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Novel Technologies for Processing Mushrooms and its Marketing Strategies

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ABSTRACT

Mushroom (*Agaricus bisporus*) a noticeable umbrella-shaped fruiting body of certain fungi which grow vigorously. Mushrooms are highly enriched in protein, vitamins and marco-nutrients. Mushrooms are proven to have anti-allergic, anti-cholesterol, anti-tumor and anti-cancer qualities. The most desirable property of freeze-dried mushrooms such as the nutritional content and quality are maintained. The products shelf life is increased by using freeze drier from 12 days to 90 days. The mushroom cultivation is a viable and attractive activity and it does not require access to land and low investment too. The present study focused on analyzing the mushroom preservation techniques and producer's market potential by captivating consumer's awareness. Self administered required to collect the primary data from consumers. SWOT analysis is used at the end to generate information and hypothesis testing is used for mathematical reasoning.

Keywords-- Freeze Drying, Marketing, Mushroom, SWOT Analysis

I. INTRODUCTION

A mushroom is one of the many species of fungi. It is the fleshy and spore bearing fruity body of a fungus. They grow above the ground, on soil or on its food source. They are rich in protein, minerals, vitamins, and antioxidants along with numerous medicinal values. Mushrooms are used in the human diet because of their culinary value, taste, texture and essential nutrients. Edible mushrooms are cultivated in a large scale and its production has increased considerably in the recent years. Mushrooms are consumed either fresh or in dried form. Due to lack of chlorophyll, mushrooms get their carbohydrates from decayed organic matter. Hence, they are also called as 'Saprophytic Macroscopic' fungi. Not all mushrooms can be eaten, out of 38,000 mushroom varieties only 100 are considered edible. Some of the predominant ones are the *Agaricus bisporus* (white button), *Lentinus edodes* (Shiitake) pleurotus species like *Pleorotus ostreatus* (Oyster), *Pleurotus sajor-caju*, *Flammulina velutipis*, *Auricularia polytrica*. The presence of essential nutrients such as proteins, vitamins, minerals, polyphones, and polysaccharides it has several health benefits and is regarded as a value health food. Due to high level of moisture content which is in the range of 85-92% they are vulnerable to microbial attack and extremely perishable. Hence, it requires adequate treatments after its harvest for effective preservation. The reason it is falls under the valuable food category is not just because of its richness in nutrients, but also its wonderful taste. The taste of button mushroom is primarily attributed to abundant soluble non-volatile taste components, such as free amino acids, 5' nucleotides, organic acids and soluble sugars and polyols. The umami taste reported by 20. Flavor enhancement is due to monosodium glutamate (MSG) and provides the enjoyable taste to button mushroom. 'Preservation' means increasing the amount of time to prevent the food from being spoilt. Some of the techniques used for its preserving mushrooms are blanching, vacuum cooling, drying, osmotic dehydration, freezing, irradiation and canning. Freeze drier are mostly used as preservation techniques in industries so that the quality of food is maintained, nutritional value is not lost, and the shelf life of the food is still increased.

Freeze drying is a process in which water is removed from a product after it is frozen and placed under vacuum allowing ice to change directly to vapour without passing through a liquid phase and is one of the most cutting-edge drying methods to maintain the quality of the product. The method is gradual process and needs affluent equipment, therefore is not used often for the preservation of cultivated mushrooms. The ability of the product to rehydrate closely depends on the porous nature of the dry products.

Freeze drying is an evolving technology for drying of mushrooms, as it eliminates some of the unwanted characteristics. Freeze-dried mushrooms are of highest quality, when compared to the mushrooms dehydrated by other methods. The ability to maintain flavor by freeze dried mushrooms is also testified to be excellent because, it not only maintains the taste of the mushroom but also retains most of the nutrients in the mushrooms.

Table No. 1: Taxonomic Classifications of *Agaricus Bisporus* (Button Mushroom)

Kingdom	*Fungi*
Division	*Basidiomycota*
Class	*Agaricomycetes*
Order	*Agaricales*
Family	*Agaricaceae*
Genus	*Agaricus*
Species	*A. bisporus*

i. Cultivation of Mushroom

Fungi culture is also another commonly used term for cultivation of mushrooms and other fungi. Cultivation of mushrooms started as simple process until 20th century. However, its growing popularity and commercial success attracted many agribusiness units. Latest technology was employed for large scale production of button mushrooms. High yield and time efficient production of button mushrooms round the year constituted 34.8% of global mushroom produced in the year 1997. The total production of mushrooms in the world was 12.25 million tons in the year 2002 in which button mushrooms occupied the lead position followed by oyster mushroom. The mushroom cultivation is done in six phases such as composting, pasteurization, spawing and growth, casing, pinning and cropping.

A recent cultivation involves several different traits including development of fruiting culture and mushroom seeds-the spawn, preparation of substrate-the compost, as well as the crop management, harvesting and marketing. However, cultivation of the shiitake, straw mushroom and oyster mushroom mostly as a cottage industry can be treated as an original type of farming in the South-East Asian countries that still continues as a rural technology thereby generating self-employment in the rural sector.

ii. Harvesting of Mushroom

The mushrooms are harvested by gently holding the body of a mushroom and turning it over. Washing is necessary to remove unwanted particles if non-peat covering soil is used but washed mushrooms generally depreciate more rapidly than dry packed mushrooms, due to the increased water content resulting in a higher rate of degradation. Small scale growers use reducing agents to delay the browning caused by polyphenoloxidase.

Types of most popular cultivated mushrooms are:

A. Oyster Mushroom

Oyster Mushroom *(Pleurotus spp.) i*s a very popular species that are marketed. They grow over in a wide temperature range because of its temperate, sub-tropical and tropical Climate. Unlike other mushrooms they adapt to varying agro-climatic conditions along with low dependence on type of substrate substrate-specificity for a wide range of lignocellulase activity. The flexible nature of this variety is mainly due to their rapid mycelial growth. They have large saprophytic colonizing ability and easier cultivation technology.

B. Button Mushroom

Button mushroom are popular varieties grown during winter season in North India (Jammu and Kashmir, H.P, Punjab, Haryana, Uttaranchal and Bihar) where temperature remains below 20°C during winter. However, its cultivation requires very stable infrastructural facilities for different operations like composting, spawning, cropping and post- harvest practices with high efficiency. Button mushroom (*Agaricus bisporus*) is widely cultivated and consumed in the world. The reason it is falls under the valuable food category is not just because of its richness in nutrients but also its wonderful taste. The taste of button mushroom is primarily attributed to abundant soluble non-volatile taste components, such as free amino acids, 5’ nucleotides, organic acids and soluble sugars and polyols. The umami taste and flavor enhancement is due to monosodium glutamate (MSG) and provides the enjoyable taste to button mushroom.

Nutritional Properties of Mushrooms

White mushrooms are packed with nutritional value. They're low in calories, are great sources of fiber and protein and also as important nutrients include vitamins, selenium, potassium, copper, zinc, thiamine, riboflavin, niacin, phytochemicals and vitamin D.

Table No. 2: Nutritional Composition of Button Mushroom

Nutritional composition	**Contents (g)**
Total fats	18
Sodium	1.173
Protein	14
Dietary fiber	6.4
Total carbohydrate	35.7

Medicinal Properties of Mushrooms

- Mushrooms are proven to have anti-allergic, anti-cholesterol, anti-tumor and anticancer.
- Enrich in dietary fibers present in the fruiting body is very important for many physiological functions in humans and also normal functioning of digestive system.
- Even patients suffering from diabetes, hypertension and obesity can consume mushrooms as they have low nucleic acid content.

II. PROCESSING AND PRESERVATION OF MUSHROOMS

Mushrooms need to be processed after it is harvested for its prolonged usage and consummation. On several occasions’ cultivators face problem of higher supply over the demand of mushrooms and hence price drop which result in losses. Everybody needs fresh mushroom at various stages in the supply chain such as farmer, whole seller, retailers and the consumer. If the yield is not fresh this will cause reduction in quality and

incur financial losses. The current trend to preserve mushroom for a long term is by drying, canning and pickling. The after-harvest food processing techniques not only reduces the yield loss but also improves the extra income to the mushroom farmers and provide nutraceutical low fat, protein rich food to the buyers.
Various food products such as soups, pasta, and snack seasonings, stuffing casseroles, meat and rice use dry mushrooms as an important ingredient. The main factor which drives us to preserve mushrooms is: The frequent loss of smooth texture, protein and carbohydrate contents are decreased in brown coloration and depletion of soluble compounds.

III. FREEZE DRYING OF MUSHROOMS

Benefits of dehydrating mushrooms when the water is removed, taste is deliciously concentrated, so that a suitable food with a taste can be better than the original. Preservatives were not added in the process of dehydration as a result this is 100% natural food that will remain tasty and nutritious for many months. It can be stored sixth months longer than the fresh mushrooms and does not need a refrigerator or a freezer which consumes electricity continuously.

Freeze-drying has proven to be an efficient method for drying organic products with least degradation to available food nutrients when compared to techniques involving heating.

It works according to the "principle of sublimation", whereby the water content present in the substance under process is frozen and directly converted into its gaseous state bypassing the liquid phase. This helps prevent browning due to enzymes and degradation due to microbes in food products. But the parameters like primary and secondary drying temperatures on the qualitative properties of the mushrooms have not been explored to a large extent.

"Freeze-drying or Lyophilisation" is a special method that is mainly used in the food industry and requires parametric optimization with respect to food concerned due to an increased cost. Consequently, it becomes even more essential to reduce process times and concurrently identify better process parameters which could lead to better quality produce.

Freeze drying is an evolving technology for drying of mushrooms, as it eliminates some of the unwanted characteristics. As compared to other dehydration techniques that uses high temperatures 'Lyophilization' causes minimal damage to the food. Heat sensitive nutrients are less lost during the process when compared to processes that involve heat for drying. Freeze-drying generally does not shrink the substance that's being dried. Besides, the aroma, odours and nutritional content usually do not change, which makes the process simple. Conversely, along with water other volatile compounds like acetic acid and alcohols also are lost that can result in detrimental results.

The rehydration of freeze-dried products is quick and easy as the process leaves microscopic pores. During sublimation the ice crystals vaporize and leave spaces or pores. For pharmaceutical purposes this is a critical factor. The shelf life can be in terms of years for pharmaceutical products using this approach. The food industry needs extended shelf life of foods while retaining the quality, this is achieved by the freeze-drying process.

Freeze-drying is known to be the best method in improving the quality of foods because structural reliability is maintained along with preservation of aromas. Presently, freeze-drying is regarded as one of the best methods for drying because it can dry high-value products for good taste and also for high level of nutrients preservation.

This process involves high energy consumption due to the need of freezing products, heating the frozen samples to induce sublimation, and lowering the total pressure of the dehydration chamber. Hence lot of research and studies are being made to modify the process so that it consumes lower amount of energy.

Advantages of Freeze Drying of Mushrooms

- The products are stable at room temperature, easy for rehydration by the adding water, weight reduction which helps in logistics.
- The product's weight decreases making it easier to carry or transport.
- Ease of sterile handling.
- All the nutrients and flavors are preserved when food is freeze dried.
- As the product is convenient food thus, requires less time for cooking.
- It has a very long shelf life and can be quickly rehydrate as well.

Disadvantages of Freeze Drying of Mushroom

- High cost due to the specialized Freeze drier equipment.
- Lack of knowledge to prepare freeze dried mushrooms at home.

Application of Freeze Drying of Mushrooms

- Freeze-drying was mainly developed to preserve bioactive molecules (DNA, enzymes, and proteins), pharmaceuticals products (antibiotics).
- Freeze-drying improves the conservation of nutrients due to low temperatures, promotes colour retention aroma, and flavors, prevents unwanted shrinkage and produces materials with high porosity and better rehydration properties.
- Freeze-drying is also commonly used for culture conservation and for the production of concentrated starter cultures.

IV. MARKETING STRATEGIES OF MUSHROOMS

Since, mushrooms are a valuable part of the human diet universal and their production plays a major role in the national circumstance, the market for mushrooms has been expanding in recent years. The trend is away from the canned product toward fresh and dried mushroom sales. Many people are interested in the nutritional and medicinal aspects of mushrooms. This study provides few indicative measures for the mushroom industry with orientation to the local Market and focuses on the marketing strategies of the Mushroom cultivator in the context of consumer preferences and attitudes about mushrooms as follows:

- There is a need for insistent promotional strategy to be made by the mushroom producers to raise awareness about it by other mediums such as Newspapers, Magazines etc.
- There is a requirement for effective and efficient marketing strategy to be implemented to encourage the other consumers to purchase the product.
- There is a need for provided that extra inducements to the purchasers to increase the rate of purchase and be habituated with the product.
- The manufacturers must use explicit advertising strategies to make the target audience aware about the nutritious contents of the product.
- Therefore the manufacturers must try and keep the price stable and avoid extra cost of production to earn more profit.

SWOT Analysis of Mushroom Industry

Strengths

- Significant targeted respondents are well aware about the edible mushroom. Thus, a huge scope of converting suspects into prospects exists in market.
- Mushroom industry is presently providing a high rise in return on capital employed at small scale area.
- The operating cost of mushroom industry in sampling area is low due to less involvement of indirect and direct expenditure heads.

Opportunities

- As majority Clients have scope to promote women entrepreneurship through self help groups.
- Effective and efficient promotional efforts may enhance and capitalize the untapped market share of this industry based on public awareness.
- Return on funds employed may be maximized as opposition level in this industry is very low at least in small scale area.

Weaknesses

- Lacks effective and efficient promotional efforts.
- The purchase frequency of existing consumers is very low i.e. major consumers purchase once in a month.
- Lack of financial assistance from desired sources.
- Lack of proper training on mushroom production is pulling down the optimum production level.

Threats

- Non-vegetarian alternative products especially meat is a major threat to the growth of this industry.
- High dependent on climatic changes, the risk for the industry is very high.
- High involvement of intermediaries leading to high distribution cost.

V. CONCLUSION

Mushroom is a highly perishable food and has a storage period of 1- 2 days. Due to less shelf life dehydrating process is carried out for the mushroom sauté to increase the shelf life. The sensory and nutritive parameter of the rehydrated product was found to have no major difference with respect to freshly prepared mushroom sauté. From the above results obtained, it can be concluded that the freeze dried mushroom sauté can be stored for a longer duration of period while the shelf life of mushroom is just 1-2 days and 7-8 days under refrigerated conditions. To conclude it may be said that there is a need for forceful promotional strategies by the mushroom producers to increase awareness and marketing demand in public. At the same time much needed financial and technical assistances from the Government is required on high main concern and right basis.

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