Value addition and Marketing of Mushrooms.

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Abstract: Mushrooms are a nutritious and profitable crop, but their high perishability limits their market potential. Using simple processing techniques like drying, pickling, and making ready-to-eat products can extend shelf life, reduce waste, and increase profits. Effective marketing, proper packaging, and infrastructure are essential to boost the mushroom industry's growth. This article explores how value addition and better marketing strategies can help farmers and entrepreneurs make the most of this promising sector. They can be grown on agricultural waste, making them an eco-friendly food source. However, mushrooms spoil quickly after harvest because of their high moisture content, leading to losses and limited market access. To overcome this, processing mushrooms into dried, canned, or ready-to-eat products can help preserve them longer and open new markets.

This article further highlights the importance of Marketing system analysis, constraints and gaps and supply chain development. We will see various products that could be prepared and commercialized at better profit rates like mushroom powders for soups or as thickeners. Mushrooms are categorized as functional foods due to their rich composition of proteins, vitamins, minerals, and bioactive compounds. The book highlights that mushroom cultivation forms part of a "non-green revolution," utilizing agricultural residues efficiently while promoting sustainable agricultural practices (Chang & Miles, 2004).

Keywords:
A.MARKETING
B.RESEARCH GAP
C SUPPLY CHAIN
D.DIRECT MARKETING
E.VALUE ADDITION

Introduction:

Edible mushrooms have long been consumed both as valuable protein and energy sources, and also to improve human health and longevity. They are considered healthy foods, being both low in calories and fat, and rich in proteins, minerals and dietary fiber. The production and consumption of mushrooms is growing each year, given their nutritional advantages in addition to their flavor, increasingly appreciated by the world population. In the mushroom production process, a large amount of by-products is generated, with a high environmental impact and management costs for the industry. By-products include caps, stipes, mushrooms that do not comply with commercial standards in terms of caliber, shape or size and spent mushroom substrate (SMS). SMS is composed of fungal mycelia, extracellular enzymes secreted from mushrooms for degradation of substances and unused lignocellulosic substrates]. These by-products have a high nutritional value and can be valued in several applications. Nowadays, industrial ecology concepts, such as circular economy, are considered leading principles for innovation using waste as raw material for the development of new products and applications.. The large amount of waste generated by mushroom production represents a huge loss of valuable organic materials raising serious management problems, both from the economic and environmental point of view.

Though a few reviews are available on SMS application ,no review is currently available on extraction of bioactive compounds from mushroom by-products and its potential applications in different fields, such as food, animal feed, fertilizer, bioremediation, energy production and bio-based materials. To the best of our

knowledge, this is the first review on valorization of mushroom
by-products, in different fields, resulting from the two mushroom production techniques (solid
substrate fermentation only or including submerged liquid fermentation steps). It is well known that
mushroom production is obtained from solid substrate fermentation, but the production process can include submerged liquid fermentation to produce liquid spawn for mushroom production. Therefore,this review aims to present and discuss the potential applications of mushroom by-products being focused on the extraction of bioactive compounds which could result in nutraceuticals with high economically value.

CURRENT STATUS:-

Globally, mushroom production has increased significantly, with species such as Agaricus
bisporus, Pleurotus spp., and Lentinula edodes dominate commercial cultivation. The book documents worldwide production trends and technological advancements in mushroom farming,emphasizing their growing role in international trade and health-oriented food markets (Chang & miles)

In the Indian context, as discussed in P. Dhar's work, mushroom cultivation is gaining
momentum as an income-generating enterprise, particularly among small and marginal farmers.
However, the market remains largely dependent on fresh mushrooms, with limited processing and value addition practices.contributors of mushroom production in the country.

Table 1: Leading states in Mushroom Cultivation

State/ UnionTerritory	Annual Production (Tonnes)
Punjab.	60000
Uttarakhand.	8000
Haryana.	7178
Uttar Pradesh	7000
Tamil Nadu	6500
Himachal Pradesh	5993
Odisha	5846
Andhra Pradesh.	3022
Delhi.	3070
Maharashtra	2975
Kerala	800

Source: Singh et al., 2011

Growth of Mushroom Production in India

Although mushroom cultivation has been practiced globally for centuries, organized mushroom production in India began only during the 1960s (Sharma et al., 2020). Since then, the sector has experienced remarkable expansion due to increasing consumer demand, technological advancements, and improved cultivation practices. At present, global mushroom production exceeds 40 million tonnes, with China emerging as the leading producer worldwide.

India has also demonstrated significant progress in mushroom production over the last two decades. The country's production increased from approximately 44,000 metric tonnes to nearly 0.31 million tonnes, positioning India among the top five mushroom-producing countries globally. During the period from 2012 to 2021, Indian mushroom production recorded a Compound Annual Growth Rate (CAGR) of nearly 8%, increasing from 0.03 million tonnes to 0.30 million tonnes. In comparison, China registered a relatively lower CAGR of 3.81% during the same period.

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A substantial improvement in productivity has also been observed in India between 1970 and 2022. Productivity levels increased from around 7% to nearly 25%, mainly due to the development of superior strains of edible mushrooms, adoption of scientific cultivation methods, improved substrate management, and enhanced environmental control practices. These developments have contributed considerably to the commercialization and sustainability of mushroom cultivation in the country.

Relative Contribution of Different Mushroom Species

Commercial mushroom cultivation in India is dominated by five major species, namely button mushroom (Agaricus bisporus), oyster mushroom (Pleurotus spp.), paddy straw mushroom (Volvariella volvacea), milky mushroom (Calocybe indica), and shiitake mushroom (Lentinula edodes). Among these, button mushrooms constitute the major share of total production, contributing nearly 70% of the overall mushroom output in the country. Oyster mushroom accounts for about 17%, followed by paddy straw mushroom with 9% and milky mushroom with approximately 3% contribution. Other specialty mushrooms such as shiitake, Hericium, and Ganoderma collectively contribute a comparatively smaller share.

Despite the dominance of button mushrooms, diversification in mushroom cultivation is gradually increasing in India. The adoption of year-round cultivation models and low-cost production systems has enabled farmers to cultivate different mushroom species according to seasonal temperature requirements. Such diversification not only enhances production efficiency but also improves income opportunities and nutritional security for growers.

Mushroom cultivation in India exhibits considerable regional variation, with certain states emerging as major production hubs due to favorable climatic conditions, substrate availability, and established cultivation practices. Bihar ranks first among the mushroom-producing states with an annual production of nearly 35.6 thousand tonnes, contributing approximately 11% to the total national mushroom output. Odisha occupies the second position with around 34.5 thousand tonnes of production, followed by Maharashtra with 32.5 thousand tonnes. Uttar Pradesh and Uttarakhand also contribute significantly to the national mushroom industry.

The cultivation pattern of mushrooms differs across regions depending on climatic suitability and resource availability. Northern states such as Punjab, Haryana, and Himachal Pradesh predominantly specialize in button mushroom cultivation owing to their comparatively cooler climatic conditions. Among these, Punjab and Haryana have developed as important centres for compost preparation and seasonal button mushroom production, particularly during the period from September to mid-March.

In contrast, tropical mushroom varieties are more common in the southern and eastern parts of the country. Milky mushroom cultivation is mainly concentrated in the southern states of India because of the warm and humid environmental conditions favorable for its growth. Paddy straw mushroom is extensively cultivated in Odisha and Chhattisgarh due to the abundant availability of paddy straw, which serves as an economical and efficient substrate material for production.

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Besides the commercially dominant species, several improved and short-duration strains of specialty mushrooms such as shiitake (Lentinula edodes), Hericium, and Ganoderma have also been developed in India. However, their cultivation and commercialization are still at an early stage. These mushrooms possess high medicinal and nutritional value and require relatively low land investment, making them economically promising for small and marginal farmers. Therefore, the promotion and wider adoption of such specialty mushrooms may contribute significantly towards income generation, poverty alleviation, and nutritional security in the country (Bijla and Sharma, 2023).

Global Mushroom Trade Scenario

India has gradually strengthened its position in the global mushroom trade market through increasing exports of processed and fresh mushroom products. In 2020, the country earned approximately 8.65 million USD through mushroom exports. France emerged as the leading export destination, accounting for nearly 42% of the total export share, followed by Germany with around 21%. Other important importing countries included Switzerland (8%), Nepal (4%), and Hong Kong (3%).

The growing international demand for Indian mushrooms indicates substantial export potential for the sector. Expansion of value-added mushroom products, improved post-harvest management, quality assurance, and better supply chain infrastructure can further enhance India's competitiveness in the global mushroom market.

.VARIES DATA

There are thousands of mushroom species globally, but only a limited number are commercially cultivated. Chang and Miles describe the diversity and increasing number of cultivated mushrooms (Chand & Miles),including Agaricus (button mushroom) – leading global production, Pleurotus (oyster mushroom) – adaptable and widely cultivated,Lentinula edodes (shiitake) – high medicinal and export value,Volvariella and Flammulina – region-specific cultivationThis diversity offers immense potential for product diversification and value addition.

RESEARCH GAP

Despite advancements in cultivation technologies, there exists a significant gap in the areas of post-harvest management, value addition, and organized marketing systems. The literature indicates that while production has expanded, the development of processing industries and value-added products remains inadequate, particularly in developing countries like India.

Limited research has been directed towards commercialization strategies, consumer behavior and supply chain integration.

PROBLEMS

One of the major constraints in mushroom marketing is their high perishability, leading to rapid quality deterioration within a short time after harvest. Other challenges include:

Lack of cold storage and transportation facilities,Poor packaging and grading systems.

Limited awareness about value-added mushroom products. Inadequate market infrastructure and price fluctuations.

According to Dhar, these issues restrict the profitability and scalability of

mushroom enterprises,especially for small-scale producers.

OBJECTIVES

In light of the above challenges, the present study/article aims to Examine the importance of value addition in extending shelf life and enhancing economic returns of mushrooms Analyze existing marketing systems and identify their limitations.Explore opportunities for diversification through value-added mushroom products Suggest strategies for improving marketing efficiency and supply chain management Promote sustainable and profitable mushroom entrepreneurship.

Materials and

Methodologies

Drying of Mushrooms

Drying is considered one of the most effective post-harvest preservation methods for mushrooms because it significantly reduces moisture content and enhances storage stability. Fresh mushrooms generally contain approximately 85–90% moisture at the time of harvest, which is reduced to below 10–12% during the drying process. Moisture reduction minimizes microbial spoilage and extends shelf life.

Traditional sun drying is commonly practiced; however, controlled dehydration using cabinet dryers at temperatures ranging from 55–60°C produces superior quality dried mushrooms with lower residual moisture and improved storage life. Dried mushrooms can subsequently be converted into powder form and incorporated into a variety of value-added food products such as instant soups, bakery formulations, seasonings, and nutraceutical preparations.

Canning of Mushrooms

Canning is a widely adopted preservation technique for long-term storage and commercial distribution of mushrooms, with shelf life extending up to one year under suitable conditions. The international trade of processed mushrooms is largely dominated by canned products. Mushrooms may be canned as whole units, sliced pieces, or stems and pieces depending on market requirements.

The canning procedure involves several sequential operations including cleaning, blanching, filling, sterilization, cooling, and packaging. Blanching is generally carried out at 95–100°C for about 5–6 minutes to inactivate enzymes and reduce microbial load. The blanched mushrooms are then packed in cans containing brine solution composed of 2% salt along with 0.1% citric acid or 100 ppm ascorbic acid. Sterilization is performed at approximately 118°C to ensure microbial safety, followed by cooling, labeling, and final packaging.

Steeping Preservation of Mushrooms

Steeping preservation is regarded as a simple and economical short-term preservation method. In this technique, blanched mushrooms are immersed in preservative solutions containing salts and acids to inhibit microbial growth. A commonly used steeping solution consists of 2% sodium chloride, 2% citric acid, 2% sodium bicarbonate, and 0.15% potassium metabisulphite (KMS). Mushrooms preserved under these conditions can remain acceptable for approximately 8–10 days when stored at temperatures between 21–28°C.

Radiation Preservation of Mushrooms

Radiation preservation using low doses of gamma irradiation has emerged as an

effective technology for extending the shelf life of mushrooms. Gamma irradiation helps reduce microbial contamination, delay maturation, and minimize losses in moisture, color, texture, and flavor during storage.

Studies indicate that irradiation at a dose of 10 kGy is capable of eliminating most microorganisms completely. Additionally, treatment of Agaricus bisporus with gamma radiation doses close to 2 kGy, followed by storage at 10°C, has been reported to extend shelf life by nearly 10 days while maintaining product quality.

Value added products of

Mushrooms

Mushroom Pickle

Mushroom pickle is a highly acceptable preserved product that can be prepared at household as well as commercial scale. In the preparation process, mushrooms are first washed, sliced, and blanched for approximately 5 minutes in a 0.05% potassium metabisulphite (KMS) solution. The blanched mushrooms are subsequently washed with cold water several times to remove residual chemicals and excess moisture. Salt curing is then performed by adding 10% sodium chloride and keeping the material overnight. The liquid released during curing is discarded, after which spices and preservatives are incorporated according to the desired sensory quality. Properly packed airtight containers can preserve the pickle for up to one year.

Mushroom Biscuit

Nutritious mushroom biscuits can be prepared using either button or oyster mushrooms in powdered form. The formulation generally consists of refined wheat flour and mushroom powder in an 80:20 ratio along with sugar, bakery fat, baking powder, ammonium bicarbonate, salt, milk powder, and flavoring agents such as vanilla essence. All ingredients are blended to obtain a homogeneous dough, which is rested for approximately 10 minutes under moist conditions. Dough sheets of suitable thickness are prepared and cut into desired shapes before baking at 180°C for around 20 minutes. The final product is cooled and packaged for storage and marketing.

Mushroom Soup Powder

Mushroom soup powder is commonly produced from dehydrated button or oyster mushrooms. The dried mushrooms are pulverized and sieved through a fine mesh to obtain uniform powder. The mushroom powder is blended with milk powder, corn flour, salt, sugar, black pepper, and oregano to prepare an instant soup mix. The product requires boiling with water for approximately 5 minutes to obtain a soup with characteristic mushroom flavor and aroma.

Mushroom Nuggets (Badi)

Mushroom nuggets are prepared by mixing coarsely ground dried mushroom powder with black gram (urd) flour in a ratio of 1:8. Water is added to form a paste, followed by incorporation of salt and red chilli powder for seasoning. Small spherical nuggets measuring about 2–4 cm in diameter are formed and dried under sunlight on steel trays. These dried nuggets can be consumed after deep frying or incorporated into vegetable curry preparations.

Mushroom Papad

Papad is a traditional Indian snack prepared from flours of black gram, lentils, chickpeas, rice, tapioca, or potato.

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Nutritional enrichment of papad can be achieved by supplementing the batter with mushroom paste or mushroom powder. The incorporation of mushrooms enhances protein content and improves the nutritional quality of the final product, thereby converting papad into a more wholesome food.



Mushroom Sauce or Ketchup

Mushroom ketchup is prepared from freshly harvested button mushrooms. The mushrooms are cleaned, sliced, and cooked in water for approximately 20 minutes before grinding into a paste. Various ingredients including salt, sugar, acetic acid, sodium benzoate, onion, garlic, ginger, cumin, black pepper, red chilli powder, and arrowroot are then incorporated into the paste. The mixture is cooked until the total soluble solids (TSS) reach approximately 35°Brix. The final product is filled into sterilized bottles or jars for storage.

Mushroom Preserve (Murabba)

Mushroom preserve, commonly known as murabba, is produced using fresh button mushrooms. The mushrooms are graded, washed, pricked, and blanched in 0.05% KMS solution for about 10 minutes. The blanched mushrooms are immersed overnight in 50°Brix sugar syrup under refrigerated conditions. Subsequently, the syrup concentration is gradually increased to 60°Brix and later to 70°Brix through repeated addition of sugar and heating in the presence of 0.1% citric acid. The mushrooms are kept immersed in concentrated syrup for approximately one week to complete the preservation process. Finally, the preserve is packed in containers with freshly prepared 68°Brix sugar syrup to maintain quality and shelf stability.

CONCLUSION

The present study underscores the critical importance of value addition and efficient marketing in enhancing the economic viability and sustainability of mushroom production systems.

Mushrooms, despite their exceptional nutritional and medicinal attributes, remain highly perishable commodities, making them particularly vulnerable to post-harvest losses. The findings clearly demonstrate that the adoption of value addition techniques—such asdehydration, pickling, canning, and the development of diversified ready-to-eat products—significantly extends shelf life, reduces wastage, and improves overall product acceptability.

Furthermore, the study reveals that value-added mushroom products offer substantially higher economic returns compared to fresh produce, thereby providing a viable pathway for income enhancement, especially for small-scale

farmers and rural entrepreneurs. However, the existing marketing framework is characterized by structural inefficiencies, including inadequate cold chain infrastructure, lack of standardized grading and packaging systems, and the dominance of unorganized market channels. These limitations not only constrain profitability but also restrict market expansion and product diversification.

The integration of value addition with modern marketing strategies and digital marketing emerges as a key determinant for the sustainable growth of the mushroom sector. Bridging the gap between production and market demand through technological innovation, improved infrastructure, and enhanced awareness is essential for unlocking the full potential of the mushroom industry. Thus,a holistic approach encompassing production, processing, and marketing is imperative for achieving long-term economic and environmental sustainability.

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