



Seasonal Patterns in Cumin Arrivals and Prices in Indian Markets: A Post-COVID 19 Analysis

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Cumin known as jeera in India, holds significant economic and cultural importance in the country's spice industry. My research paper explores the seasonal dynamics of cumin arrivals and prices in selected Indian markets, considering the profound impact of the COVID-19 pandemic. Utilizing data from the Agmarknet portal spanning from January, 2006 to December, 2021, this study employs rigorous statistical techniques to analyze the patterns. The study reveals distinctive characteristics in cumin arrivals and prices across different markets. Notably, markets like Unjha, Jamnagar, Gondal, Merta City and Mumbai witnessed significant seasonal price fluctuations in August (102.40), January (103.23), July (105.37), August (104.49) and October (108.17) respectively. Mumbai, characterized by stable supply and demand, exhibited moderate price variation (CV =

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17.81%), whereas Mandore experienced substantial fluctuations (CV = 43.55%) due to seasonal factors exacerbated by the COVID-19 pandemic. This research provides invaluable insights into the altered seasonal patterns of cumin arrivals and prices following the pandemic, offering vital information for farmers, traders and policymakers. Informed decisions about cumin production, marketing and pricing can be made, aligning with the dynamic post-COVID-19 landscape of the spice market in India.

Keywords: *Cumin; seasonal patterns; price fluctuations; indian markets; COVID-19 impact; agmarknet data; spice industry.*

1. INTRODUCTION

Cumin (*Cuminum cyminum* L.) is indeed a significant seed spice that is widely cultivated in various countries, including India, Turkey, Syria, Iran, UAE, Netherlands and the United Kingdom. With India accounting for a whopping 86% of global cumin output, it is the undisputed leader in the industry [1]. In India, cumin is primarily cultivated in arid regions such as Gujarat, Rajasthan, Madhya Pradesh, Karnataka and Uttar Pradesh. In terms of both value and quantity, India has been a major producer and supplier of cumin. In 2019, India met 85 percent of the global demand for cumin with 26 percent of its output [2]. It is the largest grown spice in the country, hovering over more than one fourth to national spices acreage. In India it is primarily grown in the states of Rajasthan and Gujarat, which accounted for 66 and 34 % of the country's land area and 47 and 53 % of its total output, respectively [3]. Cumin, a spice with a rich history dating back to 5000 BC, has significant economic and cultural importance in India. However, the agricultural sector faces challenges of price volatility and market fluctuations, necessitating market intelligence for effective decision-making. This research aims to address this need by analyzing seasonal patterns in cumin arrivals and prices in selected Indian markets. Cumin, a powerful spice with a rich history, offers a multitude of advantages for overall well-being. Its consumption has been linked to a wide range of therapeutic applications, making it a valuable addition to any diet. Alongside its flavorful appeal, cumin boasts antibacterial, antioxidant and antidiabetic properties [4]. Moreover, it serves as an abundant source of essential nutrients such as vitamin B-complex, iron, calcium and zinc [5].

Cumin is a high-value, export-oriented seed spice, experiencing remarkable growth in terms of area, production and export over the past two decades. The increasing demand in both domestic and international markets, coupled with

higher returns and lower input requirements, indicates the potential for further expansion [6]. Efficient markets are directly influenced by the prices of agricultural commodities [7]. The prices of agricultural commodities have a significant impact on the marketing decisions of farmers and other stakeholders [8]. Price fluctuations have a significant effect on farmers' income [8]. Understanding price trends and seasonality helps farmers and other stakeholders in the supply chain make informed decisions to mitigate and manage price fluctuations [9]. This information enables farmers to make informed decisions about when and where to sell their produce. Researchers should give more emphasis to increasing the area under cultivation and improving spice productivity [10]. Proper transmission of price signals from one market to another assist in price stabilization and foster healthy competition. It would also aid in defending the interests of producer sellers [11].

This Paper on cumin is of utmost importance for cumin farmers, traders and stakeholders. It provides valuable market intelligence, addressing the challenge of offering insights into seasonal patterns of cumin arrivals and prices. With this information, farmers and traders can make informed decisions about production and marketing strategies. This also identifies the dominant cumin market, helping stakeholders understand market dynamics. The prices of agricultural goods have a direct impact on efficient market functioning, influencing government policies, buyer preferences, technology adoption and marketing choices made by farmers and stakeholders. Price fluctuations greatly affect farmers income, making it crucial to understand price trends and seasonality. This knowledge helps farms and supply chain participants reduce costs and address price inequalities. Researching the relationship between market arrivals and prices is highly beneficial. Higher arrivals and output negatively affect prices, especially for goods with a short return between vendors and consumers.

Understanding these dynamics allows market forces to regulate supplies and consumption. In a mixed economy, studying market arrivals, prices and their influencing variables is essential. Evaluating market performance and addressing bottlenecks in the cumin marketing system, such as market concentration and the role of middlemen, becomes crucial for policymakers. These efforts contribute to increasing cumin farmer income and enhancing overall market efficiency.

2. METHODOLOGY

2.1 Data Collection

The research collected monthly time series data on cumin prices and arrivals from the Agmarknet portal. Therefore, the present study aims to assist cumin six markets were selected based on their high average cumin arrivals from 2018 to 2021. The selected markets included Unjha, Jamnagar and Gondal in Gujarat, Merta City and Mandora in Rajasthan and Mumbai in Maharashtra.

2.2 Analytical Techniques Used

The research employed various statistical techniques to analyze the data and identify seasonal patterns in cumin arrivals and prices.

2.3 Seasonal Variation

To measure seasonal indices, the widely used moving average method was employed. The 12-month moving average method was specifically used to quantify the seasonal changes in cumin prices. The following steps were followed to generate the seasonal indices: Generate a series of 12 months moving averages: A series of 12 months moving averages is generated by dividing 12 months moving totals by 12. Then generate a series of centered 12 months moving averages. Next step involves taking averages of pairs of two subsequent 12 months moving averages and entering between each pair. There are no corresponding moving averages for the first six and last six months. Then express each original value as a percentage of corresponding centered moving average. The percentage of moving average represents indices of seasonal and irregular components combined. The next step involves removing the irregular component. Arrange the percentage of moving averages in the form of monthly arrays. Next,

the average index for each month was calculated.

These averages were adjusted in such a way that their sum becomes 1200. This were done by working out of correction factor and multiplying the average for each month by this correction factor.

The correction factor (K) were worked out as follows: $K = 1200/S$

where, K is correction factor and S is sum of averages indices for 12 months, multiply K with the percentage of moving average for each month to obtain the seasonal indices.

Using the following formula, the degree of variation in seasonal indices were calculated using the coefficient of Average Seasonal Price Variation (ASPV), the Intra-year Price Rise (IPR) and the Coefficient of Variation (CV):

$$IPR = \left[\frac{HSPI - LSPI}{LPSI} \right] \times 100 \quad (1)$$

$$ASPV = \left[\frac{HSPI - LSPI}{(HSPI + LSPI)/2} \right] \times 100 \quad (2)$$

$$CV = \left[\frac{\sigma}{\bar{X}} \right] \times 100 \quad (3)$$

$$IPR = \frac{P_t}{P_o} \times 100 \quad (4)$$

Where,

LSPI is the Lowest Seasonal Price Index
HSPI is the Highest Seasonal Price Index.

σ is standard deviation

\bar{X} is mean

P_t is price at time period t

P_o is price of base year time period

Seasonal price index for onion were calculated by using the following equation:

$$S = \frac{O}{M} \times 100$$

Where,

S = Seasonal index

M = Twelve month centered moving average

O = Original time series data.

3. RESULTS AND DISCUSSION

The analysis of seasonal indices revealed seasonality in both cumin arrivals and prices across all selected markets. The months of March to May witnessed the highest influx of cumin, indicating the harvest season. Lower prices were prevalent during this period due to abundant supply. Conversely, the lean season from August to December exhibited higher prices due to reduced arrivals. The selected markets showed variations in the distribution of market prices, but all demonstrated clear evidence of seasonality.

3.1 Seasonal Behaviour

The analysis of seasonal indices revealed clear evidence of seasonality in both cumin arrivals and prices across all selected markets. The seasonal indices for cumin arrivals and prices in the selected markets are presented in Tables 1 and 2, respectively.

Table 1. Seasonal indices of monthly wholesale arrivals of cumin in selected markets (January, 2006 to December, 2021)

Month	Unj	Jam	Gon	MC	Mum	Man
Jan	66.05	37.20	86.22	18.91	96.60	35.08
Feb	86.46	102.74	149.93	39.49	92.22	36.65
Mar	228.04	303.90	156.82	196.73	139.81	137.52
Apr	196.11	184.91	105.43	273.02	138.93	333.10
May	112.85	122.54	95.73	200.79	88.08	232.34
Jun	91.60	82.05	72.43	158.66	103.81	155.30
Jul	74.71	95.53	79.29	99.63	86.33	96.68
Aug	63.75	53.70	82.84	78.03	85.66	44.39
Sep	64.74	56.94	106.71	56.84	82.04	39.99
Oct	74.16	48.25	79.86	26.30	93.63	29.15
Nov	75.09	46.71	115.14	28.55	92.97	30.65
Dec	66.45	65.54	69.61	23.06	99.93	29.14

Note: Unj- Unjha, Jam- Jamnagar, Gon- Gondal, MC- Merta city, Mum- Mumbai, Man- Mandore

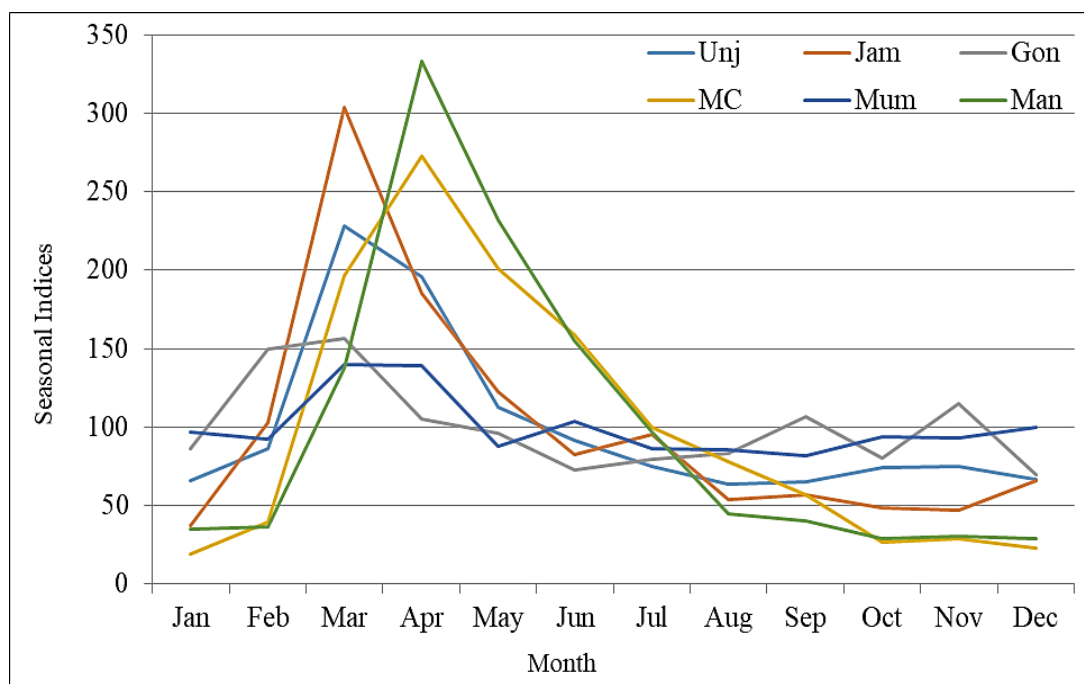


Fig. 1. Seasonal indices of monthly wholesale arrival of cumin in selected markets (January, 2006 to December, 2021)

Table 2. Seasonal indices of monthly wholesale prices of cumin in selected markets (January, 2006 to December, 2021)

Month	Unj	Jam	Gon	MC	Mum	Man
Jan	101.42	103.23	102.17	102.00	96.86	103.16
Feb	99.23	96.84	100.75	97.04	98.33	103.15
Mar	96.04	94.77	91.73	97.26	97.13	100.08
Apr	96.86	100.07	93.88	95.95	98.41	101.81
May	96.96	99.56	96.77	100.26	98.60	102.63
Jun	97.08	97.04	97.42	100.21	98.20	100.39
Jul	100.33	102.84	105.37	102.46	99.36	98.03
Aug	102.40	103.06	104.42	104.49	98.80	99.80
Sep	101.16	101.21	101.29	101.27	105.72	96.98
Oct	100.34	98.72	99.81	99.05	108.17	97.28
Nov	100.88	99.44	102.22	97.12	101.24	98.25
Dec	107.32	103.21	104.15	102.89	99.17	98.44

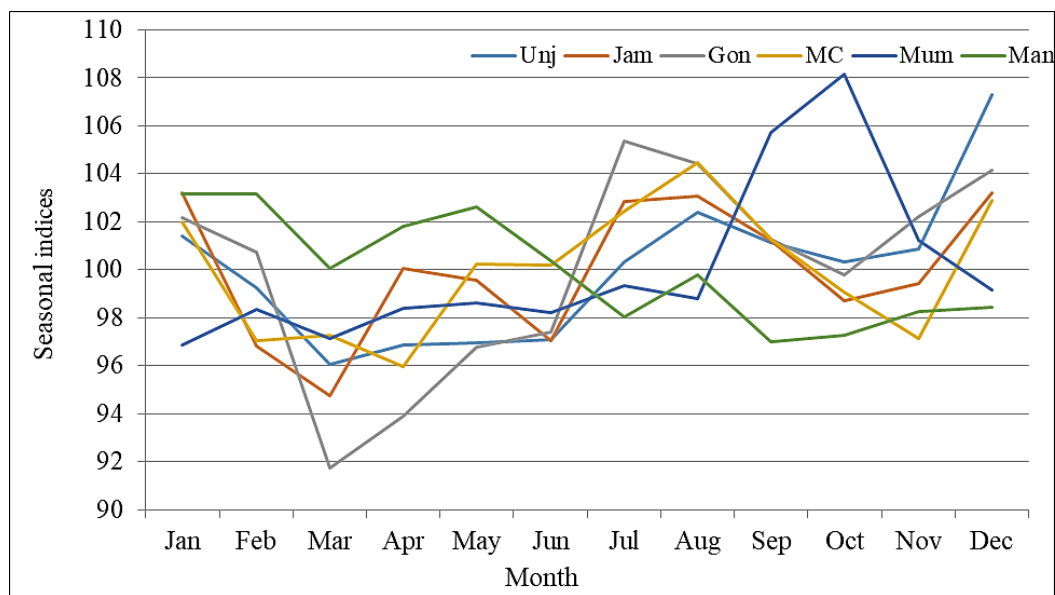


Fig. 2. Seasonal indices of monthly wholesale prices of cumin in selected markets (January, 2006 to December, 2021)

The seasonal indices provide insights into how cumin arrivals and prices vary throughout the year. The highest indices indicate periods of increased arrivals or higher prices while lower indices represent reduced arrivals or lower prices.

3.2 Seasonal Variation in Arrivals and Prices

The analysis of the seasonal indices revealed consistent patterns in cumin arrivals and prices across all selected markets. The months of March to May consistently exhibit higher arrivals indicating the harvest season for cumin as illustrated in Fig. 1. During this period, the market receives a significant influx of cumin, leading to lower prices due to abundant supply. Conversely,

the lean season from August to December shows reduced arrivals, resulting in higher prices as illustrated in Fig. 2.

In terms of price variations, the selected markets demonstrate similar trends. From March to May, the seasonal price indices are lower than the average (<100) in many markets due to the abundant supply of cumin. This period represents a favourable time for buyers as they can procure cumin at lower prices. The current results are similar with those of Meena et al. [12], who observed decreased price indices for cumin in major Indian marketplaces from March to May between 2008 and 2019. In contrast, during the lean season from August to December, the price indices are higher than the average (>100) due to reduced arrivals. This indicates a period of higher prices for cumin.

Table 3. Intra year wholesale price rise of cumin in selected markets of India

Markets	Highest	S.I.	Lowest	Magnitude of Variation			
	Months		Months	S.I.	IPR	ASPV	CV
Unjha	August	102.40	March	96.04	10.76	10.21	20.47
Jamnagar	January	103.23	March	94.77	13.58	12.72	17.81
Gondal	July	105.37	March	91.73	13.00	12.20	18.49
Merta city	August	104.49	April	95.95	14.10	13.17	20.64
Mumbai	October	108.17	January	96.86	11.13	10.55	26.79
Mandore	January	103.16	September	97.28	6.38	6.18	43.55

Note: IPR – Intra year price rise, ASPV- Average seasonal price variation, CV- Coefficient of variation

3.3 Market-specific Observations

Each selected market exhibited unique characteristics in terms of cumin arrivals and prices. For example, the Unjha market experiences a significant seasonal price increase in August (102.40), with lower prices during the harvest season. The Jamnagar market shows higher arrivals from February to May and higher price indices in January (103.23). The Gondal market witnesses fluctuations in arrivals with higher price indices in July (105.37). The Merta City market exhibits high price volatility with the highest seasonal price indices in August (104.49). In the Mumbai market of Maharashtra, cumin arrivals and prices display a cyclical and irregular pattern. October showed the highest seasonal price indices (108.17) with relatively lower arrivals (93.63). Overall, the wholesale price of cumin in Mumbai shows moderate variation throughout the year due to stable supply and demand conditions. In the Mandore market in Rajasthan, cumin arrivals are notably high, especially in April (333.10), which records the highest arrival index. The wholesale price of cumin in Mandore experiences significant variation due to seasonal fluctuations in production, supply and regional market dynamics.

3.4 Degree of Seasonal Fluctuations

To evaluate the degree of seasonal fluctuations in cumin, the Intra-year Price Rise (IPR), Average Seasonal Price Variation (ASPV) and Coefficient of Variation (CV) were calculated. The IPR represents the magnitude of price rise within a year while the ASPV indicates the average seasonal variation in price. The CV measures the price volatility, with higher values indicating greater fluctuations.

The results show that the IPR ranges from 6.38% in the Mandore market to 14.10% in the Merta City market. The ASPV varies from 6.18% in Mandore to 13.17% in Merta City. The coefficient

of variation (CV) ranges from 17.81% in Jamnagar to 43.55% in Mandore. Higher values of CV indicate higher price volatility, reflecting greater fluctuations in cumin prices, the current results are similar with those of Meena et al. [12],[13].

The findings highlight the importance of understanding and managing seasonal fluctuations in cumin arrivals and prices. Producers and stakeholders can leverage the seasonal patterns to optimize their production and marketing strategies, ensuring appropriate pricing and supply management during periods of elevated seasonal price indices.

4. CONCLUSION AND RECOMMENDATIONS

In conclusion, the impact of the COVID-19 pandemic on the cumin market in India has been profound and multifaceted, reshaping its seasonal patterns and pricing dynamics. Our in-depth analysis, as presented in this research paper, not only illuminates these altered trends but also provides actionable insights for stakeholders in the spice industry. As we navigate the post-COVID-19 world, understanding these shifts is paramount for farmers, traders and policymakers. Armed with this knowledge, strategic decisions can be made to ensure the sustainability and resilience of the cumin market. By embracing the challenges posed by the pandemic and capitalizing on the opportunities it presents, the spice industry can emerge stronger and more adaptive, contributing significantly to the broader goals of achieving sustainable development in the post-COVID-19 era. Through collaboration, innovation and informed decision-making, we can pave the way for a robust and resilient spice industry that meets the demands of the future.

Based on the study's findings, farmers should adapt cultivation practices and consider crop diversification to optimize yield and stabilize

income. Traders should diversify markets and implement risk management strategies to mitigate pricing risks. Policymakers need to formulate data-driven policies, invest in infrastructure, and promote research to support the sustainable growth of the cumin market. Collaborative efforts among stakeholders, including capacity-building and market intelligence sharing, are essential to navigating the challenges and opportunities presented by the COVID-19 pandemic, ensuring the resilience and competitiveness of the cumin market in India.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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