Original Research Article

Marketing and supply chain analysis of mushroom production in UdhamSinghNagardistrict of Uttarakhand

ABSTRACT

The presentstudy was designed with the prominent objectiveto evaluate marketing cost, margin, and efficiency. Samples of 60 mushroom growers were surveyed from two blocks of Udham Singh Nagar district.Based on the production, respondents were grouped into three categories*viz.*medium, small and marginal. For the analysis,Acharya'smethod of marketing efficiency and Garrett's ranking was used. From the study it was revealed that, marketing cost of per kg of mushroom in channel I, II and III was foundRs.22.5,Rs.23.66 and Rs.40.1, respectively. Due to the absence of intermediaries, channel I had the highest modified marketing efficiency (MME). The study stressed the need for establishment of marketing facilities as a pre-requisite to promote mushroom production and also ensure remunerative price. Addressing marketing issue like problem in delay payment, storage and transportation are the major problemswhich will help to embrace this venture on a long run by creating more revenue.

Keywords: *Marketing channels, marketing constraints, marketing efficiency, price spread*

1. INTRODUCTION

The Indian mushroom industry is experiencing growth in production and consumption, yet its response remains relatively lukewarm compared to global trends.This situation can be attributed to several factors, including the concentration on a few labor- and capital-intensive varieties, limited consumer acceptance, and infrastructural challenges (Bijla and Sharma, 2023). In recent years, oyster mushroom cultivation has gained popularity, particularly since the turn of the century. This shift can be attributed to substantial improvements in the infrastructure for oyster mushroom farming, which has resulted in lower cultivation costs compared to the more traditional white button mushroom. As a result, oyster mushrooms have become a more accessible option for many farmers and consumers alike (Roy *et al.*, 2020).

Hippocrates described the mushroom and discussed its therapeutic benefits around 400 BC. In a specific field, mushroom cultivation was first mentioned in 1652. Pennsylvania, sometimes referred to as the "Mushroom Capital of the World," recorded the first instance of

year-round commercial cultivation in 1780. Since ancient times, mushrooms have been regarded as the “Food of the Gods.” Mushroom substrate can be prepared from any clean agricultural waste material, and it can be produced in temporary clean shelters. Mushrooms are the source of protein, vitamins and minerals and are anti-cancerous, anti-cholesterolemic, and anti-tumorous. Sawdust produced the highest yield, biological efficiency and number of fruiting bodies, recommended as a best substrate for oyster mushroom cultivation. Though it is classified as vegetables in the food world, they are not technically plants. They belong to the fungi kingdom and although they are not vegetables, mushrooms provide several important nutrients.

The nation did not begin producing mushrooms until the very late 1970s. Its rise has been extraordinary in terms of both production and productivity. Button mushrooms were cultivated as a seasonal crop in the hills during the 1970s and 1980s, but with the advancement of environmental control technologies and a better understanding of cropping systems, mushroom production skyrocketed from just 5000 tonnes in 1990 to 100000 tonnes in 2006 (Singh *et al.*, 2008).In the past, mushrooms were regarded as a costly vegetable and were only used in cooking by wealthy people. Because of its many health advantages, mushrooms are now regarded by the general public as a high-quality meal (Kumar, 2008). The approximate composition of mushrooms is 80–90% water, protein (2-40%), fat (2-8%), carbohydrates (155%), fibre (3-32%) and ash (8-10%). Moreover, mushrooms are a great source of vitamins, particularly C and B (niacin, thiamine, riboflavin, and folic acid) (Chatterjee and Samajpati, 2021). The fruit bodies of mushrooms have higher concentrations of mineral potassium, sodium, and phosphorous. It is also low in calcium and iron and has trace amounts of other important minerals including copper, zinc, and magnesium (Lidyana*et al.*, 2021). More than 100 countries already engage in mushroom cultivation, and the crop’s output is rising at a rate of 67% every year.

Mushroom farming has become a high-tech sector with very high degrees of automation and mechanization in some wealthy countries in Europe and America. The majority of this delicacy rich in protein is consumed in the United States. The current global mushroom production is estimated to be 12 million tonnes, and it is increasing at a rate higher than 7% per year. According to estimates, mushroom output and demand will continue to expand, with potential peak production of 25 million tonnes by 2020 and 30 million tonnes by 2025. Worldwide, the percentage of mushrooms produced is as follows: 31% for buttons, 24% for shiitake, 14% for oysters, 9% for black ear mushrooms, 8% for paddy straw mushrooms, and the remaining percentage for milky/other mushrooms (Sharma*et al.*,

2017).India produced approximately 314,840tonnes of mushrooms during the 2022-23 period, as reported by the Ministry of Agriculture & Farmers' Welfare. Bihar emerged as the leading producer, contributing over 35,600tonnes to the national output. Following Bihar, Odisha and Maharashtra were significant contributors, with production figures of 34,500tonnes and 32,550tonnes, respectively.

Approximately 96% of the world's mushroom production currently comes from three regions: Europe, America, and East Asia. One significant factor contributing to the concentrated mushroom production in American and European nations is that the six G6 members, comprising these regions, consume approximately 85% of the global output*i.e.*USA 30%, Germany 17%, UK 11%, France 11%, Italy 10%, and Canada 6%(Borah *et al.*, 2018).

Mushrooms are increasingly sought after globally, but their rapid spoilage presents a significant challenge. An efficient marketing system is an important means for raising the income level of the farmers. Good marketing facilities, efficient marketing channels and marketing machinery provide better price for the produce in the economy than its operation in haphazard way. Hence, there is a need to estimate marketing costs, margin and price spread in marketing of mushroom. Keeping in view all these aspects, the present study was conducted with the objective of exploring marketing efficiency and identifying constraints faced by stakeholders of supply chain.

2. METHODOLOGY

The survey approach was used to gather information on several facets of the mushroom industry. The data were collected by means of in-person interviews with the selected respondents and middlemen involved in the mushroom trade.The socio-economic status of the mushroom growers in Udham Singh Nagar district is categorizing into three categories on the basis of production size namely, medium (50q and above), small(50-10 q), and marginal (less than 10q) of mushroom production. It helps in classify the mushroom growers into various socio-economic strata but also furnished a base for the next coming planning and development of mushroom cultivation.

Analytical techniques employed:

For achieving the stated objectives, the following analytical procedure was adopted (Acharya and Agarwal, 2020):

2.1Marketing margin: Marketing margin of the intermediary calculated as the difference between total payments (marketing cost + purchasing price) and receipt (sales price)

Absolute margin = PRi - (Ppi+ Cmi)

Per centmargin = Pri - (Pri + Cmi)×100

where,

Pri= Total value of receipts

Ppi= Total purchase value of goods (purchase price)

Cmi= Cost incurred in marketing

2.2Cost of marketing: The total cost incurred on marketing by various intermediaries involved in the sale and purchase of the commodity till it reaches the ultimate consumercomputed as follows:

C = Cf + Cm1+ Cm2 +Cm3+……+ Cmn

where,

C = Total cost of marketing

Cf = Cost born by the producer from the time produce leaves the farm till the sale of the produce

Cmn = Cost incurred by the middlemen in the process of buying and selling

2.3 Marketing efficiency (ME): It is the movement ofgoods from producer to consumer at a low cost consistent with the provision of servicesconsumer's desire.Marketing efficiency was formulated as:

MME = $\frac{FP}{MC + MM}$

where,

MME= Modified measure of marketing efficiency

FP= Prices received by the processor

MC= Marketing cost

MM= Marketing margins

2.4Price spread: It refers to the difference between the price received by producers for their products and the price paid by consumers.

Price spread = $\frac{\text{Consumer price} - \text{The net price of producer}}{\text{Consumer price}} \times 100$

2.5Identifying various constraints faced by mushroom growers

Using Garrett's ranking technique (Roy *etal.*, 2020), growers' identified issues with mushroom marketing were ranked. The study asked respondents to rank various issues and

results according to their impact, which was converted into a score value and ranked using the following formula:

Per cent position = $\frac{100\ (Rij - 0.5)}{Nj}$

where,

R_{ij} = Rank given for the i^{th} variable by j^{th} respondents

N_j= Number of variables ranked by j^{th} respondents

By consulting the table provided by Garrett and Woodworth (1969), the % position estimate is translated into scores with the use of Garrett's Table. Following the addition of each person's score for each factor, the total value of the scores and the mean values of the scores are determined. The elements deemed most significant are those with the highest mean value.

3. RESULTS AND DISCUSSION

3.1 Marketing channel: In order to raise consumer demand for mushroom products and highlight the health benefits of eating mushrooms, marketing is a crucial component of the mushroom industry as a whole. We'll go over a few of the most important techniques and ideas for marketing mushrooms below. The pathways that mushroom growers used to sell their produce to middlemen were determined to be crucial in the current investigation. The following marketing channels were most frequently used in the research area to sell mushrooms, based on inquiries from farmers. As a result, the marketing channels used in the analysis of particular blocks were as follows:

Channels	**Intermediaries**
Channel I	Growers→ Consumer
Channel II	Growers→ Retailer→ Consumer
Channel III	Growers→ Wholesaler→ Retailer→ Consumer

3.2 Different marketing channels adopted by mushroom growers: There are several marketing channels in use in the research region; Table 1 displays information on the methods that different mushroom growers use to market and sell their produce. Medium growers sell their mushrooms through channel II at the highest rate of sales

(44.44%),followed by channel I (33.33%) and channel III (22.23%),whereas, small growers highest sale through channel I (55.55%) followed by channel II (25.93%) and channel III (18.52%) and marginal growers sell their mushrooms largely through channel I (75%) followed by channel II (25%) and no one using channel III because of low production.. In addition, channel I (60%) became the channel with the highest sales of mushrooms, followed by channel II (28.33%) and channel III (11.67%) based on the total number of growers. The outcome shows that all three categories are adopting channel I, which was the most profitable for both growers and consumers. The study conducted by Thilakarathne and Sivashankar (2018) on several aspects of mushroom growers' marketing in the Kegalle area of Sri Lanka has also confirmed these findings.

Table 1: Adoption of different marketing channels through sample growers

Channels	Medium growers	Small growers	Marginal growers	Overall
Channel I	3 (33.33%)	15 (55.55%)	18 (75%)	36 (60%)
Channel II	4 (44.44%)	7 (25.93%)	6 (25%)	17 (28.33%)
Channel III	2 (22.23%)	5 (18.52%)	0 (00.00%)	7 (11.67%)
Total number of growers	9 (100%)	27 (100%)	24 (100%)	60 (100%)

3.3 Disposal of mushroom through various marketing channels: Table 2 displays the mushroom products that are sold through the current marketing channels during 2021-22. Channel I sells the most produce, followed by Channel II, while Channel III sells a lesser quantity of goods. The largest percentage of mushroom produce sold through different channels is through channel I (49.75%), which is followed by channels II (33.47%) and III (18.7%).

Growers on the margins sell the majority of their produce through channel I (80%), with channel II (20%) and channel III (0%). Produce from small-scale growers is mostly sold through channel I (58%), with the remainder going through channels II (25%) and III (17%). The majority of medium-sized producers' produce is sold through channel II (45.5%), with the remainder going through channels I (35%) and III (19.5%).

As a result, the majority of growers employed channel I, or direct consumer sales. The medium-sized growers, who work on a vast scale, embraced channel II for marketing. The dominance of mushroom marketing is evident in the channel that I covered, which was the most dominating channel at 49.75%.

Table 2: Disposal of mushroom through various marketing channels

Channels	Medium grower		Small grower		Marginal grower		overall	
	Disposed (q)	Disposed (%)	Disposed (q)	Disposed (%)	Disposed (q)	Disposed (%)	Disposed (q)	Disposed (%)
Channel I	206.5	35	372.94	58	90.16	80	669.6	49.75
Channel II	268.45	45.5	160.75	25	22.54	20	451.74	33.47
Channel III	115.05	19.5	109.31	17	0	0	224.36	16.68
Total	590	100	643	100	112.7	100	1345.7	100

3.4 Marketing cost, price spread and marketing efficiency: According to table 3, the marketingcost for channels II and III was Rs. 23.66 and Rs. 40.1 per kilogram, respectively. As a result, channel III has two middlemen compared to channel II, which has one intermediary, and channel I, which has no intermediaries, the overall cost of marketing was higher. The net margin earned by the wholesaler in channel III was Rs. 32, while the retailer in channel II received Rs. 22.5 per kg.

The marketing costs for the wholesaler in channel III totaled Rs. 19.3 per kg and included labor, transportation, shop rent, and other extra charges. In channel III, the wholesaler's gross marketing margins were Rs. 31.3 per kg. Conversely, the retailer's channel III gross margin per kg was Rs. 40.8 and their total cost per kg was Rs. 20.8. A net margin of Rs. 12 per kg was obtained by the wholesaler in channel III. The overall margins for Channels II and III were Rs. 22.5 and Rs. 32 per kg, respectively. Channels II and III had total marketing margins of 15.51% and 19.44% of consumer rupees, respectively, and total marketing costs of 16.31% and 24.36% of consumer rupees.Channels II and III had total marketing margins of 15.51% and 19.44% of consumer rupees, respectively, and total marketing costs of 16.31% and 24.36% of consumer rupees, respectively.

The pricing distribution among the three marketing channels is shown in Table 3. The table clearly shows that channel II had a smaller pricing spread (46.16 Rs./kg) than channel III (72.1 Rs./kg) due to the involvement of fewer middlemen. Channel II and Channel III had the

next-highest producer shares in consumer rupees since there was no intermediaries in Channel I. Because channel I gave the grower the highest net price in comparison to the other two channels, it was advantageous to both the grower and the customer. To sell a lot of produce to one customer, though, is not realistic in terms of channel adoption, in my opinion.

The table displays the marketing efficiency of the various channels, which was determined using Acharya's modified marketing efficiency approach. Channel I had the greatest modified marketing efficiency (MME) since there were no middlemen. In channels II and III, MME was found to be 2.14 and 1.28, respectively. Channel II was therefore more efficient than Channel III.

Table 3: Marketing cost, price spread and marketing efficiency

Channels					
Particular	**I**	**II**	**Percentage to consumer rupee**	**III**	**Percentage to consumer rupee**
	G-C	G-R-C		G-WS-R-C	
Grower					
Producer's selling price	118.2	98.89		92.49	
Wholesaler					
Transportation cost				4	2.43
Labour cost				5	3.03
Shop rent				3.3	2.00
miscellaneous expenses				7	4.25
Total				19.3	11.72
Wholesaler gross margin				31.3	19.01
Wholesaler net margin				12	7.29
Wholesaler gross selling price				123.79	75.21
Retailer					
Transportation cost		2.5	1.72	3.67	2.22
Labour cost		3.5	2.41	4.56	2.77
Shop rent		7.66	5.28	6.57	3.99
Miscellaneous expenses		10	6.89	6	3.64
Total		23.66	16.31	20.8	12.63
Retailer gross margin		46.16	31.82	40.8	24.78
Retailer net margin		22.5	15.51	20.00	12.15
Consumer purchasing price	118.2	145.05	100	164.59	100

Total margins	2.00	22.5	15.51	32.00	19.44
Total marketing cost	2.25	23.66	16.31	40.10	24.36
Price spread	0.00	46.16	31.82	72.10	43.80
Marketing efficiency	27.81	2.14		1.28	
Producers share in consumer Rupee (%)	100	68.17		56.19	
Note: G-Grower, WS- Wholesaler, R-Retailer, C-Consumer					

3.5 Constraints in marketing of mushroom: Mushroom production offers an additional money stream and jobs. This business is suitable for most marginal and small producers with inadequate financial underpinnings. But there are challenges along the way to successfully launch this venture. A number of important production and marketing difficulties were covered in this section. The primary issues growers experienced were inadequate marketing facilities, as evidenced by Table 4 ranking of various restrictions with Garrett scores. Issues with delay payment (72) and problem in storage (59.47) and lack of a separate marketing channel (48.78) were among the worst. It was discovered that a large number of wholesalers exclusively bought tons of mushroom produce from medium growers, rarely buying from marginal and small producers.

Examining the constraints encountered in the process of producing mushrooms revealed that the construction of marketing facilities is a necessary step that will also help to boost the production of mushrooms and guarantee the output is sold for a fair price. Regardless of how serious other obstacles may be, having fair pricing and resolving a marketing problem would be very helpful in promoting and supporting this project as a strategy to increase income and employment in the research area.

Table 4: Mean score and ranks of different constraints faced by mushroom growers

S. No.	Constraints		
	Marketing constraints	**Score**	**Rank**
1	Problem of disposal	31.78	7
2	No separate marketing channel	48.78	3
3	Total demand is not adequate	46.13	5
4	Problem in transportation	47.67	4
5	Problem in packing	44.95	6
6	Problem in storage	59.47	2
7	Problem in delay payment	72.00	1

4. CONCLUSION

Mushroom growers in the study area primarily utilized three marketing channels. Channel I was most adopted, particularly by marginal growers (75%) due to its direct-to-consumer approach, offering the highest profitability and lowest costs. Small growers also favoured Channel I (58%), while medium growers mostly used Channel II (45.5%) due to their larger-scale operations. Overall, Channel I accounted for 60% of total sales, followed by Channel II (28.33%) and Channel III (11.67%).Marketing costs were highest for Channel III (Rs.40.10/kg) due to more intermediaries, compared to Channel II (Rs.23.66/kg). Channel I had the highest marketing efficiency (no intermediaries), followed by Channel II (MME 2.14) and Channel III (MME 1.28). Channel I provided the highest producer share of consumer prices, benefiting both growers and consumers.Challenges included delayed payments (Garrett score: 72), insufficient storage (59.47), No separate marketing channel (48.78),transportation, and total demand is not adequate. Medium and large-scale wholesalers rarely dealt with smaller growers, further disadvantaging them.

REFERENCES

Acharya, S. S., and Agarwal, N. L. (2020).Agricultural Marketing in India.Oxford and IBH publishing. (Original Publish 1987).

Bijla, S., and Sharma, V. P. (2023). Status of mushroom production: Global and national scenario. Mushroom Research, 32(2), 91-98.

Borah, T. R., Gogoi, R., andHelim, R. (2018). Mushroom production for farmers' additional income. Indian Farming, 68(3).

Chatterjee, A., and Samajpati, N. (2021). Nutritional value of edible mushrooms J. Mycopathol. Res., 59(4), 357-362.

Chauhan, S. K., and Sharma, K. D. (2015).A study on production potential, economic viability and marketing system of varied size mushroom units in Himachal Pradesh.Department of Agricultural Economics, Extension Education & Rural Sociology, CSK HP KrishiVishavidyalaya, Palampur. Publication73. Pp121.

Garrett, H.E., andWoodworth, R.S. (1969).Statisticsin Psychology and Education.Vakils, Feffer and Simons Pvt. Ltd., Bombay. p-329.

Kumar, A. (2008). Marketing system of mushroom: A study with special reference to Jharkhand state. BhartiyaKrishiAnusandhanPatrika, 23(1), 45-50.

Lidyana, N., Perwitasari, D. A., andRustianawati, M. (2021).Revenue and Marketing Channel of Oyster Mushroom in Probolinggo District.Wiga: JurnalPenelitianIlmuEkonomi, 11(1), 31-38.

Roy, R., Rudra, B. C., Majumder, D., andMondal, A. (2020).Perceived constraints in mushroom production enterprise in West Bengal. Int. J. Curr. Microbiol. App. Sci, 9(4), 1579-1583.

Sharma, V. P., Annepu, S. K., Gautam, Y., Singh, M., and Kamal, S. (2017). Status of mushroom production in India. Mushroom research, 26(2), 111-120.

Singh, N., Mehta, S., Godara, A. K., andYadav, V. P. (2008).Constraints in mushroom production technology in Haryana. Agricultural Science Digest, 28(2), 118-120.