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## Article

# Exploring the Impact of COVID-19 and the Associated Lockdown on the Production, Distribution, and Consumption of Poultry Products in Gujarat, India: A Qualitative Study

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**Abstract: Introduction:** The COVID-19 severely marred the Indian poultry industry, worth approximately one trillion INR. Hence, this study was conducted to understand the COVID-19 related factors that harmed the poultry production and distribution network and explore their varied impact on its actors in Gujarat, India. **Methods:** An exploratory qualitative study, using semi-structured interviews, was conducted with 34 poultry stakeholders in Gujarat. The data were thematically analysed using an interpretative phenomenological approach. **Results:** The study revealed that COVID-19 and the associated lockdown had hugely impacted the production, distribution and consumption of poultry products. The first COVID-19 lockdown disrupted the supply of production inputs and the distribution of poultry and poultry products because of movement restrictions. Rumours also played a crucial role in decreasing the consumption of poultry products between March and June 2020. The market situation, including the prices and availability of poultry products, was found to be improved post-lockdown as there was an increase in consumption; however, the profits were not sufficient to immediately compensate for the losses incurred during the lockdown. **Conclusion:** The first COVID-19 lockdown restricted the production and distribution of essential goods and influenced the perception of consumers regarding poultry products. COVID-19 resulted in many short- and medium-term challenges in the poultry sectors in India, which need to be addressed to make this sector more resilient to face any such crisis in future.

**Keywords:** COVID-19; lockdown; rumours; poultry; chicken meat; egg; qualitative research

## 1. Introduction

Poultry is one of the fastest-growing sectors among all other agriculture sectors in India, which is essential to fulfilling the requirement of protein and nutrition to the population [1]. In India, the poultry sector was worth one trillion INR in 2020, with most of the production being vertically integrated, matching the production efficiency levels of many high-income countries [2,3]. In the last three decades, India has rapidly transitioned from backyard to commercial poultry production. Almost 30 years ago, 70% of the poultry population was “native”, accounting for 70% of eggs produced in the country; at present, over 80% of poultry production is an “intensively managed production system” [4]. India is also one of the largest manufacturers of broiler meat and egg, with their production growing at the rate of 8–10% per annum [1]. The poultry sector is thus characterised

by the coexistence of intense (technology, capital, scale) vertically-integrated production and marketing, with farming based on traditional knowledge and practices [4].

The Indian poultry industry, worth approximately one trillion Indian Rupee (INR) was severely marred by the COVID-19 and the associated lockdown. The pandemic affected 25 million farmers and over five million employees in the fields of poultry production, trading, feed manufacturing, agriculture crops, logistics, poultry-based products, vitamins, minerals and pharmaceuticals, exports, etc. [2]. By the end of April 2020, losses were estimated at INR 225 billion [5]. India's weekly sales had plummeted to 47% towards the end of January and early February 2020 [6]. In the same period, the chicken prices at farm gates had declined from INR 80-85 to INR 30-35 [6]. The projected loss caused by these events for the Indian poultry industry was around INR 226.8 billion [7]. In comparison, the first avian influenza outbreak in February 2006, during which only the western part of India was affected, resulted in a loss of INR 2.22 billion [8,9] in the country, which is far less compared to the present COVID-19 situation.

With this study, we aim to understand the COVID-19 related factors that harmed the poultry production and distribution network (PDN) and explore their varied impact on PDN actors in the state of Gujarat, India, which has experienced rapid growth in vertically-integrated broiler poultry farming. One of the previous studies exploring and defining poultry PDN in Bangladesh has highlighted that narrow profit margins, lack of robust regulation systems, and credit-reliant production system exposed the intrinsic fragility of the PDNs [10]. This paper also captures the experiences, perspectives and challenges faced by different stakeholders in PDN in the first half of 2020 and the various mitigation strategies adopted to address the challenges posed by the pandemic.

## 2. Methods

An exploratory qualitative study was conducted to understand the impact of COVID-19 on the poultry industry in Gujarat, India, between May and July 2020. The recall period for the respondents was between January and July 2020 to understand the impact of COVID-19 on their business. The study was conducted at Anand Agricultural University (AAU), Gujarat, and data were collected face-to-face or over the phone due to lockdown. For this qualitative study, 34 participants were recruited by the AAU team using purposive and exponential non-discriminative snowballing methods. These methods helped in recruiting a diverse group of participants associated with the poultry sector, including farmers, traders, retailers and consumers, to understand the range of poultry production, distribution and consumption-related challenges during COVID-19 lockdown. The participants included broiler farmers (n=6), backyard farmers (n=3), layer farmers (n=3), breeders (n=2), traders (n=5), chicken meat retailers (n=4), egg retailers (n=3), and consumers (n=8). Though we also relied on maximum variation sampling to create a diverse sample of participants, which helped ensure high-quality, detailed descriptions and key "shared patterns that cut across cases and derive their significance from having emerged out of heterogeneity" [11]. This method also helped in identifying the "essential features and variable features of a phenomenon as experienced by diverse stakeholders among varied contexts" which facilitate informed decision-making [12]. Though we could recruit a smaller number of participants in each category, we managed to represent a diverse group of stakeholders who experienced challenges due to COVID-19 and the associated lockdown.

A team based at AAU conducted semi-structured interviews either face-to-face or over the telephone between May and July 2020. Face-to-face interviews were conducted at the participants' farm/shop by making a prior appointment. Although the team started reaching data saturation [13,14] by the 13th and 14th interviews, interviews with 34 participants (due to the diversity of stakeholders) were conducted to ensure that no new and unique information was missed. The interviews were conducted in Gujarati, the local language of the region and/or Hindi, a common language across India and as preferred by participants using a pre-tested interview schedule. The interview guide had some key open-ended questions, which were complemented by probing questions, adapted to the participants' responses to develop an in-depth understanding of each response. The topics covered were the personal profile of the participants, the effect of COVID-19 and

associated risk mitigation measures, including lockdown, on the overall poultry sector and their business. The other key topics were the measures taken to counteract the rumours, financial situation, and change in food preference of the consumers. The interviews were digitally recorded, transcribed verbatim, and then translated from Hindi and Gujarati to English by an agency hired for translation and transcription work [14]. The researchers at AAU and Jawaharlal Nehru University (JNU) ensured the quality of the transcripts, constantly comparing the audio files with transcripts. The same researchers at JNU familiarised themselves with the data during and after data collection by reading the transcripts multiple times. The team at JNU coded all the interviews using the interpretative approach and deductive logic manually [15,16].

2.1. Data Analysis (Excel Coding Method)

The analysis for this paper was done using Microsoft Excel version 2010 [17]. The transcripts were developed using Microsoft Word version 2010 and transferred to the Excel sheet. We created four columns; First indicating the category of the respondent, second indicating interviewer and respondents, third indicating question and answer and fourth indicating codes. We created a separate sheet for codes and code numbers which was used while coding the interviews. Though we had developed an a priori code list using the interview guide, we went ahead by adding emergent codes as and when required. After coding the interview, we merged all the interviews in a separate file sequentially and added all the interviews. We later ran the ‘concatenate’ [17] command to get the data frequency, transferred the coded data to Microsoft Word, and conducted the thematic analysis.

The interpretative coding approach helped organise data to identify themes “that, while perhaps contextualised in the research setting, were decontextualised with regard to an individual’s experience” [18]. After coding the transcripts, summaries were prepared against each code. The summaries were organised into themes and sub-themes. The process was continuously discussed with the study investigators in UK, Gujarat, and New Delhi for refinement. In order to rule out the possibility of missing views and perceptions of the participants, original data were continuously reflected and discussed within the team and patterns were developed from themes and concepts. We categorised data under eleven analytical themes (Table 2) that emerged from the interview data. These themes emerged from the linear process of interpretative analysis of data [18]. After developing the theme, the qualitative researcher looked for a connection among themes to organise them in linear order the way they had emerged from the interviews [18]. Participants’ context and the initial reflexivity of the qualitative researcher were the significant factors while interpreting the data [18].

Table 2. Analytical themes.

Themes	
1.	Impact of the COVID-19 lockdown on the production of poultry products
2.	Impact of the COVID-19 lockdown on the distribution of poultry products
3.	Impact of the COVID-19 lockdown on poultry health supplies
4.	Impact of COVID-19 on financial arrangements along PDN
5.	Impact of the COVID-19 on chicken meat consumption
6.	Impact of the COVID-19 on egg consumption
7.	Spread of Rumours through social media
8.	Mitigation strategies for COVID-19 rumours
9.	Government initiative to address COVID-19 related challenges
10.	Quality of products post-lockdown
11.	Post-lockdown recovery of the market

Ethical approval for this study was obtained from the institutional ethics committees of the Anand Agricultural University, Gujarat, India, Jawaharlal Nehru University, India and Royal Veterinary College, UK. The participant information sheet and consent form (available in Hindi, Gujarati, and English) were read and shared with the potential participants. Written informed

consent was obtained from those interested in participating, including for digital recording of interviews.

### 3. Results

The challenges faced by the diverse stakeholders at different stages of the PDN and COVID-19 mitigation strategies are summarised under eleven themes. These themes have emerged by grouping together various concepts which were related and indicating towards a specific issue. The first four themes (Table 2) summarised the challenges faced at different stages of the PDN, including financial arrangement along the PDN. Two themes revolved around the change in consumption patterns of poultry products, and two others on the spread and mitigation of rumours about the role played by poultry in the spread of COVID-19. Finally, one theme covered the governmental response to the pandemic, and two themes focused on the situation post-lockdown.

#### 3.1. Impact of the COVID-19 Lockdown on the Production of Poultry Products

The COVID-19 lockdown hugely impacted the production in the poultry sector. It led to a cascade effect on the PDN, with a negative impact on a node also negatively impacting other nodes in the network. Disruption in feed supply impacted poultry production across the State. All interviewed farmers shared that it was difficult for them to procure the feed for the birds in the early phase of the lockdown.

"We didn't get (feed) in the starting of the lockdown then it was easily available... Yes no one was giving on credit during lockdown before that they used to give credit or one or two days." (Layer farmer; IC-31)

"No, what happened is that they died gradually as feed was finished and I couldn't get it, feed supply was discontinued. So, the birds lived on water as much as they could and once, they died we would bury them in the ground itself." (Broiler farmer; IC-10)

Breeders could not breed chicken as they did not have the raw material, including grains (corn, soy, groundnut, rapeseed and sunflower seeds) and other nutrients such as protein, calcium, and lysine because of the restrictions on transportation.

"In the starting in the March we had to face many difficulties and even in the month of April we face a lot of problems for transportation, we didn't get enough raw materials and even the supply was restricted the cars (vehicles) were not allowed to enter, police used to charge fines." (Breeder; IC-1)

The fall in prices of finished chickens further pushed breeders to stop their production of day-old chicks (DOC), causing financial losses:

"Our main work is to produce chickens but as the market is down right now, we are not able to produce more chicks." (Breeder; IC-1)

The above mentioned disruption in feed supply and the drop in finished chicken and chicken product prices also meant that broiler and layer farmers had to reduce flock sizes, resulting in reduced farmers' earnings and demand for DOC.

"It was around 12000...We reduced around 6000 birds due to COVID (now)... And during lockdown there were around 12000 birds... Because of loss that we suffered for 6 months there were no earnings at all." (Layer farmer; IC-31)

"Before lockdown I had around 48000 to 50000 birds... Yes, I had then I sold at lower prices some I gave away the birds (to others) to eat and later I had around 5000 to 6000." (Broiler farmer; IC-3)

Layer farmers shared that they were already facing problems in production for the last many years due to the disrupted supply and volatile prices of feed and its raw material, which was worsened by the COVID-19 lockdown.

"Layer industry is in loss since last many years. The over production that was there in 2019 there was not much products and in corn there was a worm problem. So, at that time the rates of the corn had almost become double the price. Right now, the one that is for 14 rupees it has gone to 24 to 25 rupees. If the selling price is 325 or 350, we feel it is a decent price. At that time, the cost of production went up to 400." (Layer farmer; IC-33)



As feed prices went up during the lockdown, the feed quality went down. The commonly cited reason for the poor quality of the feed was the delayed supply of corn and soy. They also mentioned that the quality of corn and soy was not good because of the longer duration of stocking in the granaries.

"It was 28 to 30 rupees and now it is 45 rupees...Shortage was there, everyone tried to buy it, so there was shortage... The quality was really bad...The rates were high, they had made a syndicate for that and they charged just anyhow, at will." (Layer farmer; IC-34)

The situation did not improve after the lockdown was lifted, as chicken weight losses were such that a huge financial setback could not be averted.

"And later when transportation started it was expensive and there was no point feeding those birds because they had already lost weight." (Broiler farmer; IC-3)

Backyard farmers, on the contrary, did not face any challenge with procuring feed during the lockdown since their birds were fed with whatever was available at home, and they never had to buy feed.

"So, I don't have to incur any additional cost on them I don't even bring feed from outside." (Backyard farmer; IC-32.2)

### 3.2. *Impact of the COVID-19 Lockdown on Poultry Health Supplies*

Layer farmers noted that the supply of vitamins and essential medicines was disrupted because of which the flock suffered from vitamin deficiency and diseases.

"No sir, not appropriate at all. I think during lockdown, they must not be having Vitamin A, so we got quite a big loss; it was quite consistent before. And because of deficiency of Vitamin A. eggs loosen out and the yolk dies. It is just of 3 to 4 days but we feel it is 15 to 17 days old." (Layer farmer; IC-33)

Broiler farmers also shared that many medicines were not available at the pharmacies due to the supply disruption.

"Even the medical stores did not have the stock of the medicines." (Broiler farmer; IC-7)

In contrast, many backyard farmers shared that they did not face any problem with the supply of medicines, and veterinarians were available.

"No nothing like that we did not face any problems related to medicines during lockdown." (Backyard farmer; IC-32.2)

### 3.3. *Impact of the COVID-19 Lockdown on the Distribution of Poultry Products*

Many traders could not meet other traders, farmers and retailers due to movement restrictions during the lockdown, due to which the informal business negotiations could not occur.

"Now due to corona it is not possible to meet physically like there is no place in the market where we can meet." (Trader; IC-19.2)

Because of the strict lockdown, no movement was allowed. In some instances, movements were also restricted by police, and the situation did not get better even after the lockdown was lifted.

"After lockdown police were harassing us, they use to stop the drivers and hit them then we stopped going on that road. There were problems in between but everything is fine right now but it is back to normal. Policemen are still harassing sometimes." (Trader; IC-19.2)

In the early days of lockdown, retailers were delivering poultry products to customers at their doorsteps; however, home deliveries were soon stopped by police controls, as the government did not recognise chicken meat as an essential good.

"Yes, we used to provide but police used to catch us on the road...So we stopped delivering at home...Yes it didn't work we had to pay fines even in the amounts bigger than our earnings so we stopped." (Retailer; IC-2)

"The main problem was that the government did not consider chicken as grocery. They didn't consider that the chicken is something which is used by few people every day." (Retailer; IC-2)

"If the government would have given the permission to the chicken shops like how they gave to the grocery shops to keep open for the specified timings along with cleanliness and safety then it

would have surely made a big difference and even the people would come to know that there is no harm in eating chicken." (Retailer; IC-2)

Layer farmers also noted that, due to lockdown-related movement restrictions, transportation was one of the biggest challenges in the distribution of eggs. Only part of the production could be distributed, with the rest being dumped or used as poultry feed.

"Yes, there was problem for transportation and even the demand...50% of the eggs were sold and 50% of the eggs we boiled and gave the birds to eat." (Layer farmer; IC-31)

"I did it for 90 paise also. Then also the vehicles did not approach. In the end, I had to throw two and half to three lakh eggs." (Layer farmer; IC-33)

### *3.4. Impact of COVID-19 on Financial Arrangements along the PDNs: The Spread of COVID-19 and the Subsequent Lockdown Negatively Impacted the Market. Some Traders Reported that the Prices of Poultry Products went Down During Lockdown and did not Increase Substantially once it was Lifted*

"Now the rates have been reduced after the lockdown. The rates at which I am getting the chicken, it is less by five rupees after the lockdown. Earlier before the lockdown, the rates had gone up sky-rocketing. Now the rates have been slashed down... Sometimes it was 100 rupees per kg. sometimes it rose to 120 rupees per kg. and sometimes it came down to even 36 rupees per kg. also. The current rate is 65 rupees per kg." (Trader; IC-27)

Due to the drop in demand, all poultry products could not be sold, and the surplus was disposed.

"There were huge losses which I had to incur. Also, it was meaningless to keep excess stock of chicken in my shop." (Trader; IC-27)

Retailers' egg sales were also affected during the lockdown, as eggs could only be sold at a limited scale and egg price dropped by one rupee. Retailers could not sell eggs to consumers directly but had to sell their stocks to wholesalers.

"Let me tell you. In March, if you take the actual number, it was quite less...No, no it wasn't zero. Sale was there, we have sold the eggs." (Egg retailer; IC-31)

"I reduced at least a rupee... During April to May, the price was three and a half only. Probably once or twice some change, there was no major change in that...Post June there is a difference, it's around four rupees. It's around three rupees and seventy-five paise. A difference of around twenty-five paise is there." (Egg retailer; IC-31)

The COVID-19 lockdown also impacted financial transactions among farmers, traders and retailers. Prior to the pandemic, most transactions were credit-based. However, producers and traders began to ask for payment in cash due to the prevailing uncertainty and lack of trust about actors' ability to reimburse their credit.

"Problems like due to slow-down of my business, like if I had kept my chicken stock with you on credit basis for 10 days. And suddenly, I supplied you with stock of 20,000 rupees or 30,000 rupees, and suddenly lockdown got implemented by the Government. The lockdown lasted for two to three months. Like your business also got shut down and my business also got affected. Your money was lying with me since I was unable to repay due to non-sales." (Trader; IC-27)

"Suddenly, the retailer despatches me chicken worth 20,000 rupees and suddenly lockdown gets implemented. Then I used to tell the retailer to have patience and that his dues will be repaid to him once the lockdown gets lifted. Keep courage and faith on me, slowly start sending me the chicken. I will try to restart my business. But he used to tell me, that if he supplied chicken then I have to pay him outright cash." (Trader; IC-27)

Due to a massive decrease in poultry product prices, many traders and retailers sold their products at a low price to cope with the financial loss.

"Like if I was able to sell my chicken at 50 rupees per kg to a customer. So, the balance chicken I used to dispose it off at 40 rupees the next day." (Trader; IC-27)

Many retailers did not face such problems as their business mainly rely on credits; however, in some instances, they were asked to pay in cash to receive good quality chicken. However, some of

them shared that the credit-based poultry business model suffered setbacks during and after the lockdown.

"No, that did not affect us much as our business is done on credit basis...Yes we used to get because we have good relations with everyone...Few places they were asking for cash...They use to tell us that we will give good quality if you pay in cash." (Retailer; IC-2)

"Earlier traders would wait for two to four days when we used to pick up the stock. Now even traders too aren't in that position, because farmers are breaking too and farmers also put forth a condition that if it costs a hundred rupees, you may cut two rupees but pay me today... They only have one condition that is to pay either by the night or by 11:00- 12:00 the following day. So, the credit limit is lesser." (Retailer; IC-41)

Consequently, retailers also stopped selling their products on credits to customers, including hotels and restaurants, as they all needed cash to make payments.

"Earlier... hotels haven't opened yet. Some people have shut down their hotels. What we do now is that we also emphasise that whoever we deal with, like the five-star restaurants and all, they never pay in cash... Other restaurants and dhabas, the owners who we can personally meet, we have started dealing mostly in cash with them." (Retailer; IC-41)

Some retailers did not earn money during the lockdown and faced financial losses. The need to reimburse rent and taxes also added to their financial burden.

"We suffered a huge amount of loss because even when the shop we closed we had to pay the rent and tax." (Retailer; IC-44)

Many migrant workers had left for their hometowns before and during the lockdown. However, the payment of the remaining employees' salaries was challenging for them due to the lack of income and contributed to additional financial burdens on traders. Also, some traders could not pay their employees, and gave them food or other goods instead.

"Labour is a must right. Without labour, my business will not be able to run smoothly...There are four labourers who are working for me... they were the drivers. So, I had to pay them their salary during lockdown. I had to incur their food expenses and take care of them... If I did not take proper care of them, then they will not work for me again." (Trader; IC-27)

"No, we give as much as we can sometimes, we give them food not more than that...Yes that we provide, we should always help people with food, we should do good for others what will happen next we never know." (Trader; IC-29)

Retailers had to reduce their employees' salaries due to the lockdown and downturn in the business. Likewise, many broiler and breeder farmers had to reduce their workforce as the workload was reduced and they could not pay salaries.

"It was around 12000-13000... Not even half even less than that...Now as the chicken rates have gone up the salary has increased to some extent it is around 14000-15000 now." (Retailer; IC-2)

"I had around 17 labourers...I removed 5-6 labourers before lockdown. Workload was less so we removed them." (Broiler farmer; IC-3)

Broiler farmers' business had reduced by up to 50% during the lockdown, and they needed a loan to keep their business afloat.

"Now we have lost so much, I do not have strength to fulfil that loss, so I have started fifty percent farming gradually...I need a loan now, but no one provides me a loan." (Broiler farmer; IC-5)

Some estimated that it would take at least five years for their business to recover, and this may be further jeopardised by the absence of a loan facility.

"I breed fifteen thousand birds. So don't work on rental sheds. So, I lost around thirty-five to forty lakhs in three to four months. And to recover it back, I would take five years. Now no one provides anything on credit in market." (Broiler farmer; IC-5)

Farmers mentioned that their credits were converted into loans. They had to repay these loans first, then only they could start their credit-based business again.

"No, how can we cover the losses, now that if we want to start the business, we need money, like earlier the business we had, we used to get credit we had 10 to 12 lakhs credit and because of this



that credit has turned into a loan, we have to pay and now that if we want to restart the business we will need that much money in hand, if you have 50000 to 1 lakh in hand then you can start your business on a small scale.” (Broiler farmer; IC-10)

As they did not depend on the supply of feed or other input material to rear birds, backyard farmers did not suffer any financial loss during the lockdown.

“No as of now there is no loss (due to lockdown) but if something happens to these birds then I would suffer a loss.” (Backyard farmer; IC-32.2)

### 3.5. Impact of the COVID-19 on Chicken Meat Consumption

Before COVID-19, many consumers consumed chicken meat regularly, at least once a week, while others consumed meat once in three to four months, depending upon meat availability, accessibility, religious belief, income, and food preference.

“I eat chicken 4 times in a week. I need meat I can’t do without meat but here I don’t get what I want... Here you buy Venky’s chicken worth rupees 800 and the quality is not up to the mark.” (Consumer; IC-15)

They reported facing challenges for buying chicken: while some mentioned that chickens were available, they could not go to the market due to the lockdown.

“Yes, it was available, but because of lockdown, we couldn’t go to buy.” (Consumer; IC-21)

For many consumers, lockdown negatively influenced their consumption of poultry products. They suffered a financial crunch due to job loss, resulting in a reduction of their purchasing power. There was also a change in the consumers’ preference for poultry products. Some were concerned about the quality and safety of chicken meat, hygiene standards during the dressing of chickens and the role of chickens in transmitting COVID-19. In contrast, some retailers reported that, as some doctors stated publicly that consuming chicken could boost the immune system, the demand for chicken necks and mutton legs increased.

“Actually, there is nothing like quality when it comes to livestock it was difficult to maintain the quality even before corona and after corona also.” (Consumer; IC-15)

“People mostly come and ask for the chicken’s neck...Or for the mutton legs. Its sale has increased from earlier. And it’s used mostly for soup, people mostly consume its soup.” (Retailer; IC-41)

### 3.6. Impact of the COVID-19 on Egg Consumption

Before COVID-19, eggs were consumed daily or weekly, depending on their availability and accessibility, consumers’ income and food preference. Rumours did not affect the consumption of eggs as much as they affected the consumption of chicken meat. However, the lockdown restricted consumers’ access to egg leading to a decline in egg consumption.

“**M:** Okay so how many eggs you used to consume before lockdown per week? **R:** 2 dozen per week. **M:** 2 dozen per week okay. During lockdown? **R:** 1 dozen per week” (Consumer; IC-21)

“**M:** Okay. Do you remember its exact words, what was the exact headline or the statement? **R:** Yes, we had got to know that corona is spreading because of it. **M:** Was it only for chicken or eggs as well? **R:** No, not for eggs, it was chicken related information.” (Consumer; IC-17)

### 3.7. Impact of COVID-19 on the Quality of Products

While the quality of chicken meat was considered to have decreased during the lockdown, many traders reported that they could supply retailers with healthy birds and fresh eggs once the lockdown was lifted.

“Yes definitely. The quality is good...It is the same quality of chicken which I was dealing with, before the lockdown. (Trader; IC-27)

According to traders, birds were not fed adequately during lockdown due to a shortage in corn and soya, impacting chicken weight.

“But during lockdown there was shortage of corns and soya bean, so they were not able to feed the birds properly, so birds were under weight.” (Retailer; IC-2)

Although most participants reported that the quality of eggs did not change during the study period, some complained about a reduction in egg quality, especially their taste and freshness, during lockdown.

“All the eggs are big in size. Quality of eggs is good.” (Consumer; IC-24)

“Maybe due to storage problem, we were not getting good quality during the lockdown.” (Consumer; IC25)

### *3.8. Spread of COVID-19 Related Rumours Through Social Media*

Participants reported that many fake videos showing a sick chicken, with a message that chicken consumption caused COVID-19, circulated on WhatsApp and Facebook. These videos impacted consumers' food preferences.

“Yes, it was more on WhatsApp, they used to send the video of hurt chicken and say that it is suffering from corona and if we eat that chicken even, we might get corona.” (Retailer; IC-2)

“So, if the chicken is infected... and we consume imported product. If we get it from abroad, Corona spreads through chicken. I heard that it's in chicken too so don't consume chicken, it would spread the virus.” (Consumer; IC-24)

Indeed, while most reported not having adequate information about the benefits and harm of consuming chicken; they preferred not to consume chicken, as they felt it could be risky.

“This information wasn't confirmed through the sources, but I since I was doubtful so we had stopped the consumption.” (Consumer; IC-17)

Rumours were mainly about chickens and chicken meat, less about eggs, as a source of SARS-CoV-2. Due to these rumours, some broiler farmers were not allowed by the local authorities to sell their chickens and chicken meat during the lockdown.

“No one was giving us permissions. Our chicken association requested the authorities, even in Sansad, they got us the permissions from the government. But the power is with the collector at the local level, so they used to take advantage of power.” (Broiler farmer; IC-10)

### *3.9. Mitigation Strategies for COVID-19 Rumours*

Many traders approached poultry integrators to address the issue of rumours. They made announcements among the public to provide evidence of coronavirus infection in chickens as one strategy to address the rumours.

“Then we got in touch with chicken companies and put a challenge for public that whoever proves that chicken causes corona will be given price money of 1 lakh rupees.” (Trader; IC-19.2)

Traders reported offering chickens and chicken products for sales at low prices, and even giving them for free but this did not help to quash the rumours.

“Like we were being asked to sell the chicken at lower rates. Even give it for free at times. But I did not have anything with it.” (Trader IC- 27)

In coordination with their local unions, retailers published advertisements in newspapers, on public billboards, and pasted pamphlets in their localities to convey the message that chicken consumption did not cause COVID-19.

“Then we gave out the advertisements that chicken does not cause corona, so then those ads helped us little to grow the business.” (Retailer; IC-2)

The poultry farming department of the state also issued notices on government portals and billboards to address the rumours.

“We made people aware by putting up the boards; the poultry farming departments also displayed the notice regarding the same.” (Retailer; IC-2)

Although newspapers also published news that poultry products did not cause COVID-19, retailers also shared that it was difficult to change people's perceptions immediately, which impacted their business.

"Yes, it had come in the newspaper that you should consume eggs they are good for immunity and all that...No once the rumours are viral it is hard to wash people's brain and make them aware of the truth." (Retailer; IC-2)

Once the lockdown was lifted, and physicians and clinicians began to address the rumours publicly, to the rumours progressively disappeared.

"Yes, sir demand will increase because as doctors are saying that you should increase your immune system to fight and stay away from the diseases...So people are consuming more of protein rich foods like eggs and all, so even the poultry is considered as high protein food so I think yes the demand will definitely increase." (Trader; IC-19.2)

Several campaigns, online and in newspaper, to address the rumours and make people aware of the benefits of consuming eggs, were led by layer farmers along with the poultry farming associations, the National Egg Coordination Committee (NECC), and egg companies. Initially, the campaign was run locally in Ahmedabad and later on was expanded to other cities in Gujarat. Farmers believed that many people started consuming eggs after watching those campaigns.

"We had arranged an online campaign poultry farming association and a group of people made people aware with the help of the campaign by telling people the benefits of eating eggs and all." (Layer farmers; IC-31)

**M:** Yes, NECC... National Egg Coordinator.

**R:** Yes, they had published in the newspaper that it's not as such." (Consumer; IC-23)

"Yes, the consumption was raised to 25% because of this campaign people started eating." (Layer farmers; IC-31)

### 3.10. Government Initiative to Address COVID-19 Related Challenges

Traders reported that the government made limited efforts to address the rumours. Some government guidelines issued in the early phase of the spread of COVID-19 discouraged people from eating chicken meat, considering chickens as potential vectors of SARS-CoV-2.

"Then slowly they started realizing about the situation so the Arogya Setu team and the Aayush Ministry updated the rules of not buying chicken or any kind of meat... So, they put a banner everyone that to stay safe from Corona you have to maintain social distancing and not eat non-veg food stay away from mutton chicken and all those non-veg foods." (Trader; IC-19.2)

They also mentioned that frequent changes in government department guidelines led to confusion among consumers.

"So, if one department of the government is saying that you should avoid eating non-veg and the other department is saying that it doesn't cause corona then whom are we supposed to believe?" (Trader; IC-19.2)

Traders also reported that they could not get adequate financial support from the government as poultry production was considered a semi-agricultural sector.

"Yes sir 100%. Poultry is considered as semi agriculture not complete agriculture...So, because of that we don't get many benefits this one negative impact." (Trader; IC-19.2)

### 3.11. Post-Lockdown Recovery of the Market

The price of broiler chickens went up after the lockdown was lifted. However, prices and sales volumes did not reach their pre-COVID-19 levels.

"Now the rate is around 200-220 rupees...It was around 80-85 INR...During lockdown it was 12-15 rupees." (Retailer; IC-2)

"They used to buy five thousand worth of stock from us, now they only buy stock worth of thousand to twelve hundred." (Retailer; IC-41)

According to retailers, the reduction in consumers' incomes during the lockdown has influenced their food preferences and reduced their consumption of chicken meat.

"I presume that it's not that they are not consuming non-veg because of my chicken quality, but they have financial problems currently due to which I feel sale is less." (Retailer; IC-42)

Layer farmers also shared that they were able to sell eggs at a good price after the lockdown was lifted.

"The rates are good now so if the rates remain same for around 4-5 months, then the loss will be recovered... We are still compensating the loss." (Layer farmer; IC-31)

Breeders' business went back to normal after the lockdown was lifted. However, it took some time to produce enough DOCs to cover farmers' post-lockdown demand, and compensate for the loss incurred during the lockdown.

"Now things have returned back to normal routine. Business is good. But day-old chick wasn't available in the market, farmers faced a problem." (Breeder; IC-12)

Some farmers had to empty their farms during the lockdown as there were no demand for their chickens. As the lockdown ended, and people started buying chicken meat again, farmers were not left with any chickens to sell.

"Reason being is that chicks were destroyed during the lockdown, no one placed them, everyone emptied their farms, entire Gujarat was empty. And when lockdown started to be lifted, permission to open different shops was given... but stock wasn't available, and since stock wasn't available, price was high." (Broiler farmer; IC-19.1)

Consumers reported that prices spiked after the lockdown was lifted because of the limited availability of poultry products. As the impact of COVID-19 on consumers' preferences decreased, the demand for chicken meat increased again, causing a spike in prices, according to consumers, because of the limited availability of poultry products after the lockdown was lifted.

"Yes, because of that people started consuming more chicken and even the rates were increased." (Consumer; IC-21)

#### 4. Discussion

In this paper, we have identified factors that hindered poultry production, distribution, and consumption in the first half of 2020 in Gujarat, India. Logistic and quality issues related to transport, competition from the international market, disease outbreaks, cost of feed ingredients, misuse of antibiotics, lack of biosecurity and price fluctuation are some of the major challenges faced by PDN stakeholders in India, and were exacerbated by the pandemic [1]. COVID-19 lockdown further negatively affected poultry production and distribution due to movement restrictions. Rumours about chickens being a vector of COVID-19 had a direct impact on the demand for poultry products. Social media played a crucial role in spreading those rumours. Farmers, retailers and traders suffered substantial financial losses due to this drop in demand, as well as the difficulty to access capital, labour, production inputs and financial relief packages from the government.

In Iran, pandemic-related rumours were also reported to have had an impact on the demand for poultry meat with stakeholders' activities being also affected by import restrictions on raw materials due to the increase in border controls, rising prices of input materials, supply restrictions on foreign currency [Palouj et al. 2021]. In common with our study, a global media analysis concluded that COVID-19 mitigation measures, including lockdown and movement restrictions, disrupted the PDN more than the SARS-CoV-2 virus itself [20].

A pan-India review of the impact of COVID-19 on the poultry sector, has reported that broiler farmers were more affected by the pandemic than layer farmers because of the dramatic fall in farm gate prices of live broilers, similar to the findings of our study [21]. Indeed, although there was also a decline in egg prices, it was less pronounced than for chicken meat. Eggs and other poultry products were not included in the list of essential goods for which shops were granted a licence to remain open during the lockdown. A major cause of the decline in egg prices and disruption of the PDN was thought to be due to the closure of schools, as eggs were an essential item of the mid-day meal programme, a flagship nutrition programme of the government of India [7].

One of the unique findings of this study was the impact of the pandemic on the transaction dynamics along the PDN. Previously, many transactions were based on credits. However, fearing that their business partners could not reimburse them, many stakeholders, in all PDN nodes, refused to sell good on credit any longer. These included the sales of chicken and egg to consumers, DOC

and feed to farmers, chickens and eggs to traders and retailers. While farmers, traders and retailers could not rely on credit for their transactions any longer, they could not get any loan from the government, which negatively influenced the post-lockdown recovery of their business. Another review study evaluating the impact of COVID-19 on the poultry sector also suggests that an increase in the costs of production inputs and their restricted availability negatively impacted the growth of the poultry industry and consumers' purchasing power after the COVID-19 pandemic [22]. The large vertically integrated companies like Suguna signed an agreement with Asian Development Bank to receive essential liquidity support to build inventory buffers and make timely payments to contract farmers and suppliers [23]. However, it will be difficult for small farmers, retailers and traders who have limited financial capital and heavily rely on credit transactions to operate without government support.

As highlighted in this study, interdependencies between PDN actors meant that disruption occurring in one node of the network would affect other nodes, will resulting in a cascade effect spreading through the entire network. A similar pattern was reported in Bangladesh, where the negative impact of COVID-19 on one node of PDN also had a ripple effect on the interconnected stakeholders and businesses across the poultry sector [24]. This was not unique to poultry production, but affected all agri-food sectors, including the fruit, vegetable, fish, poultry, and grain supply chain [25,26], with the restriction on transportation and population mobility being identified as a major influencing factor. As the production and distribution of different food commodities are interrelated, such cascade effects did not stop at PDN boundaries. For instance, the drop in poultry production also impacted on soya and maize producers. Indeed, with most soya and maize produced in Bihar, the main producing region of India, being used as poultry feed, the drop in poultry production was likely to be a major contributor to the 40.9% reduction in soya and maize prices from December 2019 (USD 29.94) to April 2020 (USD 17.69) [9].

To the best of our knowledge, this is the first in-depth qualitative study undertaken to understand the impact of COVID-19 lockdown on poultry production, distribution, and consumption. To get a holistic picture of the contextual impediments posed by COVID-19 on the PDN, eight categories of respondents were interviewed. Conducting such study in other Indian states may reveal a greater diversity of challenges faced by PDN actors during the COVID-19 pandemic and associated lockdown.

## 5. Conclusion

The first COVID-19 lockdown restricted the production and distribution of essential goods and influenced the perception of consumers regarding poultry products. Different farmers, traders, and retailers suffered substantial financial losses due to the unavailability of production inputs, lack of demand, and disruption in transportation. Consumers reduced their consumption of chickens due to their unavailability in the market, and fears about chicken consumption causing COVID-19. The non-inclusion of poultry products in the essential good list, changes in modes of transactions and difficult access to financial capital were major impediments for PDN actors to sustain their activities. Our study highlighted an intrinsic fragility of the PDN, which requires immediate attention and timely government support to avoid the disruption and promote the resilience of the PDN during future crises.

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