

PANDEMIC PRICES: COVID-19 PRICE SHOCKS AND THEIR IMPLICATIONS FOR NUTRITION SECURITY IN INDIA

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Pandemic Prices: COVID-19 Price Shocks and Their Implications for Nutrition Security in India

ABSTRACT

The COVID-19 pandemic has had massive economic impacts throughout the world, and especially in India, where a strict lockdown was put in place to curb the spread of the virus, bringing unprecedented disruption to the Indian economy. While the exact extent of this disruption will remain unknown in the short run, many attempts are being made by scholars and policymakers to assess the immediate and more visible impact of the lockdown. Disruption in the global and regional food systems and their potential implications on food prices have been significant concerns.

In this report, we look at the impact of the lockdown on the prices of essential agricultural commodities and the potential implications for nutrition security in India. We compare the prices of cereals and non-cereals before and during the lockdown to the prices in the same period last year, in an attempt to isolate the effect of the lockdown on food prices.

The findings of the report reveal that (1) following the lockdown, there was a rise in prices across food groups compared to last year; (2) the rise in prices was higher for non-cereals than for cereals; (3) following the lifting of the lockdown, prices stabilized quickly to pre-lockdown levels for cereals, eggs, and vegetables, such as potatoes, onions, and tomatoes; and (5) the price of nutritionally rich crops such as pulses have remained high, despite the easing of the lockdown.

While the price patterns have shown the food systems in India to be resilient, the distortions in price trends in cereal versus non-cereal food groups could have implications for nutrition security in India, especially for vulnerable populations. A disproportionate rise in prices of non-cereals may divert consumer spending toward staples (that is, wheat and rice), resulting in inadequate intakes of protein-rich food groups, like pulses. Unemployment and income loss from the decline in remittances to rural areas will further exacerbate the problem.

COVID-19 LOCKDOWN, SUPPLY CHAIN DISRUPTIONS, AND NUTRITIONAL IMPLICATIONS

The novel coronavirus pandemic has brought a devastating shock to the Indian economy. Health experts believe that until a vaccine is discovered, and mass vaccination carried out, measures to curb further outbreak are necessary, including social distancing, isolation, and limiting or eliminating movement across domestic and international borders. To comply with these procedures, the prime minister of India requested every Indian to observe a one-day lockdown on March 22, 2020. This curfew was followed by a 21-day, nationwide lockdown, starting March 24, 2020. The imposition of this lockdown nationally is not only unprecedented, but is also the most stringent action adopted by any country to combat the contagion (*Times of India* 2020).

The lockdown coincided with the harvesting of rabi crops (wheat, pulses, and oilseeds) in northern and central India. Owing to a good monsoon, harvesting season was characterized by record production for most of the crops (Moneycontrol 2020). Abundance in production usually implies stability in prices. However, the current pandemic affected prices through two main channels: interruption of agricultural

supply chains and changes in consumer demand. Although the ban on interstate movement of essential goods and cargos was eased as of March 25, 2020, there was a prolonged disruption in the supply chains of agricultural commodities (Jestin 2020).

On the supply side, there was limited movement of fresh produce from farmers to consumers, as markets were either closed or working at suboptimal capacity since the lockdown. Interstate transport of commodities was also constrained (Sundria 2020). For a few weeks after the first lockdown, the daily movement of the trucks was at only 10 percent of pre-lockdown levels. Reports indicated that agriculture input shops remained closed. All these factors collectively threatened the timely sowing of the summer crop, and perhaps the upcoming kharif crop as well (Kaur 2020). Despite permission to operate Agricultural Produce Market Committee (APMC) *mandis*, trucks, and fertilizer shops, the supply chain remained severely choked for several days after the first lockdown. Some farmworkers even said that they were unaware of the exemption to work on farms (*Economic Times* 2020b). Aggravating this supply chain problem was the large-scale exodus of migrant workers to their native villages, which led to shortages of labor on farms (Ellis-Petersen and Chaurasia 2020). This exodus also left looming concerns of hunger and starvation in its wake (Adhikari et al. 2020; Nag 2020).

On the demand side, consumers were expecting the lockdown to continue and engaged in panic buying of food commodities with extended shelf lives (*India Today* 2020). This prompted an increase in demand and a consequential steep rise in the prices of commodities, like pulses, onions, and potatoes. The demand for perishable fruits and vegetables dipped drastically, as bulk buyers, like hotels, restaurants, and *dhabas*, remained closed (*Livemint* 2020).

To contain the deteriorating situation, the government's efforts were concentrated on ameliorating disruptions in the supply chain and providing access to food. On March 28, 2020, the government exempted from the lockdown agencies engaged in procurement of agriculture products, including minimum support price (MSP) operations; functioning of *mandis* (operated by the APMC); farm operations by farmers; manufacturing and packaging units of fertilizers, pesticides, and seeds; intra and interstate movement of harvesting- and sowing-related machines like harvesters (Tripathi 2020). To ease concerns regarding food and income security, Finance Minister Nirmala Sitharaman announced a socioeconomic package of US\$22.6 billion on March 26, 2020 (Beniwal and Srivastava 2020). This included measures for direct cash transfers under prevalent government programs and provision of additional wheat and rice per month for the next three months to households registered under the Public Distribution System (PDS). Later, this distribution was extended for the returning migrants' families as well.

However, one overlooked aspect of this public intervention is that the pandemic also has the potential to exacerbate the malnutrition problem in India. Provisioning of additional grains and some pulses through the PDS was largely meant to tackle only the food security problem, specifically caused by the lockdown. However, the sole focus on cereal availability will not be able to resolve the pandemic's exacerbation of undernutrition and micronutrient malnutrition in India. These issues have been stubbornly persistent in India for decades, mostly due to the lack of diversity in peoples' diets. According to the Indian Council of Medical Research (ICMR), Indians predominantly consume more carbohydrates, fewer proteins, and even fewer fruits and vegetables than the daily recommended levels. In other words, dietary consumption from non-cereal food groups like pulses, fruits, vegetables, poultry, and dairy, is grossly inadequate and lacks diversity (Hemalatha et al. 2018;

Rukmini 2019). Women and children are the most vulnerable groups. The National Family Health Survey (NFHS)-4 in 2015–16, shows 38.4 percent of children below five years to be stunted, 35.8 percent to be underweight, and 60 percent of children to be anemic. Twenty-three percent of adult women have a body mass index (BMI) of less than 18.5—indicative of inadequate food intake, and 53 percent are anemic. Pandemic-induced supply chain bottlenecks are aggravating their susceptibility.

Diet choices are dependent on both accessibility and affordability of food (Pingali and Sunder 2017). Previous research suggests that disproportionate hikes in prices for non-cereal food groups decrease their composition in the diet and lower the quality of total intake (Gómez et al. 2013; Pinstrup-Andersen 2013). In this paper, we seek to study the potential implications of the outbreak on the prices of agricultural commodities and subsequent access of Indians to nutritious food groups. We examine the prices of selected cereals and non-cereals from March through May 2020. We compare the weekly average prices before, during, and after the lockdown to the same period in 2019.

The findings of the report reveal that (1) following the lockdown, there was a rise in prices across food groups, compared to last year; and (2) the rise in prices was higher for non-cereals than cereals. This is easily explained, as India is presently food secure in terms of wheat and rice. Hence, it was able to meet additional demand for cereals and was infrastructurally equipped to overcome supply disruptions. The lack of preemptive strategies to minimize the deterrence of procurement and spoilage of pulses and vegetables led to a spike in prices for these groups. However, following the lifting of the lockdown, prices stabilized quickly to pre-lockdown levels for cereals, eggs, and vegetables, such as potatoes, onions, and tomatoes, while the prices of nutritionally rich crops such as pulses have remained high, despite the easing of the lockdown. We argue that a disproportionate rise in prices of non-cereals may divert consumer spending toward staples, such as wheat and rice, resulting in inadequate intake of protein-rich food groups like pulses. Unemployment and income loss from the decline in remittances to rural areas will further exacerbate the problem of food access.

Section 2 of this report elaborates on the data and methods employed in the study. Section 3 presents the empirical results for cereals and non-cereal food prices across major cities in India. Section 4 analyzes the results and highlights discernable differences in price hikes between the different food groups. Section 5 presents the implications of disproportionate hikes in non-cereal food prices for food and nutrition security, especially regarding India's vulnerable populations. In Section 6, we explain the recent agricultural reforms that might mitigate the impact of a nationwide crisis on the agriculture sector in the future. Section 7 concludes the report.

DATA AND METHODS

To assess the impact of COVID-19 on retail prices of different commodities and explore the implications for nutrition security, we compared weekly average prices from 11 cities, from March 1, 2020 to May 31, 2020, to the same period in 2019. Data was gathered from the Department of Consumer Affairs (DCA) of the Government of India and the National Egg Coordination Committee (NECC).

City-level weekly retail data from DCA provided information for cereals (wheat and rice), pulses (*tur*, *masur*, and *moong*, gram, and *urad dal*), and vegetables (potato,

onion, and tomato).¹ Retail price data for eggs were unavailable, and therefore, we used consumption center (CC) price data from the NECC.² CC rates are the opening rates at which the wholesalers in various cities declare egg prices. The retailers buy eggs from wholesalers at those prices. It is important to note that retailers add a margin to these CC prices before making a sale to the consumers. Therefore, the CC prices do not adequately capture the prices paid by the consumers. We restrict our analysis to these specific commodities, as we are constrained by the availability of data.

We analyze data from six Tier I cities—Bengaluru, Chennai, Delhi, Hyderabad, Mumbai, and Kolkata—and five Tier II cities—Bhubaneshwar, Bhopal, Patna, Guwahati, and Lucknow. These cities were selected, as they serve as capitals (or major cities) of different states, making them ideal representatives of each of the states. The inclusion of selected cities also covered a wide geographic range across the country. The distinction between Tier I and Tier II was purposely made to explore any discernable distinction in food prices across the tiers. Tier I cities are known to have a higher cost of living than are Tier II cities. Although, as we will see later, this higher cost of living is not reflected in the food prices.

Table 1 summarizes the data available for all the commodities across cities and presents the relevant data source pertaining to the commodities.

Table 1: Summary of Data Availability

| Food Group | Commodity | DCA Data |
|------------|---------------------|---|
| | | (City-level Data) (March 1–May 31, 2019 and 2020) Retail Price |
| Cereals | Wheat | Available for all Tier I cities (except Kolkata) and all Tier II cities |
| | Rice | Available for all Tier I and Tier II cities |
| Pulses | Arhar Dal (Tur Dal) | Available for all Tier I and Tier II cities |
| | Masur Dal | Available for all Tier I and Tier II cities |
| | Moong Dal | Available for all Tier I and Tier II cities |
| | Gram Dal | Available for all Tier I and Tier II cities |
| | Urad Dal | Available for all Tier I and Tier II cities |
| Vegetables | Potato | Available for all Tier I and Tier II cities |
| | Onion | Available for all Tier I and Tier II cities |
| | Tomato | Available for all Tier I and Tier II cities |

Note: Egg prices data from NECC is available for five tier I Cities (Bengaluru, Chennai, Delhi, Kolkata, and Mumbai) and one of five tier II cities (Lucknow).

¹ Source: https://fcainfoweb.nic.in/Reports/Report_Menu/Web.aspx

² Source: <http://www.e2necc.com/EGGDailyAndMontlyPrices.aspx>

For each of these commodities, we constructed average retail prices for each week from March 1, 2020 to May 31, 2020, and from March 1, 2019 till May 31, 2019. We conduct two kinds of analysis for each agricultural commodity: (1) to ascertain the price change relative to 2019, we calculate the percentage change in weekly average prices relative the same week in 2019; and (2) we plot the average prices by week to see the trend of change after the lockdown (that is, since the fourth week of March 2020). If the COVID-19 pandemic and the lockdown did exert pressure on the prices, then the relative prices from last year and trend in prices for this year following the fourth week of March should demonstrate a change. This helps improve understanding of the fluctuations in prices at a granular level.

THE NATURE OF PRICE VARIATION ACROSS FOOD GROUPS— EVIDENCE FROM SELECTED INDIAN CITIES

This section evaluates the change in prices for foods that compose India diets: cereals (wheat and rice); pulses (*tur*, *masur*, and *moong*, gram, and *urad dal*); vegetables (potato, onion, and tomato); and poultry (eggs). Indian diets are largely staple-based, so the inclusion of wheat and rice was vital for analysis. Pulses are the most important source of protein for the vegetarian population in India. For a comprehensive analysis, we included the five most widely consumed pulses. The three vegetables included in our study are the most widely grown and consumed vegetables in India. Lastly, eggs are an important source of protein for non-vegetarians in India. We now present the price trends for these food groups across cities, comparing them to the previous year and the period of the lockdown.

CEREALS

Following the Green Revolution in the 1960s, India's food and agricultural policies have focused on cereals. The Government of India, through central and state procurement agencies, buys millions of tons of wheat and rice every year at minimum support prices. This action incentivizes farmers to produce cereals, and subsequently, ensures adequacy in the supply and maintenance of abundant buffer stocks. Unsurprisingly, these factors contribute to stability in cereal prices.

Wheat

Table 2 shows that, between 2019 and 2020, change in wheat retail prices lies in the range of -20 to 20 percent. Guwahati, Hyderabad, and Patna experienced a decline in retail wheat prices for all the weeks of our study period. Cities like Chennai, Delhi, and Mumbai showed a drop initially, followed by a steep rise in the subsequent weeks, while cities like Bhopal, Bhubaneshwar, and Lucknow showed a consistent increase in prices. Prices in Bangalore remained stable. All prices are calculated relative to 2019.

Table 2: Wheat Retail Prices

Percentage change between 2020 and 2019

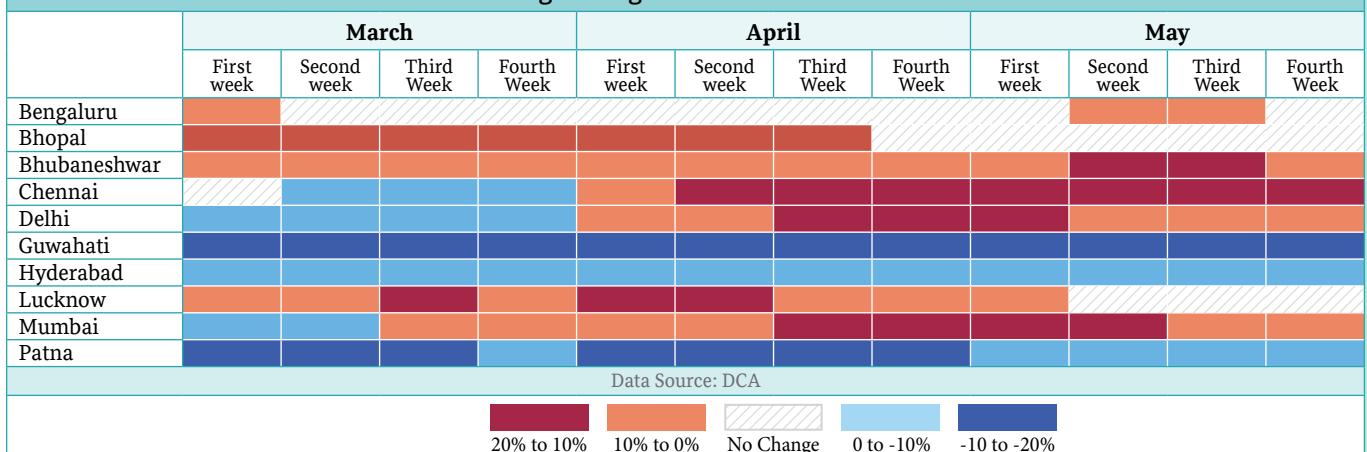
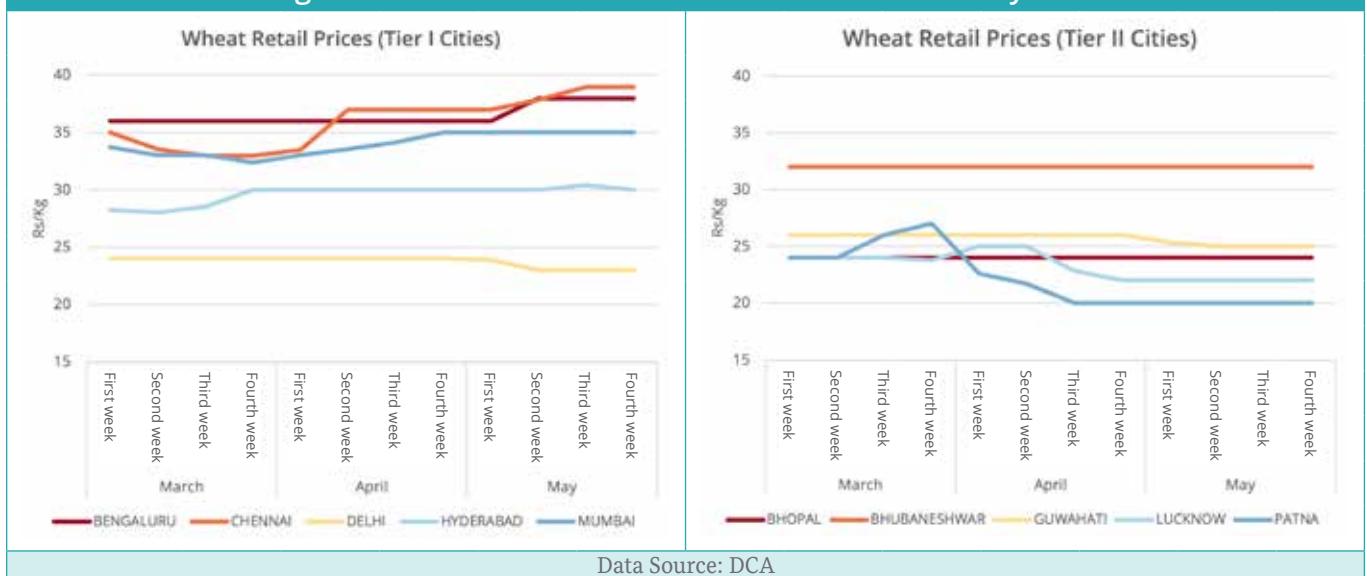


Figure 1 demonstrates that the retail wheat prices post-lockdown appear to be either stable or declining in 9 of the 10 cities. Therefore, according to the data available, consumers in Tier I and Tier II cities appear to have been shielded from a retail price rise in wheat. Lucknow, Patna, and Guwahati show a declining trend in prices in the weeks after the lockdown.

Figure 1: Wheat Retail Prices from March 2020 to May 2020



Rice

Table 3 shows that city retail prices (relative to 2019) for rice declined by 5–20 percent for Delhi, Lucknow, and Patna; remained stable for Bengaluru, Bhopal, and Bhubaneshwar; increased 0–10 percent for Guwahati and Kolkata; and increased by 40–60 percent for Chennai and Hyderabad. For Mumbai, the prices remained in the range of –10 to 10 percent. The estimates are listed for most weeks.

Table 3: Rice Retail Prices

Percentage change between 2020 and 2019

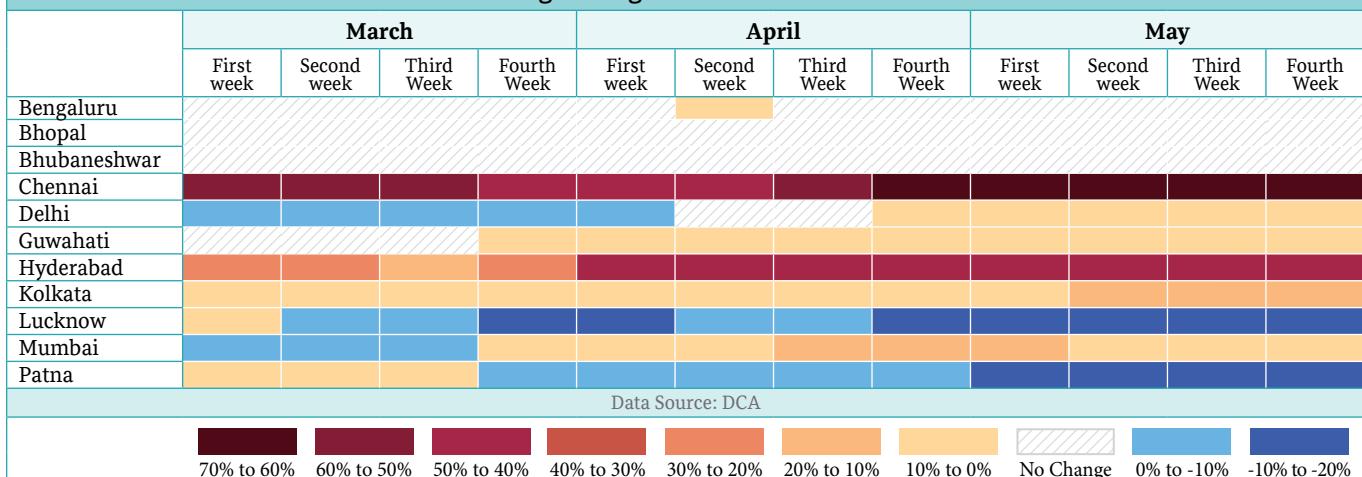


Figure 2 shows that, following the city-level trend, except for Hyderabad and Guwahati, retail prices have remained stable or declined post lockdown in all the Tier I and Tier II cities. For two Tier II cities—Patna and Lucknow—the prices started to decline after the third week of March (before the imposition of lockdown).

Figure 2: Rice Retail Prices from March 2020 to May 2020



PULSES

Pulses serve as an important source of protein for the Indian population. India is the largest producer, consumer, and importer of pulses in the world. Due to the limited availability of data with the DCA, we are focusing on five of the most often consumed pulses in India: *arhar* (*tur*), *moong*, *masur*, *gram*, and *urad dal*. Pulse price movements

are determined jointly by production, imports, and rainfall. The government often intervenes to stabilize prices through intermittent releases from the buffer stocks.

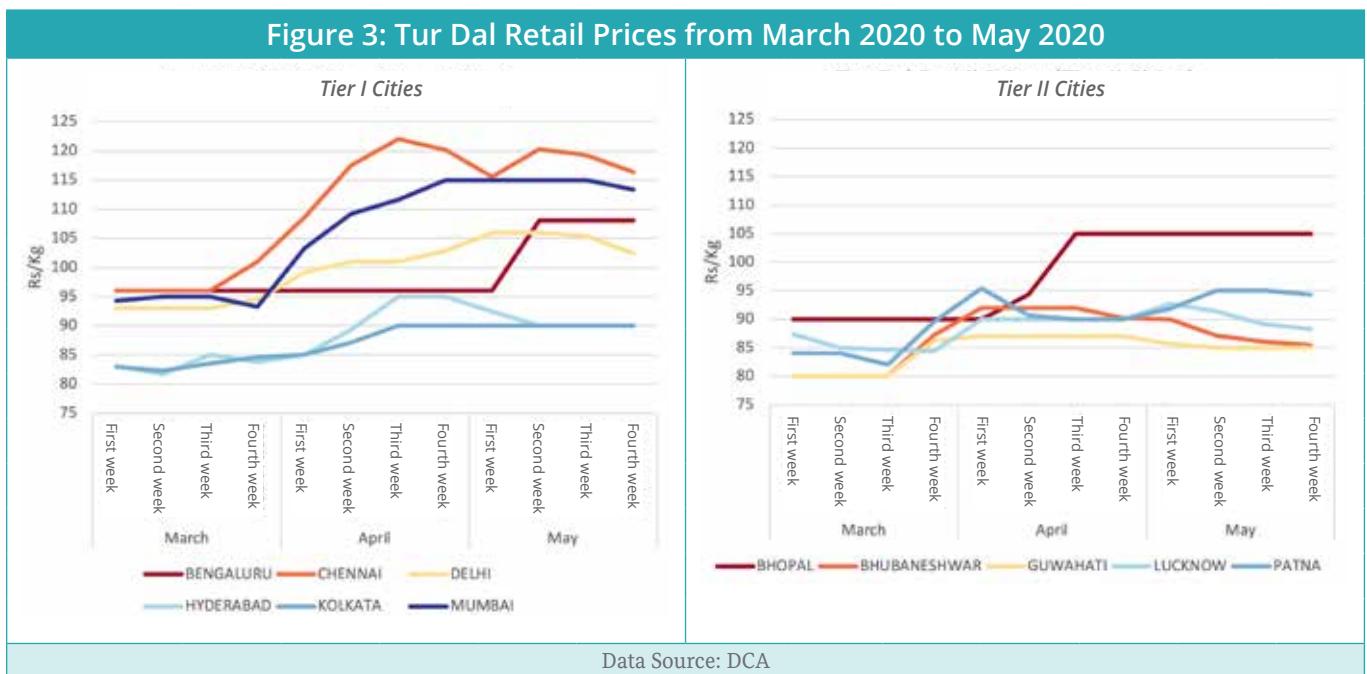
Arhar (Tur) Dal

Table 4 shows that *tur dal* retail prices across cities have risen by up to 45 percent, relative to last year's prices. This price rise seems consistent across all the weeks when compared to last year. For the last two weeks of the study period, the retail price, compared to 2019, decreased for Bhubaneshwar, Kolkata, and Patna.

| | Table 4: Tur Dal Retail Prices | | | | | | | | | | | |
|--------------|--------------------------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| | March | | | | April | | | | May | | | |
| | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week |
| Bengaluru | | | | | | | | | | | | |
| Bhopal | | | | | | | | | | | | |
| Bhubaneshwar | | | | | | | | | | | | |
| Chennai | | | | | | | | | | | | |
| Delhi | | | | | | | | | | | | |
| Guwahati | | | | | | | | | | | | |
| Hyderabad | | | | | | | | | | | | |
| Kolkata | | | | | | | | | | | | |
| Lucknow | | | | | | | | | | | | |
| Mumbai | | | | | | | | | | | | |
| Patna | | | | | | | | | | | | |

Data Source: DCA

Figure 3 provides a visual representation of the increase in retail prices for *tur dal* for all the cities, except Bengaluru, following the lockdown. Prices have remained higher than the pre-lockdown levels.



Red Lentil (*Masur Dal*)

Compared to last year, *masur dal* retail prices rose, with a pronounced increase beginning the first week of April, as is shown in **Table 5**. The increase was in the range of 0–20 percent for Bengaluru, Bhopal, Delhi, Guwahati, Hyderabad, and Lucknow; 20–40 percent for Bhubaneshwar, Chennai, and Patna; around 20 percent for Kolkata; and almost 50 percent for Mumbai (relative to the third week of April 2019). The prices have remained higher than the last year, even toward the last week of May.

Table 5: Masur Dal Retail Prices

Percentage change between 2020 and 2019

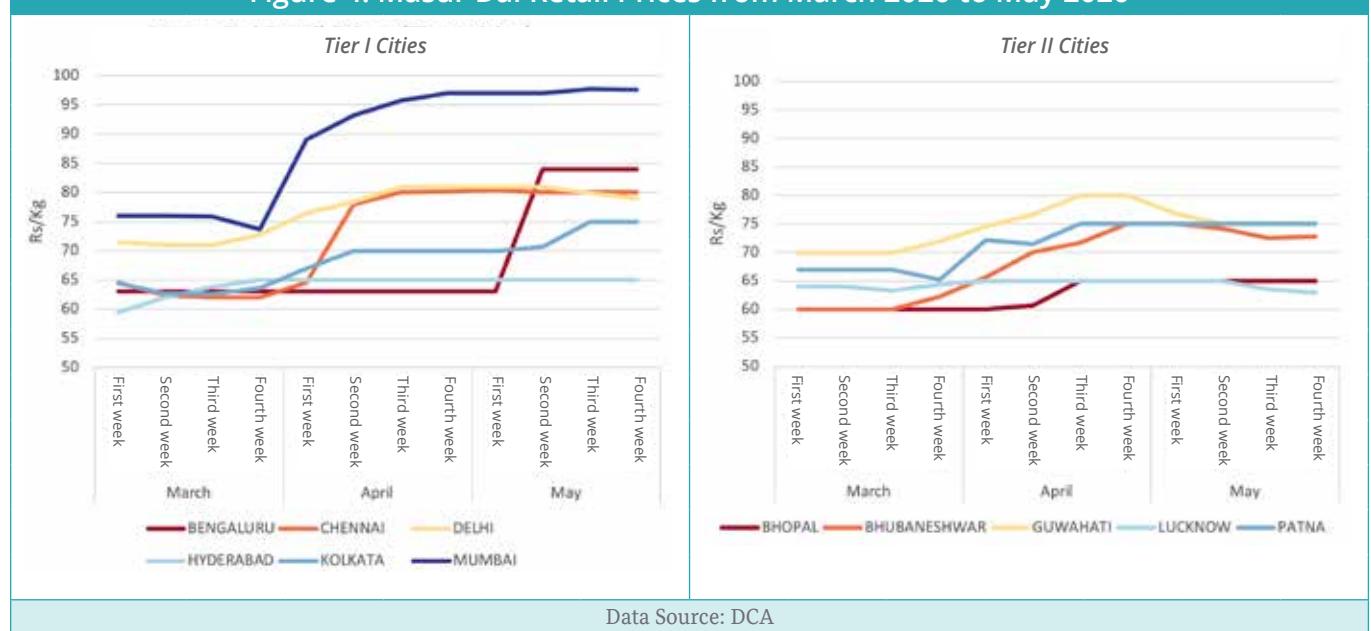
| | March | | | | April | | | | May | | | |
|--------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week |
| Bengaluru | | | | | | | | | | | | |
| Bhopal | | | | | | | | | | | | |
| Bhubaneshwar | | | | | | | | | | | | |
| Chennai | | | | | | | | | | | | |
| Delhi | | | | | | | | | | | | |
| Guwahati | | | | | | | | | | | | |
| Hyderabad | | | | | | | | | | | | |
| Kolkata | | | | | | | | | | | | |
| Lucknow | | | | | | | | | | | | |
| Mumbai | | | | | | | | | | | | |
| Patna | | | | | | | | | | | | |

Data Source: DCA



It is interesting to note that *masur dal* prices remained stable for the initial weeks in March and then spiked suddenly after the lockdown, as is seen in **Figure 4**. The prices increased for all the Tier I cities, except Bengaluru, and for all Tier II cities, except Bhopal, where an increase in price toward the second week of April is observed. Consumers across cities, regardless of the tier, are continuing to pay higher prices for *masur dal*, relative to prices before lockdown.

Figure 4: Masur Dal Retail Prices from March 2020 to May 2020



Moong Dal

Table 6 shows that, relative to last year, *moong dal* retail prices increased 20–80 percent. The price rise was most pronounced in Chennai and Mumbai from the first week of April onward.

Table 6: Moong Dal Retail Prices

Percentage change between 2020 and 2019

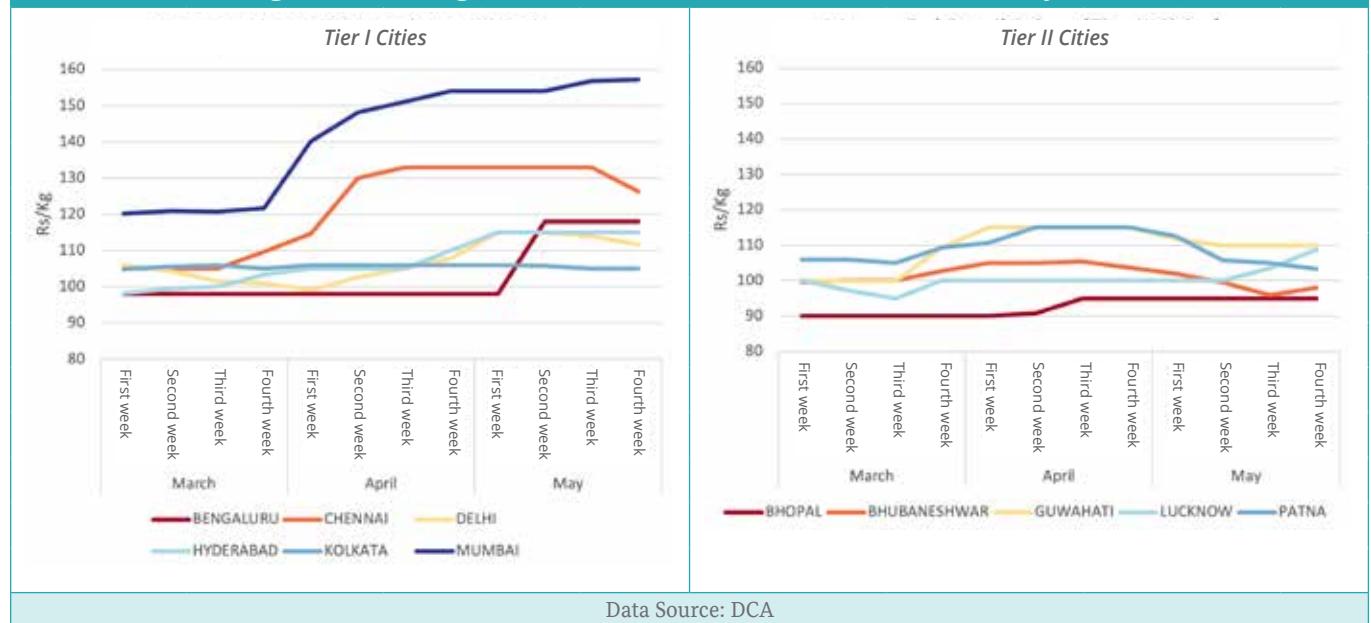
| | March | | | | April | | | | May | | | |
|--------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week |
| Bengaluru | | | | | | | | | | | | |
| Bhopal | | | | | | | | | | | | |
| Bhubaneshwar | | | | | | | | | | | | |
| Chennai | | | | | | | | | | | | |
| Delhi | | | | | | | | | | | | |
| Guwahati | | | | | | | | | | | | |
| Hyderabad | | | | | | | | | | | | |
| Kolkata | | | | | | | | | | | | |
| Lucknow | | | | | | | | | | | | |
| Mumbai | | | | | | | | | | | | |
| Patna | | | | | | | | | | | | |

Data Source: DCA

| | | | | | | | | | |
|--|------------|------------|------------|------------|------------|------------|------------|-----------|-----------|
| | 80% to 70% | 70% to 60% | 60% to 50% | 50% to 40% | 40% to 30% | 30% to 20% | 20% to 10% | 10% to 0% | No Change |
|--|------------|------------|------------|------------|------------|------------|------------|-----------|-----------|

The retail price remained stable until the third or fourth week of March before rising in two Tier I cities (Chennai and Mumbai) and four Tier II cities (Bhubaneshwar, Guwahati, Lucknow, and Patna), as is exhibited in **Figure 5**. The price range of *moong dal* prices was higher in Tier I (Rs 90–150 per kg) cities relative to Tier II cities (Rs 90–115 per kg). The prices have continued to remain higher than pre-lockdown levels.

Figure 5: Moong Dal Retail Prices from March 2020 to May 2020



Gram Dal

Table 7 demonstrates that the percentage change in gram dal retail prices relative to 2019 ranged from around -10 to 40 percent. Bhopal and Mumbai registered the highest increases relative to last year.

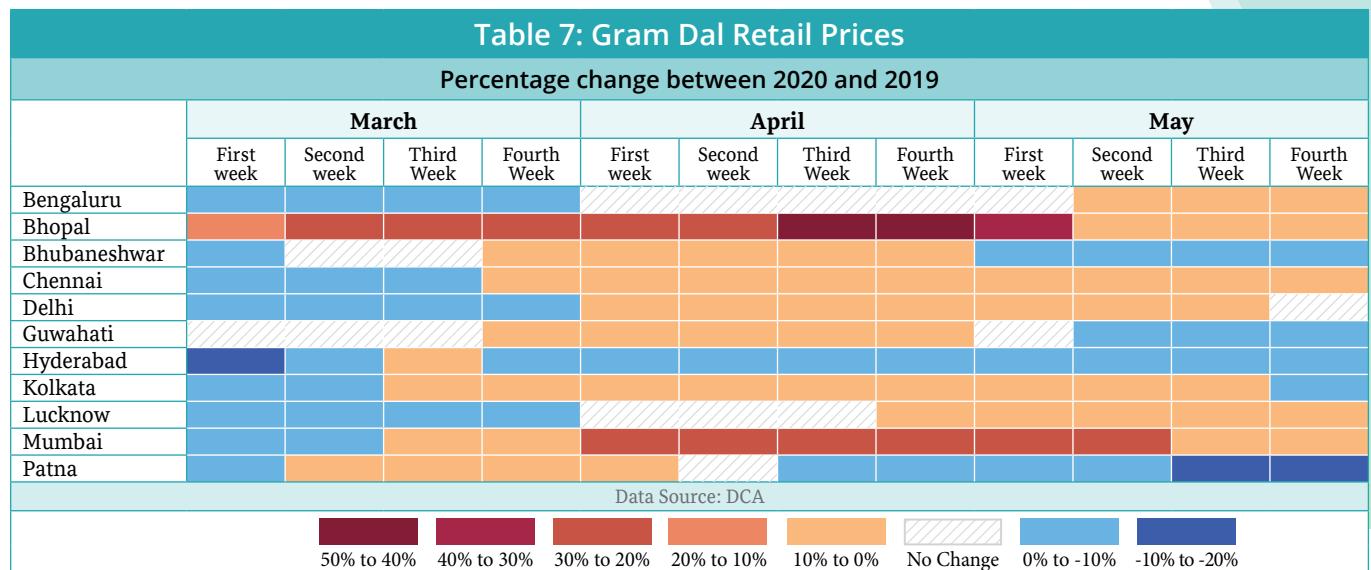
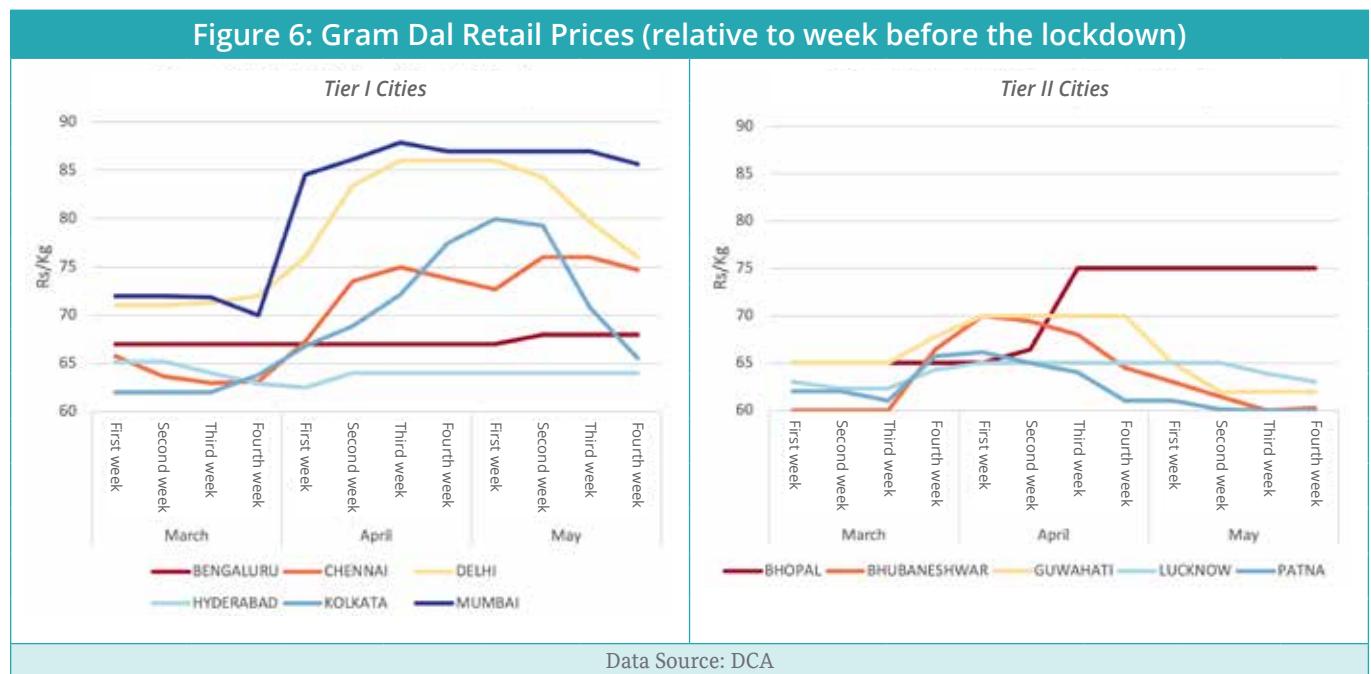


Figure 6 shows that, with the exception of Bangalore, the retail prices in other Tier I cities and all Tier II cities increased after the lockdown. Prices remained higher in Tier I and Tier II cities (except for in Patna and Guwahati) up to the first week of May. After that, the price of gram dal retail appears to be stabilizing to the pre-lockdown level for almost all the cities.



Urad Dal

Relative to 2019, retail prices for *urad* dal rose in all cities for all of the weeks observed. The increase ranged from 0–80 percent (see **Table 8**).

| | Table 8: Urad Dal Retail Prices | | | | | | | | | | | |
|--------------|---|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| | Percentage change between 2020 and 2019 | | | | | | | | | | | |
| | March | | | | April | | | | May | | | |
| | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week |
| Bengaluru | | | | | | | | | | | | |
| Bhopal | | | | | | | | | | | | |
| Bhubaneshwar | | | | | | | | | | | | |
| Chennai | | | | | | | | | | | | |
| Delhi | | | | | | | | | | | | |
| Guwahati | | | | | | | | | | | | |
| Hyderabad | | | | | | | | | | | | |
| Kolkata | | | | | | | | | | | | |
| Lucknow | | | | | | | | | | | | |
| Mumbai | | | | | | | | | | | | |
| Patna | | | | | | | | | | | | |

Data Source: DCA

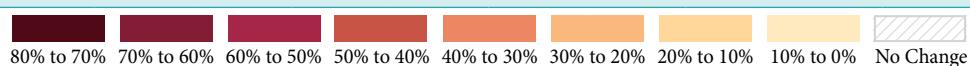
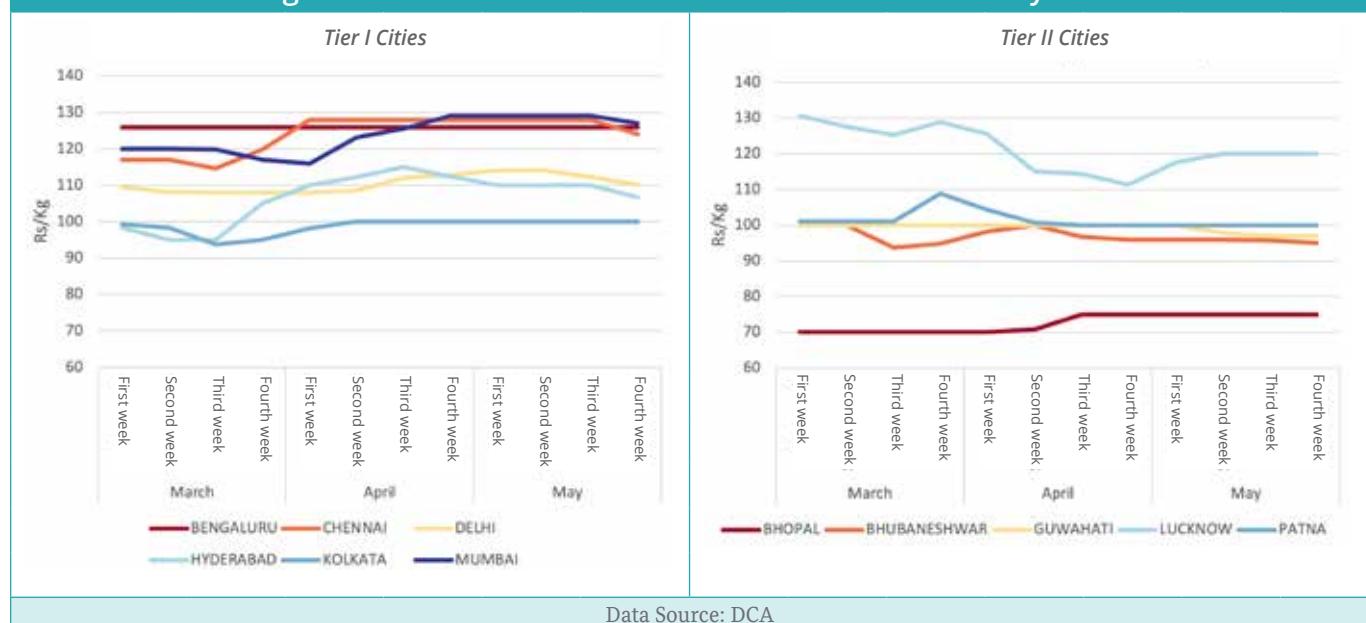


Figure 7 demonstrates that *urad* dal retail prices increased for all the Tier I cities, except Bangalore, after the lockdown. During the same period, prices in Tier II cities remained stable and even declined in Lucknow and Patna.

Figure 7: Urad Dal Retail Prices from March 2020 to May 2020



Data Source: DCA

VEGETABLES

India is the second largest producer of vegetables in the world (FAO 2017). The country's horticultural production reached a record high of 314.67 million tons during 2018–19, approximately 187.5 million tons of which were vegetables. As per recent estimates, production in 2019–20 is expected to be about 0.84 percent higher than the previous year. However, despite the abundance in vegetable production, prices of

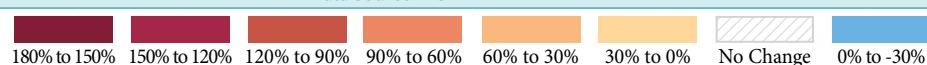
vegetables in India suffer from frequent fluctuations. It forces poorer households to substitute more nutritious vegetables with less micronutrient-dense vegetables, like onions and potatoes.

Potato

Among vegetables, potato production is the highest in India. **Table 9** shows that, relative to last year, potato prices have increased for all cities during the lockdown. The retail prices for potatoes jumped the steepest in the week following lockdown and appear to have stabilized to pre-lockdown levels by the last week of May (relative to last year).

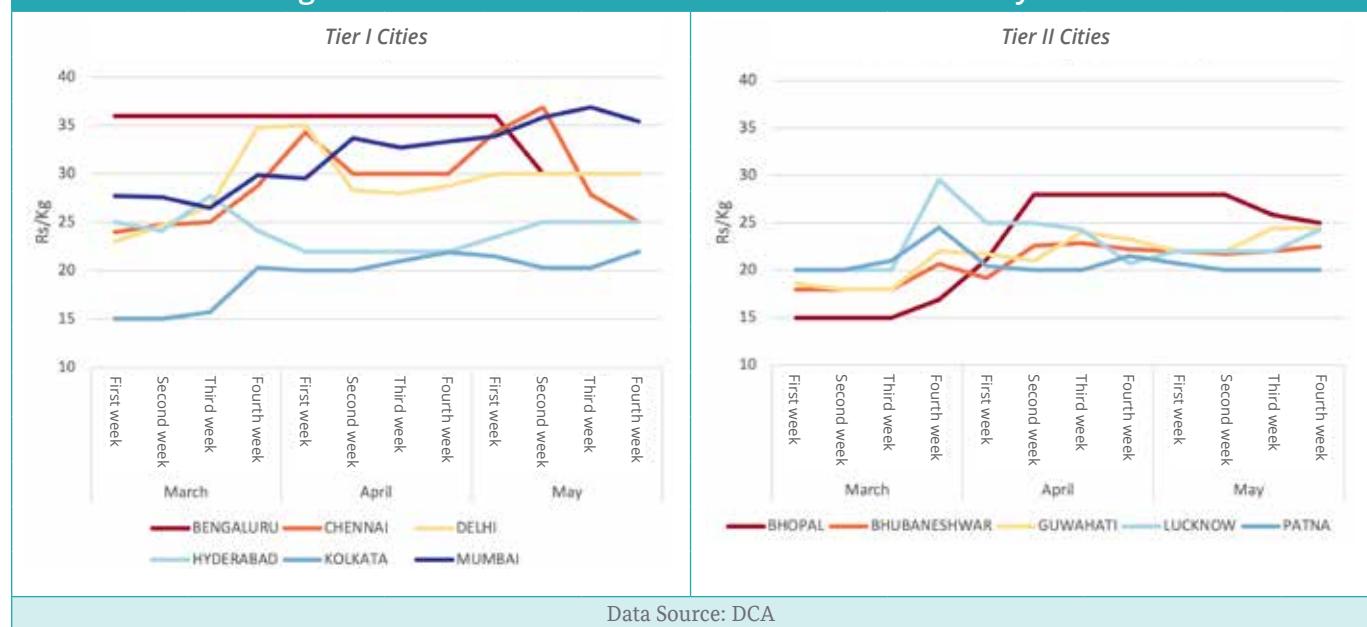
| | Table 9: Potato Retail Prices | | | | | | | | | | | |
|--------------|---|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| | Percentage change between 2020 and 2019 | | | | | | | | | | | |
| | March | | | | April | | | | May | | | |
| | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week |
| Bengaluru | | | | | | | | | | | | |
| Bhopal | | | | | | | | | | | | |
| Bhubaneshwar | | | | | | | | | | | | |
| Chennai | | | | | | | | | | | | |
| Delhi | | | | | | | | | | | | |
| Guwahati | | | | | | | | | | | | |
| Hyderabad | | | | | | | | | | | | |
| Kolkata | | | | | | | | | | | | |
| Lucknow | | | | | | | | | | | | |
| Mumbai | | | | | | | | | | | | |
| Patna | | | | | | | | | | | | |

Data Source: DCA



With the exception of Bengaluru and Hyderabad, retail prices increased in the weeks following the lockdown. The rise in prices was stabilized for most cities by the last few weeks of the study period (see **Figure 8**).

Figure 8: Potato Retail Prices from March 2020 to May 2020



Onion

Table 10 reveals that the onion retail prices were higher than last year, since the beginning of the study period. The retail percentage differentials trend down toward the end of the study period.

Table 10: Onion Retail Prices

Percentage change between 2020 and 2019

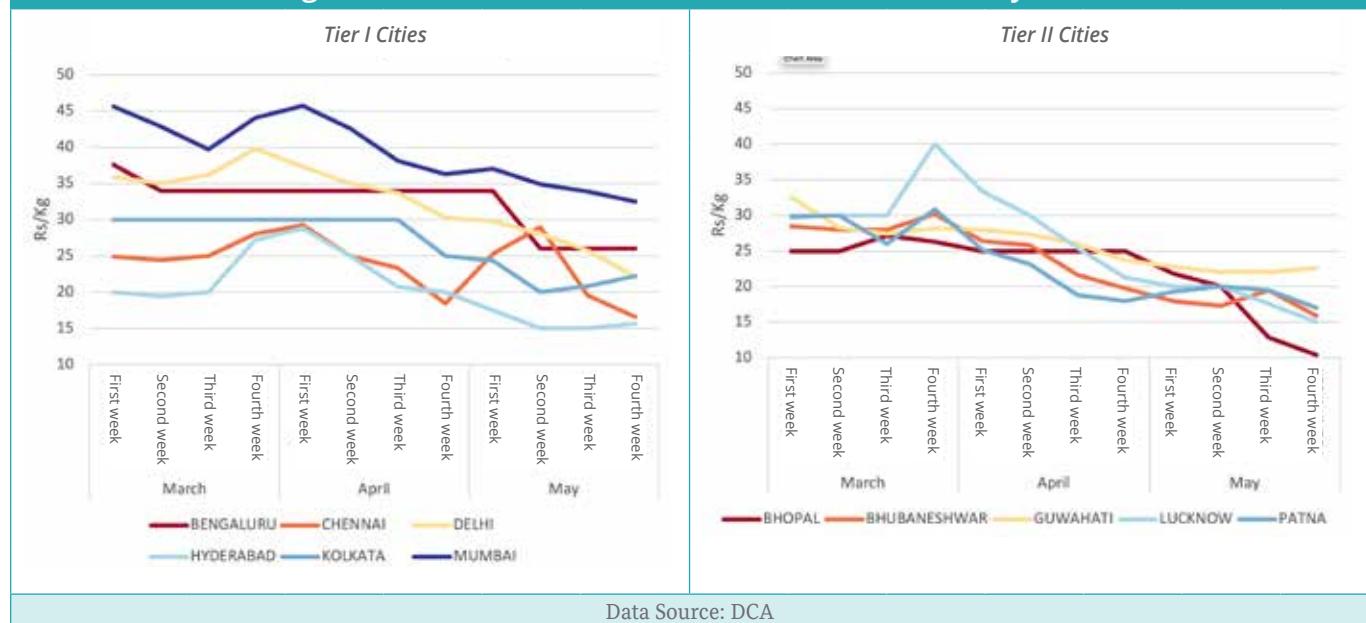
| | March | | | | April | | | | May | | | |
|--------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week |
| Bengaluru | | | | | | | | | | | | |
| Bhopal | | | | | | | | | | | | |
| Bhubaneshwar | | | | | | | | | | | | |
| Chennai | | | | | | | | | | | | |
| Delhi | | | | | | | | | | | | |
| Guwahati | | | | | | | | | | | | |
| Hyderabad | | | | | | | | | | | | |
| Kolkata | | | | | | | | | | | | |
| Lucknow | | | | | | | | | | | | |
| Mumbai | | | | | | | | | | | | |
| Patna | | | | | | | | | | | | |

Data Source: DCA

| | | | | | | |
|--------------|--------------|--------------|------------|----------|-----------|------------|
| 250% to 200% | 200% to 150% | 150% to 100% | 100 to 50% | 50 to 0% | No Change | 0% to -50% |
|--------------|--------------|--------------|------------|----------|-----------|------------|

With the exception of Bengaluru and Kolkata, retail prices rose for all other cities in the study after the lockdown. The rise in prices was followed by a decline in almost all cities from the first week of April onward (see **Figure 9**).

Figure 9: Onion Retail Prices from March 2020 to May 2020

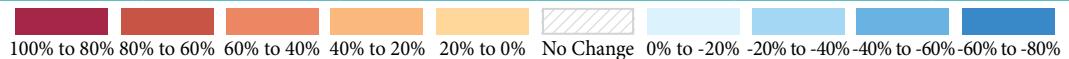


Tomato

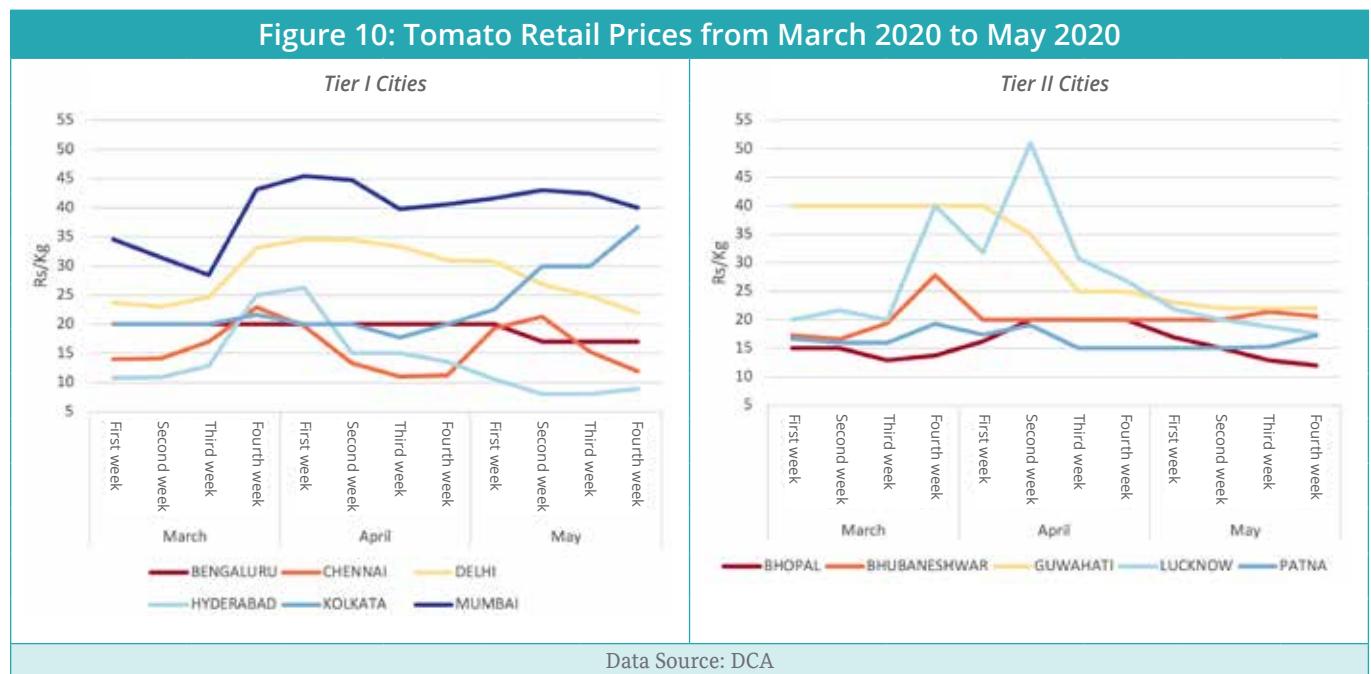
As shown in **Table 11**, compared to 2019 prices, 2020 retail prices were higher in Mumbai for most weeks. All other cities had prices lower than in 2019 for most weeks. In the last week of May, the prices became negative, relative to last year for all cities.

| | Table 11: Tomato Retail Price | | | | | | | | | | | |
|--------------|---|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| | Percentage change between 2020 and 2019 | | | | | | | | | | | |
| | March | | | | April | | | | May | | | |
| | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week | First week | Second week | Third Week | Fourth Week |
| Bengaluru | | | | | | | | | | | | |
| Bhopal | | | | | | | | | | | | |
| Bhubaneshwar | | | | | | | | | | | | |
| Chennai | | | | | | | | | | | | |
| Delhi | | | | | | | | | | | | |
| Guwahati | | | | | | | | | | | | |
| Hyderabad | | | | | | | | | | | | |
| Kolkata | | | | | | | | | | | | |
| Lucknow | | | | | | | | | | | | |
| Mumbai | | | | | | | | | | | | |
| Patna | | | | | | | | | | | | |

Data Source: DCA



Retail prices for Tier I cities increased around the period of lockdown and then declined. Prices in Tier II cities showed a variable pattern. Hyderabad showed a steep rise in prices from the second week of March to the first week of April. Among the smaller cities, prices in Lucknow started climbing from the third week of March and peaked around the second week of April. As shown in **Figure 10**, prices for all the cities were hovering around the pre-lockdown level by the end of May. All the trends are shown clearly in **Figure 10**.



Data Source: DCA

POULTRY (EGGS)

Table 12 demonstrates that the CC prices of eggs fell in March 2020, relative to March 2019, increased in April, and declined again in May.

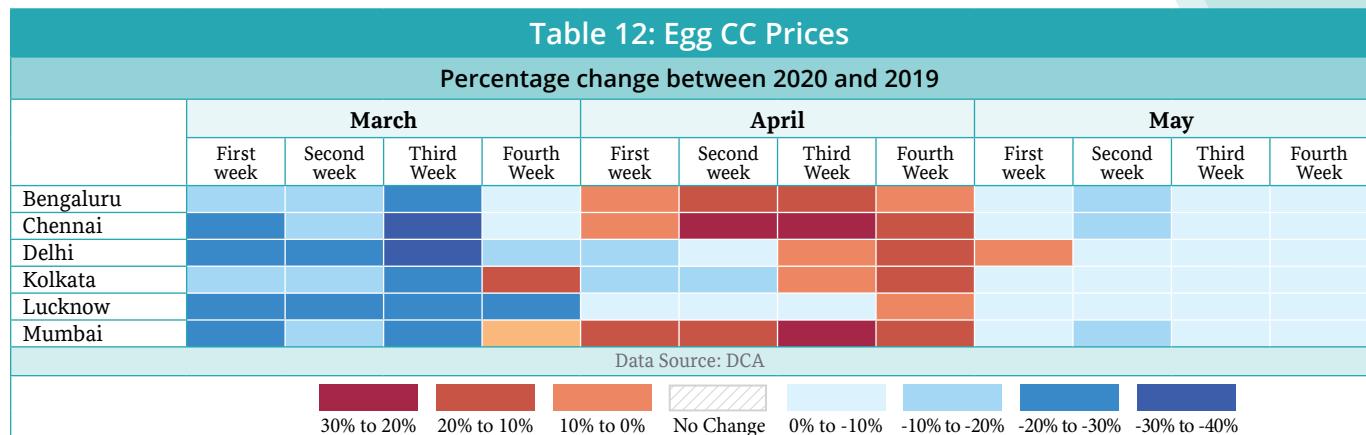


Figure 11 shows that, beginning in the fourth week of March, the price of eggs increased compared to the weeks before lockdown. Towards the end of May, prices nearly stabilized and returned to the level in the first week of March for all the cities.



PRICES OF NUTRIENT-RICH NON-CEREALS AFFECTED MORE THAN STAPLE GRAINS

India has maintained self-sufficiency in cereal production for over 50 years. While abundant production of rice and wheat has greatly contributed to the decline in undernutrition, it has also translated into mostly cereal-based diets. Such diets are nutritionally inadequate. Diet composition of non-cereal foods for Indians, while lower than the recommended dietary allowance, is vital for gaining essential nutrition. Therefore, it is important to assess the impact of COVID-19 separately on cereal and non-cereal food prices to improve our understanding of its potential effect on food and nutrition security.

TRENDS IN CEREAL PRICES

Cereal prices remained stable relative to last year and across the weeks following lockdown. This stability can be explained through India's cereal-centric policies, which resulted in huge stockpiles of grains across the country. Food Corporation of India (FCI) and state-run granaries manage these staples, and from time to time, supply additional grains in the open market to stabilize prices (*Economic Times* 2020c). The National Food Security Act (NFSA) ensures that rice and wheat are available at subsidized rates to almost 810 million people (Haq and Dutta 2020). The lockdown and disruption in the movement of grains raised concerns about the declining stocks and delayed procurement in subsequent weeks. However, after the release of nearly 12 million tons of wheat under NFSA, wheat procurement remained stable, exceeding 13 million tons on April 30, 2020 (*Economic Times* 2020a). These measures have prevented shortages of wheat and rice in the short run and largely contributed to the stability of cereal prices.

TRENDS IN NON-CEREAL PRICES

Non-cereal food groups are composed of pulses, vegetables, and eggs.

Pulses are exhibiting a consistent increase in the retail prices across cities, and the prices have not stabilized after more than a month of lockdown. An increase in demand for pulses due to panic buying and disruptions in the supply chain plausibly contributed to the rising trend in prices (Laskar 2020; Northeast Now 2020). The disruptions in the supply chain include the inability of farmers to move produce to APMCs due to the lack of transport (Kulkarni 2020). Further, stock replenishment was reported to have been affected due to reduced available labor. For example, a retailer noted that from an average of 10 visits per week by salespeople before lockdown, they are now receiving only two visits per week to replenish stocks (Buch 2020).

Potato retail prices increased for all cities relative to last year and across weeks after the lockdown. We also observed a fall in arrivals. This fall, along with the sudden rise in demand, could have led to a much sharper increase than what the markets experienced. However, the supply and hence price rise was ameliorated to some extent as potatoes are the third most heavily stocked agricultural commodity in the nation (after wheat and rice) and are dependent on cold storage operated by the private sector (Jayan 2020).

Onion retail prices more than doubled in almost all the cities studied, relative to last year. The price rise was due to decreased deliveries that occurred because of transportation bottlenecks (Ojha 2020).

Relative to last year, tomato retail prices seem to have dropped in most cities. When the lockdown was announced, there were media reports of farmers selling their tomatoes at very low prices or dumping them, as they were unable to access markets. A probable reason could be a drop in demand due to the high perishability of tomatoes. Among other vegetables, tomato retail prices have been the most unstable. Transport disruptions also plagued the deliveries of tomatoes to markets (Angadi 2020). Bulk demand for tomatoes was affected as restaurants and *dhabas* closed (Bose and Pandey 2020). Labor shortages also worsened the pace of loading and unloading of the produce (Mukul 2020).

The fall in egg CC prices in March 2020, relative to March 2019, was the result of widespread misinformation that COVID-19 is spread through eggs and poultry (Krar 2020). The rumors started abating, as scientists and medical practitioners repeatedly confirmed no link between eggs and the coronavirus (Acharya 2020). Demand resurfaced and was reflected in both price increases for April 2020 (relative to April

2019) and the rise in price trends during the lockdown. Prices were stabilized to pre-lockdown levels by the end of May.

Narayanan and Saha (2020) also report that a significant increase in retail prices has been observed in pulses, potato, and onions post-lockdown, while the increase in tomato prices has not been sustained. These findings are in line with our results.

Our analysis has some limitations. First, the price change for certain commodities was found to be disproportionately higher in select cities. For example, the price rise for all pulses after the lockdown was most pronounced for Mumbai and Chennai (relative to the week before the lockdown). However, pulse prices in Bangalore were unaffected by the pandemic. A possible reason could be that Mumbai had the largest number of positive COVID-19 cases when the lockdown was announced, which could have affected the agricultural supply chains more severely. This study does not explore reasons for the increase in food prices on a city-by-city basis.

Second, our results exhibit variation in commodity prices across Tier I and Tier II cities. For example, the rise in *moong* dal retail prices was higher in Tier I cities than in Tier II cities for the weeks following the lockdown. Analysis of such price movements is beyond the scope of the study. We believe this is an interesting research topic that deserves further attention.

Finally, the rise in prices could likely have led to a drop in the quality of produce available in the marketplace. However, given the nature of data in hand, we are unable to comment on this issue.

SUMMARY OF TRENDS IN CEREAL AND NON-CEREAL PRICES

Our study extensively discusses the trends in food retail prices across major cities in India. This subsection provides a summary of those trends.

Tables 13 and 14 summarize the changes in retail prices for all commodities, relative to 2019 and the week before the lockdown, respectively.

These tables show that cereal prices remained relatively stable when compared to other food groups. The hike in pulses was sustained till the end of the study period. A sharp hike in potatoes and onions was witnessed after the lockdown, but the prices stabilized for all the cities within two to four weeks of the lockdown. Similarly, egg prices stabilized by May 2020.

NUTRITIONAL IMPLICATIONS OF SUPPLY DISRUPTIONS ON CONSUMER DIETS AND VULNERABLE POPULATIONS

To our knowledge, this study is the first to discuss the implications of an exogenous shock like COVID-19 on nutrition security in India through a disproportionate increase in food prices. Our main finding is a distinct differential rise in the prices of cereal versus non-cereal products, both when compared to the year 2019 and the period after lockdown. Wheat and rice prices appear relatively stable across time and cities. Potatoes, onions, and pulses recorded the highest price increases. However, potato, onion, and tomato prices stabilized within two to four weeks of the lockdown. Likewise, egg prices eventually stabilized around the beginning of May 2020. Unlike vegetables and eggs, the prices of pulses remained higher, even 12 weeks after the lockdown.

The relative stability in cereal prices and enhanced prices of pulses will most likely distort spending and consumption decisions. The relative increase in non-cereal food prices influences a household's purchasing power and makes it cheaper to consume wheat and rice (Gómez et al. 2013). This will perpetuate reliance on a staple-based, protein-deficient diet. The most efficient way to increase the consumption of

Table 13: Summary of the Percentage Changes in the Prices of Food Groups for Twelve Weeks of Study Period (Relative to 2019)

| Food Group | Commodity | Price Increase | | Price Decrease | | Stable Prices |
|------------|--|----------------|--|----------------|---|-------------------------------------|
| | | Range | Cities | Range | Cities | Cities |
| Cereals | Wheat | 0-20% | Bhopal, Bhubaneshwar, Chennai, Delhi, Lucknow, and Mumbai | 0-15% | Guwahati, Hyderabad, and Patna | Bengaluru |
| | Rice | 0-65% | Chennai, Guwahati, Hyderabad, Kolkata, and Mumbai | 0-20% | Delhi, Lucknow, and Patna | Bengaluru, Bhopal, and Bhubaneshwar |
| Pulses | Arhar Dal (Tur Dal) | 0-45% | All states | | | |
| | Masur Dal | 0-50% | Bhopal, Bhubaneshwar, Chennai, Delhi, Guwahati, Hyderabad, Kolkata, Lucknow, Mumbai, and Patna | | | Bengaluru |
| | Moong Dal | 20-80% | All states | | | |
| | Gram Dal | 0-40% | Bhopal, Bhubaneshwar, Chennai, Delhi, Guwahati, Kolkata, Lucknow, and Mumbai | 0-20% | Hyderabad and Patna | Bengaluru |
| | Urad Dal | 10-80% | All States | | | |
| Vegetables | Potato | 20-180% | All states | | | |
| | Onion | 10-200% | All states | | | |
| | Tomato | 0-100% | Guwahati, Lucknow, Mumbai, and Patna | 0-70% | Bengaluru, Bhopal, Bhubaneshwar, Chennai, Delhi, Hyderabad, and Kolkata | |
| Poultry | Egg prices (before lockdown) | | | 5-35% | Bengaluru, Chennai, Delhi, Kolkata, Lucknow, and Mumbai | |
| | Egg prices (four weeks after lockdown) | 0-30% | Bengaluru, Chennai, Delhi, Kolkata, and Mumbai | 0-5% | Lucknow | |

Notes: Wheat retail price data for Kolkata for 2020 was unavailable.

The analysis was conducted at the weekly level.

Certain commodities in some cities experienced more than one kind of price fluctuation (that is, increase, stability, or decline) during the 12 weeks of the study period (when compared to 2019). For those commodities, we classified the cities to only one of the three categories depending on the price behavior for the majority of weeks.

Egg price data was available for five Tier I Cities (Bengaluru, Chennai, Delhi, Kolkata, and Mumbai) and one of five Tier II cities (Lucknow).

Data Source: Department of Consumer Affairs and National Egg Coordination Committee.

nutrition-dense protein foods is to reduce their prices (Herforth and Ahmed 2015).

Price rises during a crisis could also be mitigated by complementary strategies like social safety nets that provide households with alternate means to cope with price shocks (Skoufias 2003). For example, the government can ensure the provision of supplementary protein that is expected to be lost due to the price rise of more

Table 14: Summary of Food Groups (Relative to Week before Lockdown)

| Food Group | Commodity | Change in retail prices |
|------------|---------------------|---|
| Cereals | Wheat, Rice | Stable |
| | Rice | Higher |
| Pulses | Arhar Dal (Tur Dal) | Higher but showing a downward trend in the last few weeks of the study period |
| Vegetables | Potato | Higher but showing a downward trend in the last few weeks of the study period |
| | Onion | Higher but showing a downward trend in the last few weeks of the study period |
| | Tomato | Higher but showing a downward trend in the last few weeks of the study period |
| Poultry | Eggs | Higher but showing a downward trend in the last few weeks of the study period |

Data Source: Department of Consumer Affairs and National Egg Coordination Committee.

nutritious food groups. However, food safety nets in India are also weakening due to the pandemic. Therefore, the present situation necessitates timely government interventions to stabilize the increase in prices.

Despite India's extensive food safety nets, daily wage earners and migrant workers are unable to even meet daily calorie requirements. According to a telephone survey conducted across India by the Ministry of Health and Family Welfare, 44 percent of respondents were either facing issues accessing their daily food or curtailing consumption by skipping meals (Tandon 2020). Another survey conducted with stranded migrant workers suggests that until April 13, 2020, 96 percent of respondents did not receive rations, and 70 percent did not receive any cooked food from the government. Additionally, 90 percent had not received any payment from either their employers or the government (Adhikari et al. 2020), depleting their ability to buy rations, cook meals, and feed themselves. Although promised during the last week of March 2020, even the pulses pledged under the COVID-19 package have not yet been delivered. Supply instability and food price rise have gravely impacted the ability of the poor and marginalized to access essential nutritious food items.

After the poor and marginalized, women and children are also less likely to be resilient to COVID-19-related price increases and food shortages. The Integrated Child Development Services (ICDS) program launched *anganwadi* centers in 1975 to solve the problem of hunger and malnutrition in rural India, especially among women of reproductive age and children. The program now employs more than a million women and is the largest early child healthcare program in the world. ICDS runs two nationwide programs: take-home rations (THR) and hot cooked meals (HCM). HCM are provided to children between the ages of 3 and 6. THR is given to pregnant and lactating mothers, and children between 6 months and 3 years old.

After the coronavirus outbreak, the government closed the centers, and instead of the HCM services, the *anganwadi* workers are distributing THR (ANI 2020; Modak 2020; Pioneer 2020; Singh 2020). The effectiveness of this scheme amid the lockdown has been uneven across states. For example, reports suggest that in Karnataka, in 70 percent of cases, eggs were not distributed, while in 44 percent of cases, milk was not supplied to children (Madhavan 2020).

The Mid-Day Meal Scheme (MDMS) was launched for children enrolled in

government and government-aided schools. It aims to enhance attendance and also to provide one nutritious meal per child (MHRD 2019; Sharma 2020). With government schools closed, millions of children have lost the opportunity to be fed a balanced, nutritious meal (PTI 2020). This loss imposed an additional burden on families who may have already been struggling to procure meals for themselves.

During the month of Ramadan (April 23–May 23, 2020), Muslims observe by fasting during the day and breaking the fast in the evening. This observance pushes the demand for dairy products, fruits, and meat (Yousef 2020). The disruptions in supply chains of fruits and meat will make the poorer members of this community less likely to be able to afford these products at a time when their bodies are already calorie and nutrition deprived.

The sustained rise in prices of pulses and the weakening of social safety nets are likely to threaten the food and nutrition security problem in India. Further exacerbating this impact has been the loss of income through unemployment spurred by the COVID-19 crisis. Figures from the Centre for Monitoring Indian Economy show that in April 2020 alone, 122 million people lost their jobs. Among them, 75 percent were small traders and daily wage earners. Therefore, the lockdown and decline in remittances subsequently triggered the world's largest exodus of migrant workers to their native villages. Jan Sahas conducted a rapid assessment survey with 3,196 migrant workers across northern and central India between March 27 and 29, 2020 (Kapur 2020). Eighty percent of migrants and daily wage earners were worried that they would run out of food by the end of the first lockdown. These migrants represent the severely impoverished and marginalized subsections of India's population. Their loss of income left them vulnerable and at the mercy of food handouts from temporary community kitchens and food distribution centers. In addition to the threat of infectious disease, the pandemic has also unleashed a hunger crisis in India (Kazmin and Singh 2020).

In such a national crisis, the government's interventions should seek to ensure the delivery of adequate food by ameliorating the disruptions in the supply chain to guarantee the food security of its population (Pingali, Alinovi, and Sutton 2005). This study acknowledges that, given the present situation, the government is working in the right direction. However, during such outbreaks, the importance given to nutrition security should not be diminished.

Previous studies suggest that any shock that leads to relatively higher non-cereal food prices has an immediate, negative impact on diet quality (Brinkman et al. 2010; Gómez et al. 2013; Pinstrup-Andersen 2013). Our results also predict that, with the distortions in prices of protein-rich food groups, the next urgent challenge will be the provision of adequate protein.

Literature shows that the effect of price shocks leading to lower diet quality is significantly more pronounced in poorer households of developing countries (Brinkman et al. 2010; Green et al. 2013). As discussed previously, the lockdown disproportionately impacted migrant workers, daily wage earners, women, younger children, and Muslim communities—all of whom are already among the marginalized and vulnerable sections of Indian society. In a country where undernutrition and micronutrient deficiencies are widespread, especially among the poorer and vulnerable factions of the society, the consumption of other food groups is necessary to ensure nutrition security (Pingali, Mittra, and Rahman 2017).

Diverse diets are a prerequisite for building and sustaining people's immunities. A healthy immune system plays a critical role in fighting infections, becoming indispensable during the current pandemic. Therefore, supplying adequate nutrition

should also become a policy priority. COVID-19 presents an opportunity to reset India's supply chain by developing policies that mitigate future disruptions for non-cereal food groups. If non-cereal foods are managed as efficiently as India's handling of cereals during this pandemic, then it will ameliorate sudden price hikes and prevent unintended food wastage.

EMERGENCY-INDUCED POLICY REFORMS AND POTENTIAL FUTURE IMPLICATIONS FOR FOOD SECURITY

Confronted with pressing challenges in the agricultural sector during the pandemic, Finance Minister Nirmala Sitharaman amended the Agricultural Produce Marketing Committee (APMC) Act and the Essential Commodities (EC) Act on May 15, 2020 (Batra 2020). The APMC Act allows states to divide into distinct market areas. They are administered by separate APMCs that frame and conduct their own rules and regulations. The APMCs tended to maintain a monopolistic hold on prices, harming the welfare of the farming community (Verma 2020). Amendment to the act frees the farmers from the obligation to sell at APMCs within the states and allows them to sell their produce at attractive prices.

The EC Act was a significant instrument to maintain specific stock limits and a price cap for essential commodities. Yet, the act has hindered benefits to farmers and the creation of assets in the agricultural sector. The problem worsens during a bumper harvest. If farmers were able to store excessive produce, they could smoothen the supply and reduce price volatility. However, the EC Act imposes punitive measures on merchants or farmers who are suspected of hoarding. Therefore, the agencies were deterred from investing in storage facilities, and farmers were obligated to sell their produce at throwaway prices in the wholesale markets.

After the amendment, the government deregulated cereals, edible oils, oilseeds, pulses, onions, and potatoes. The stock limits no longer apply to value chain participants or processors. Essentially, the price of essential commodities will be determined by market forces. Repealing jaded restrictions will now allow merchants to directly procure produce from the farmers. The farmers are no longer confined to interstate markets for sale. They can engage with processors, aggregators, large retailers, and exporters (Verma 2020). This enables better price realization for the farmers. A fair return for harvest will benefit the farming community and encourage long-term investments in agricultural assets. The finance minister assured that, in the future, India will create funds for enhancing cold storage units and postharvest management infrastructure (Jagannath 2020).

The central government has taken extensive measures to curtail the adverse impact of COVID-19 on the agricultural sector. Amendments to these acts will achieve two important goals for the agricultural sectors: strengthening the economic security of farmers and encouraging diversification of farm production through access to better technology.

CONCLUSION

On the health front, India is facing two unprecedented challenges. First, curbing the spread of the coronavirus by imposing a nationwide lockdown, and second, navigating through the lockdown to ensure the smooth supply of essential goods and services. The end objective of both challenges is to minimize damage to the health of India's citizens. This study highlights the impact of supply chain disruption on the nutrition security of Indian citizens, using government data on retail for essential agricultural commodities. Data shows that the price rise is uniquely borne by nonstaple food

groups, such as pulses, vegetables, fruits, and eggs. Timely government interventions and already established infrastructure have safeguarded any interruption in the supply, and hence, stabilized prices of cereals. Lack of efficient policies to restore the supply of pulses, vegetables, and fruits drove up prices following the lockdown. This relative stability in prices of cereals and higher prices of other food groups will distort consumer spending, preserving excessive reliance on staples as a major component of the Indian diet.

The threat to nutrition security poses a pressing challenge during the pandemic, as malnourishment is linked to lower immune health. Studies suggest that there is a link between immune-compromised status and higher mortality in COVID-19 patients. This leaves marginalized populations in developing countries particularly vulnerable to the virus. The COVID-19 pandemic brings the debate back to the need for developing immunity by consuming fresh and diverse nutritious diets, and offers an opportunity to redesign India's nonstaple supply chain.

With the looming concerns of decline in remittances and loss of income security among migrants and daily wage earners, the most impoverished in India are battling a different challenge: acquiring adequate food and nutrition. India made tremendous gains in its battle against undernutrition in the past decade. Undertaking immediate measures for the smooth functioning of the agricultural supply chain for nonstaples will be important to ensure that these gains are not reversed. This will be critical for guaranteeing food and nutrition security.

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