• Herbal product consistency relies on precise plant selection and standardized production.
Ahmad *et al.* (2006)	lack of a uniform quality control	• Plant-based medication's variability complicates quality control; advanced analysis is needed.
Pingali *et al.* (2013)	Effect of *Withania* on mental stress	• Withania somnifera extract significantly reduced aortic pressure and augmentation index compared to a placebo.
Singh *et al.* (2014)	Quality control on herbal medicine	• To minimize risks, rigorous quality control is essential throughout the entire production process, from sourcing to final product.
Maqbool *et al.* (2019)	Benefits of herbal medicine	• Ease of intake, minimal risk of deadly adverse reactions, affordability are factors which are prefered by consumers
Zahiruddin *et al.* (2020)	Effect of Ashwagandha on anxiety	• Ashwagandha leaf powder shows potential for obesity prevention due to its antianxiety, anti-inflammatory, and anti-apoptotic effects.
Smith *et al.* (2021)	Annual spending on herbal supplements in USA	• Mainstream channel, ashwagandha (Withania somnifera, Solanaceae) saw the biggest increase in sales
Pathak *et al.* (2024)	Sustainable cultivation of medicinal plants	• Only after dependable and economical cultivation methods have been developed should cultivation be undertaken

Table 4: Findings on consumer perception towards herbal products by various authors

Author	Parameter Studied	Key Findings
Verma (2009)	Satisfaction level of OTC users	• Customers who have used OTC health supplements earlier are somewhat satisfied
Eichhorn *et al.* (2011)	Anixety Disorder	• Herbal remedies are common for self-treating anxiety and depression. Kava is beneficial for mild to moderate anxiety.
Ali and Yadav (2015)	Attitudes towards ayurvedic products	• Respondents report no side effects from Ayurvedic products and maintain a positive attitude towards them.
Jibril *et al.* (2019)	Consumer behaviour of herbal products	• Education and processing level, not demographics, drive herbal product preference..
Alwhaibi *et al.* (2021)	e-commerce use for purchasing herbal products	• Online drug purchases: safe, but verifying pharmacy legitimacy is difficult.
Akhgarjand *et al.* (2022)	Ashwagandha for anxiety	• Ashwagandha supplements significantly reduced tension and anxiety