



HAL
open science

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

Pallavi Mishra, Akash Golaviya, Ketankumar Panchal, Ankit Hinsu, Kavita Yadav, Guillaume Fournié, Tony Barnett, Prakash Koringa, Haidar Ul Iman Paleja, Rajib Dasgupta

► **To cite this version:**

Pallavi Mishra, Akash Golaviya, Ketankumar Panchal, Ankit Hinsu, Kavita Yadav, et al.. 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. *Poultry International*, 2023, 2 (3), pp.395-410. 10.3390/poultry2030029 . hal-04094737

HAL Id: hal-04094737

<https://hal.inrae.fr/hal-04094737>

Submitted on 20 Jun 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

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

Pallavi Mishra ¹, Akash Golaviya ² , Ketankumar Panchal ², Ankit Hinsu ² , Kavita Yadav ¹, Guillaume Fournié ^{3,4,5} , Tony Barnett ^{3,6}, Prakash Koringa ², Haidar Ul Iman Paleja ²  and Rajib Dasgupta ^{1,*}

- ¹ Centre of Social Medicine and Community Health, Jawaharlal Nehru University, New Delhi 110067, India; pallavimishra.research@gmail.com (P.M.); kavitarekha@gmail.com (K.Y.)
- ² Department of Animal Biotechnology, College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand 388110, India; golaviyaakash14@gmail.com (A.G.); ketan9589@gmail.com (K.P.); ankit4035hinsu@gmail.com (A.H.); prakashkoringa@gmail.com (P.K.); hpaleja@yahoo.com (H.U.I.P.)
- ³ Veterinary Epidemiology, Economics and Public Health Group, Department of Pathobiology and Population Sciences, The Royal Veterinary College, London NW1 0TU, UK; gfournie@rvc.ac.uk (G.F.); abarnett@rvc.ac.uk (T.B.)
- ⁴ INRAE, VetAgro Sup, UMR EPIA, Université de Lyon, 69280 Marcy l'Etoile, France
- ⁵ INRAE, VetAgro Sup, UMR EPIA, Université Clermont Auvergne, 63122 Saint-Genes-Champanelle, France
- ⁶ Firoz Lalji Institute for Africa, London School of Economics, London WC2A 2AE, UK
- * Correspondence: dasgupta.jnu@gmail.com

Abstract: Background: The poultry industry in India, estimated to be worth about one trillion INR, was severely affected by the COVID-19 pandemic. This study was conducted in Gujarat, India to unpack the processes through which COVID-19-related factors affected the poultry production and distribution network and explore the impacts on the relevant actors. **Methods:** An exploratory qualitative study was conducted among 34 poultry stakeholders using semi-structured interviews. The data were thematically analyzed by adopting an interpretative phenomenological approach. **Results:** Convincing evidence emerged that the lockdown and the pandemic significantly impacted the production, distribution, and consumption of poultry products. Movement restrictions during the first lockdown disrupted the supply of inputs and the distribution of poultry and poultry products. Between March and June 2020, rumors contributed to a substantial decrease in the consumption of poultry products. Consumption picked up following the reopening after the lockdown and the prices and availability of poultry products. The profits, however, failed to compensate for the losses that had been incurred. **Conclusions:** The experience and impacts of the first COVID-19 lockdown on the poultry industry unraveled several short- and medium-term challenges in the poultry sector in India that need to be addressed to make it more resilient to similar shocks.

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



Citation: Mishra, P.; Golaviya, A.; Panchal, K.; Hinsu, A.; Yadav, K.; Fournié, G.; Barnett, T.; Koringa, P.; Paleja, H.U.I.; Dasgupta, R. 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. *Poultry* **2023**, *2*, 395–410. <https://doi.org/10.3390/poultry2030029>

Academic Editor: Michael Hess

Received: 29 April 2023

Revised: 18 July 2023

Accepted: 4 August 2023

Published: 16 August 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Poultry is one of the fastest-growing sectors among all other agriculture sectors in India, and is essential for fulfilling the requirements of protein and nutrition for the population [1]. In India, the poultry sector was worth one trillion Indian rupees (INR) in 2020, with most of the production being vertically integrated, matching the production efficiency levels of many high-income countries [2,3]. India has rapidly transitioned from backyard to commercial poultry production in the last three decades. 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 characterized 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 was severely affected by COVID-19 and the associated lockdowns. The pandemic affected 25 million farmers and over 5 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 plummeted to 47% between January and early February 2020 [6]. In the same period, the chicken prices at farm gates 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, far less compared to the COVID-19 fallouts.

We aim to understand the COVID-19-related factors that harmed the poultry production and distribution network (PDN) and explore their varied impacts on PDN actors in the state of Gujarat, India, which have 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, a lack of robust regulation systems, and a credit-reliant production system exposed the intrinsic fragility of the PDNs [10]. This paper 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 the COVID-19 pandemic on the poultry industry in Gujarat, India. The study was conducted between May and July 2020. The recall period was specified for the respondents to be January to July. The study was conducted at Anand Agricultural University (AAU), Gujarat. A total of 34 participants were recruited by the AAU team using purposive and exponential non-discriminative snowballing methods [11,12]. These helped recruit diverse participants associated with the poultry sector—farmers, traders, retailers, and consumers—with the aim of understanding the challenges faced during the first lockdown in the areas of poultry production, distribution, and consumption.

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 ($n = 8$). A maximum variation sampling strategy was used to create a diverse sample of participants to ensure high-quality, detailed descriptions and key “shared patterns that cut across cases and derive their significance from having emerged out of heterogeneity” [13]. This helped us identify the “essential features and variable features of a phenomenon as experienced by diverse stakeholders among varied contexts, “facilitating informed decision-making [14].

The AAU team conducted face-to-face semi-structured interviews between May and July 2020 by prior appointment at their farm/shop. While data saturation [15,16] had ensued by the 13th and 14th interviews, all 34 interviews (across stakeholder categories) 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; this was as per the preference of the respondents. The interview team was proficient in both the languages.

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 included: personal profile of the participants, effects of COVID-19, and associated risk mitigation measures, including lockdown, on the overall poultry sector and their respective business. The other key topics addressed

measures taken to counteract the rumours, the financial situation, and changes in the consumers' food preferences. 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 [16]. 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 familiarized 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 [17,18].

Data Analysis (Excel Coding Method)

The transcripts were developed using Microsoft Word version 2010 and transferred to the Excel sheets; Microsoft Excel version 2010 [19] was used for data analysis. We created four columns: the first, indicating the category of the respondent; the second, indicating interviewer and respondents; the third, indicating question and answer; and the fourth, indicating codes. While coding the interviews, a separate sheet for codes and code numbers was used. Though the interview guide was framed with an a priori code list, we added emergent codes as well. After coding, all the interviews were merged sequentially in a separate file. The 'concatenate' [19] command was run to obtain the data frequency. The coded data were transferred to Microsoft Word to conduct the thematic analysis.

The interpretative coding approach helped organize data to identify themes "that, while perhaps contextualized in the research setting, were decontextualized with regard to an individual's experience" [18]. After coding the transcripts, summaries were prepared against each code and categorized into themes and sub-themes. Study investigators in the UK, Gujarat, and New Delhi carried out iteration processes for constant comparison and refinement. Care was taken to rule out the possibility of missing views and perceptions of the participants. We categorized the data under eleven analytical themes (Table 1) that emerged from the interview data. These themes emerged from the linear process of the interpretative analysis of data [20]. After developing the theme, the qualitative researchers looked for connections among themes to organize them in linear order the way they had emerged from the interviews [20]. The participants' contexts and the initial reflexivity of the qualitative researcher were the significant factors while interpreting the data [20].

Table 1. Analytical themes.

Themes	Sub-Themes
Impact of the COVID-19 lockdown on the production of poultry products	<ul style="list-style-type: none"> • Feed supply • Chicken breeding • Reduction in flock size • Increased feed price decreased feed quality
Impact of the COVID-19 lockdown on the distribution of poultry products	<ul style="list-style-type: none"> • Unavailability of essential vitamins and medicines
Impact of the COVID-19 lockdown on poultry health supplies	<ul style="list-style-type: none"> • Negative impact on informal business negotiations • Stopped home deliveries of products for consumers • Negative impact on distribution of eggs due to restricted transport

Table 1. *Cont.*

Themes	Sub-Themes
Impact of COVID-19 on financial arrangements along PDN	<ul style="list-style-type: none"> • Decline in price of poultry products • Decline in sale and surplus disposal • Shift in credit to cash-based transactions • Loss of employment among labors
Impact of the COVID-19 on chicken meat consumption	<ul style="list-style-type: none"> • Decline in consumption of chicken • Negative impact on purchasing power
Impact of the COVID-19 on egg consumption	<ul style="list-style-type: none"> • Decline in egg consumption
Impact of COVID-19 on the quality of products	<ul style="list-style-type: none"> • Lack of feed availability of chicken • Reduced quality of egg
Spread of COVID-19-related rumors through social media	<ul style="list-style-type: none"> • Rumors impacted consumers' food preference
Mitigation strategies for COVID-19 rumors	<ul style="list-style-type: none"> • Public announcement to address COVID-19—related rumors • Advertisements in newspapers and pamphlets on public billboards
Government initiative to address COVID-19-related challenges	<ul style="list-style-type: none"> • Required more efforts to curtail rumors • Financial support for farmers
Post-lockdown recovery of the market	<ul style="list-style-type: none"> • Restricted feed supply impacted weight of birds • Prices and sales volumes recovery will take time • Revival of consumer food preference will take time • Breeders' business is on rise • Spike in price of poultry products

Ethical approval for this study was obtained from the institutional ethics committees of the Anand Agricultural University, Gujarat, India, Jawaharlal Nehru University, India and the 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 the digital recording of interviews.

3. Results

The challenges faced by the diverse stakeholders at different stages of the PDN and the COVID-19 mitigation strategies are summarized under eleven themes. These themes have emerged by grouping together various concepts which were related and indicating a specific issue. The first four themes (Table 1) summarized the challenges faced at different stages of the PDN, including financial arrangements along the PDN. Two themes revolved around the change in consumption patterns of poultry products and two others on the spread and mitigation of rumors 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 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. The disruption in feed supply impacted poultry production across the state. All interviewed farmers shared that it was difficult for them to procure feed for the birds in the early phase of the lockdown.

“We didn’t get (feed) in the starting of the lockdown then (later) it was easily available... No one was giving (feed or input material) on credit during lockdown. Before that they used to give (supplies) on credit for one or two days”. (Layer farmer; IC-31)

“What happened is that they (birds) died gradually as feed was finished and I couldn’t get it, (as) 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, soybean, groundnut, rapeseed, and sunflower seeds) and other nutrients such as protein, calcium, and lysine, because of the restrictions on transportation.

“In the beginning in March, we had to face many difficulties, and even in the month of April we faced 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, (and) police used to levy fines”. (Breeder; IC-1)

The fall in price 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 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 12,000... We reduced by 6000 birds due to COVID (now)... And during lockdown, there had around 12,000 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 48,000 to 50,000 birds... I had then I sold at lower prices (during lockdown) 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 several years due to the disrupted supply and volatile prices of feed and its raw material, which was worsened by the COVID-19 lockdown.

“The layer poultry industry has been facing problems since 2018–2019 due to excess supply of eggs and disease in maize. Due to that the maize rates were almost double. At present rates are INR 14/kg but for maize, however, at that time it was INR 24–25/kg responsible for an increase in the cost of production to INR 400 for 100 eggs though the selling rates (market rates) for egg were good between INR 325–350 for 100 eggs as compared to previous years, it was less in comparison to the production cost. These were the reasons for heavy losses”. (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 soybean meal. They also mentioned that the quality of corn and soybean meal was not good because of the longer duration of stocking in the granaries.

“It was INR 28 to 30, and now it is INR 45... The shortage was there; everyone tried to buy it, so there was a shortage (of supply)... The quality was really bad... The rates were high, they had made a syndicate for that and they charged just arbitrarily, at (their) 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 was restored, 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 and, consequently, the flock suffered from vitamin deficiency and diseases.

“I think during the lockdown, they must not have had Vitamin A, so we got quite a big loss; it was quite consistent before. And because of vitamin A deficiency, eggs become loose and the yolk dies. It is just 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 disruptions of the supply logistics.

“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.

“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, thereby affecting informal business negotiations.

“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 improve even after the lockdown was lifted.

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

In the early days of the 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 recognize chicken meat as an essential good.

“We used to provide (poultry products at door steps) but police used to catch us on the road... So we stopped delivering at home... We had to pay fines even more 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 is consumed by many 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 them open for a specified timings following cleanliness and safety, then it would have surely made a big difference and even people would have 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.

“There was a problem for transportation and even the demand (decreased)... 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 INR 0.9 also. Then also the vehicles did not approach. In the end, I had to throw two and a 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 (Figures 1 and 2). Some traders reported that the prices of poultry products went down during the lockdown and did not increase substantially once it was lifted.

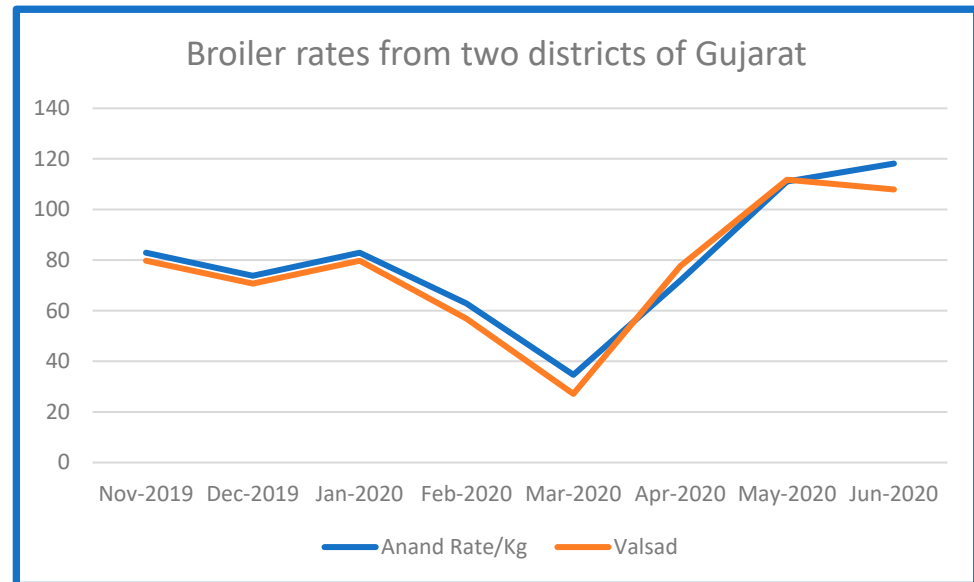


Figure 1. Broiler rates from Anand and Valsad Districts, Gujarat. Data source: Rates and directory: Poultry Bazar (an open access website to promote fair trade practices in the industry) [21]. Graphic by author team.

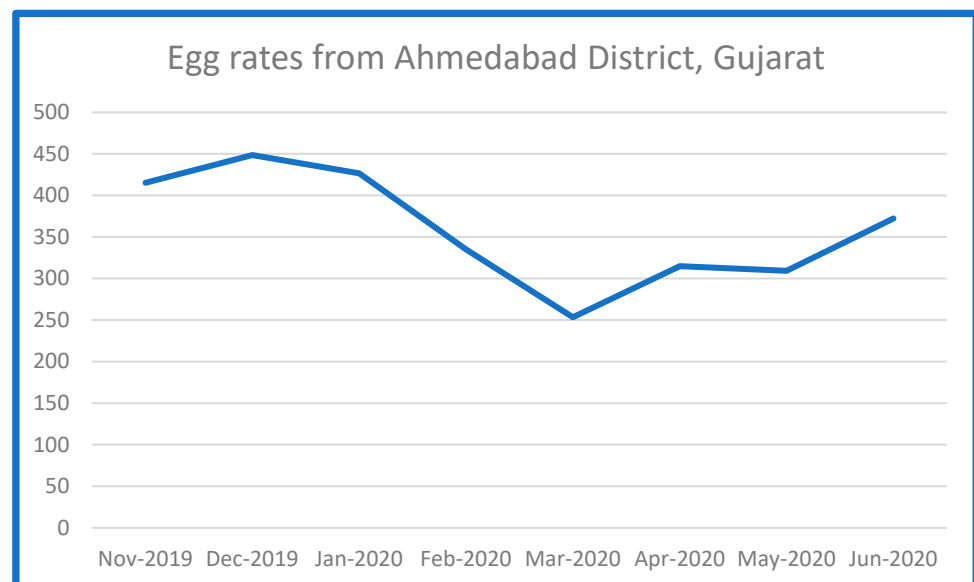


Figure 2. Egg rates from Ahmedabad District, Gujarat. Data source: Rates and directory: Poultry Bazar (an open access website to promote fair trade practices in the industry) [22]. Graphic by author team.

“Now, the rates have been reduced after the lockdown. The rate that I am getting the chicken are less than five rupees after the lockdown. Earlier before the lockdown, the rates had gone up skyrocketing. Now the rates have reduced considerably... Sometimes it was INR 100 per kg. sometimes it rose to INR 120 per kg. and sometimes it came down to even INR 36 per kg. also. The current rate is INR 65 per kg”. (Trader; IC-27)

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

“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 (sold only at a few places and in lesser quantities) 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 (the price) at least by INR 1 during April to May, the price was INR 3.5/egg only. Probably once or twice some change (took place), there was no major change in that... Post June, there is a difference, it’s around four rupees (the price increased by INR 0.50). It’s around INR 3.75 (now). A difference of around twenty-five paisa i.e., quarter rupee (INR) is there (as compared to April and May)”. (Egg retailer; IC-31)

The COVID-19 lockdown also impacted financial transactions among farmers, traders, and retailers. Before 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 in actors’ ability to reimburse their credit.

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

“Suddenly, the retailer dispatches me chicken worth INR 20,000 and suddenly lockdown gets implemented. Then I told the retailer to have patience and that his dues will be cleared once the lockdown gets lifted. Have faith in me, slowly (they) started sending me the chicken. I will try to restart my business. But he (trader) used to tell me that if he supplied chicken, 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 low prices to cope with the financial loss.

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

Many retailers did not face such problems as their business mainly relied on credits; however, in some instances, they were asked to pay in cash to receive good quality chicken. Some of them shared that the credit-based poultry business model suffered setbacks during and after the lockdown.

“No, that (closure of banks) did not affect us much as our business is done on credit basis... Yes, we used to get it 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 aren’t in that position because farmers are breaking too (incurring financial losses) and farmers also put forth a condition that if it costs INR 100, you may deduct or reduce price by INR 2 but pay me today... They only have one condition which 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 credit to customers, including hotels and restaurants, as they all needed cash to make payments.

“Hotels haven’t opened yet. Some people have shut down their hotels. What we do now is that we also emphasize that whoever we deal with, like the five-star restaurants and all, they pay in cash... Other restaurants and dhabas (roadside eateries), 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 incurred a huge financial loss because (at the time of lockdown) when the shop was closed, we had to pay the rent for the shop and annual tax (to the government)". (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.

"Labor is the most essential resource, right? Without labor, my business will not be able to run smoothly... There are four laborers who are working for me... they are 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 would not work for me again". (Trader; IC-27)

"We give (support in cash and kind) 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". (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 INR 12,000–13,000... 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 INR 14,000–15,000 now". (Retailer; IC-2)

"I had around 17 laborers... I ended service of 5–6 laborers before lockdown. Workload was less so we ended their services". (Broiler farmer; IC-3)

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

"Now we have lost so much, I do not have the strength to fulfil that loss, so I have reducing my farming to fifty per cent 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 jeopardized by the absence of a loan facility.

"I breed fifteen thousand birds. So I don't work on rental sheds. So, I lost around 3.5 to 4 million 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, only then could they start their credit-based business again.

"How can we compensate for 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 INR 100,000 to 120,000 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 INR 50,000 to 100,000 in hand then you can start your business on a small scale". (Broiler farmer; IC-10)

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

"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 four 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 INR 800 and the quality is not up to the mark”. (Consumer; IC-15)

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

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

For many consumers, the lockdown negatively influenced their consumption of poultry products. They suffered a financial crunch due to job loss, resulting in a reduction in 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 chickens 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 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. Rumors did not affect the consumption of eggs as much as they affected the consumption of chicken meat. However, the lockdown restricted consumers’ access to eggs, leading to a decline in egg consumption.

“M: Okay. Do you remember its exact words? What was the exact headline or the statement (of the WhatsApp message)? 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.

“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 the lockdown due to a shortage in corn and soybean meal, impacting chicken weight.

“But during lockdown, there was a shortage of corn and soybean meal, so they were not able to feed the birds properly, so birds were underweight”. (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 the lockdown.

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

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

3.8. Spread of COVID-19-Related Rumors through Social Media

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

“Yes, it was more on WhatsApp, they used to send the video of chicken bleeding 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 the imported product. If we get it from abroad, Corona spreads through the 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 since I was doubtful so we had stopped the consumption”. (Consumer; IC-17)

The rumors were mainly about chickens and chicken meat, and less about eggs, as a source of SARS-CoV-2. Due to these rumors, the local authorities did not allow some broiler farmers 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 (parliament), they get us the permission 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 Rumors

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

“Then we got in touch with chicken companies and published an open call for publicly stating that whoever proves that chicken causes corona will be given prize money of INR 100,000”. (Trader; IC-19.2)

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

“We were being asked to sell the chicken at lower rates. Even gave 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 issued an advertisement 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 rumors.

“We made people aware by putting up the bulletin 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 shared that it was difficult to change people’s perceptions immediately, impacting their business.

“Yes, it was published in newspapers that one should consume eggs as they are good for immunity and all that. . . But once the rumors spread, it was hard to change the perception of people and make them aware of the truth”. (Retailer; IC-2)

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

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

Several online and newspaper campaigns to address the rumors 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 ran an online campaign with the help of the poultry farming association a group of a few individuals was also formed to run the campaign to make people about 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)

“The consumption increased by 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 rumors. 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. Poultry are unlikely to carry SARS-CoV-2 and MERS CoV viruses [23].

“Then, slowly they started realizing about the situation so the Arogya Setu team and the Aayush Ministry updated the rules for not buying chicken or any kind of meat. . . So, they put a banner everywhere stating that to prevent 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 obtain adequate financial support from the government as poultry production was considered a semi-agricultural sector.

“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 INR 200–220. . . It was around INR 80–85. . . 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 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 could sell eggs at a good price after the lockdown was lifted.

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

Breeders’ businesses 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 back to the 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 was 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 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 the stock wasn't available, and since the stock wasn't available, the 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, after the lockdown, 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]. The COVID-19 lockdown further negatively affected poultry production and distribution due to movement restrictions. Rumors that chickens were vectors of COVID-19 had a direct impact on the demand for poultry products. Social media played a crucial role in spreading those rumors. Farmers, retailers, and traders suffered substantial financial losses due to this drop in demand and the difficulty in accessing capital, labor, production inputs, and financial relief packages from the government.

In Iran, pandemic-related rumors were also reported to have had an impact on the demand for poultry meat, with stakeholders' activities also being affected by import restrictions on raw materials due to the increase in border controls, rising prices of input materials, and supply restrictions on foreign currency [24]. In line with our study, a global media analysis concluded that COVID-19 mitigation measures, including lockdowns and movement restrictions, disrupted the PDN more than the SARS-CoV-2 virus itself [25]. The poultry market in countries like Bangladesh, Morocco, Nigeria, China, and Myanmar also reported incurred losses due to COVID-19-associated lockdowns [26–30]. In Bangladesh, along with rumors, the pre-existing structural factors, such as volatility of input and production prices and credit-dependence, exacerbated the adverse impact of the COVID-19-associated lockdown on PDN [26]. Similarly, in Morocco and China, a huge decline in the consumption of poultry products was registered during COVID-19 due to the lockdown of hotels, restaurants, and cafes and a decline in the purchasing power of consumers [27,28]. In Myanmar, COVID-19 hit the poultry market badly, resulting in the temporary or permanent closure of many broiler farms [29]. Similar to other countries, poultry industries in Myanmar and Nigeria also suffered due to low cash flow, the high cost of feed, and a decline in demand for poultry products [29,30].

A pan-India review of the impact of COVID-19 on the poultry sector 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 [31]. Indeed, although there was also a decline in egg prices, this 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 license 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 program, a flagship nutrition program 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 goods on credit any longer. These included the sales of chicken and egg to consumers, DOC and feed to farmers, and chickens and eggs to traders and retailers. While farmers, traders, and retailers could no longer rely on credit for

their transactions, they could not obtain a 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 (labor, feed, etc.) and their restricted availability negatively impacted the growth of the poultry industry and consumers' purchasing power after the COVID-19 pandemic [32]. Large vertically integrated companies like Suguna signed an agreement with the Asian Development Bank to receive essential liquidity support to build inventory buffers and make timely payments to contract farmers and suppliers [33]. However, it would be difficult for small farmers (farmers who keep a flock of less than 8000 broilers) [34], retailers, and traders who have limited financial capital to operate without government support as they heavily rely on credit-based transactions

As highlighted in this study, interdependencies between PDN actors meant that disruption occurring in one node of the network would affect other nodes, which further had a cascade effect that disrupted the entire network. A similar pattern was reported in Bangladesh, where the negative impact of COVID-19 on one node of the PDN also had a ripple effect on the interconnected stakeholders and businesses across the poultry sector [26]. This was not unique to poultry production but affected all agri-food sectors, including the fruit, vegetable, fish, poultry, and grain supply chain [35,36], 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 soybean meal and maize producers. Indeed, with most soybean meal 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 soybean meal 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 lockdowns on poultry production, distribution, and consumption. To obtain a holistic picture of the contextual impediments posed by COVID-19 on the PDN, eight categories of respondents were interviewed.

5. Conclusions

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, the lack of demand, and the 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 goods list, changes in modes of transaction, and difficult access to financial capital were major impediments for PDN actors to sustain their activities. Our study highlighted the intrinsic fragility of the PDN, which requires immediate attention and timely government support to avoid disruption and promote the resilience of the PDN during future crises.

Author Contributions: R.D., H.U.I.P., P.K., T.B., G.F., K.Y., K.P., A.G. and P.M. conceptualized and designed the study. H.U.I.P., A.G., K.P. and A.H. collected the data. P.M. analyzed the data. P.M. wrote the first draft of the manuscript. R.D., H.U.I.P., P.K., T.B., G.F., K.Y., K.P. and A.G. contributed significantly to the revision of the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This work was funded by the UKRI GCRF One Health Poultry Hub (Grant No. BB/S011269/1), one of twelve interdisciplinary research hubs funded under the UK government's Grand Challenges Research Fund Interdisciplinary Research Hub initiative. The funders were not involved in the conducting of the research or preparation of this paper.

Institutional Review Board Statement: The study was reviewed and approved by the institutional ethics committees of the Anand Agricultural University, Gujarat, India, Jawaharlal Nehru University, New Delhi and the Royal Veterinary College, UK.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Acknowledgments: The authors would like to extend thanks to all those who participated in the study.

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

- Sharma, G. Indian Poultry Industry: Challenges, Problems and Opportunities. Poultry Punch. Available online: <https://thepoultrypunch.com/2020/10/loomb-poultry-industry-challenges-problems-and-opportunities/> (accessed on 20 May 2021).
- Business Today. Coronavirus Impact: Govt Needs to Act before COVID-19 Slaughters the Rs 1 Lakh Crore Indian Poultry Industry. Available online: <https://www.businesstoday.in/opinion/columns/coronavirus-crisis-poultry-industry-covid-19-pandemic-animal-agriculture-sector-india/story/405296.html> (accessed on 23 May 2021).
- Ministry of Food Processing Industries. Opportunities in Meat & Poultry Sector in India. Available online: <https://mofpi.nic.in/sites/default/files/OpportunityinMeat%26PoultrysectorinIndia.pdf> (accessed on 25 May 2021).
- PRADAN. Indian Poultry Sector. Available online: https://www.pradan.net/images/news/pdfs/presentation_by_mr_anish_kumar_pradan.pdf (accessed on 25 May 2021).
- Singh, A. COVID-19 Rumours, Fake News Slaughter Poultry Industry; Rs. 22,500 Crore Lost; 5 Crore Jobs at Stake. SME FUTURES. Available online: <https://www.smefutures.com/COVID-19-rumours-fake-news-slaughterpoultry-industry-rs-22-500-crore-lost-5-crore-jobs-at-stake> (accessed on 27 May 2021).
- Bloomberg. Indian Poultry Sales Drop on Virus Rumours Spread by Social Media. Available online: <https://www.bloomberg.com/news/articles/2020-02-27/rumors-of-avian-links-to-coronavirus-hit-poultry-sales-in-india> (accessed on 28 May 2021).
- Kolluri, G.; Tyagi, J.S.; Sasidhar, P.V.K. Research Note: Indian poultry industry vis-à-vis coronavirus disease 2019: A situation analysis report. *Poult. Sci.* **2014**, *100*, 100828. [CrossRef] [PubMed]
- World Organization for Animal Health. Follow-Up Report No.: 4. Available online: https://web.oie.int/wahis/reports/en_fup_0000011948_20120517_105552.pdf (accessed on 20 May 2021).
- Mohan, U.; Viswanadham, N.; Trikha, P. Impact of avian influenza in the Indian poultry industry: A supply chain risk perspective. *Int. J. Logist. Syst. Manag.* **2009**, *5*, 89. [CrossRef]
- Hennessey, M.; Fournié, G.; Hoque, A.; Biswas, P.K.; Alarcon, P.; Ebata, A.; Mahmud, R.; Hasan, M.; Barnett, T. Intensification of fragility: Poultry production and distribution in Bangladesh and its implications for disease risk. *Prev. Vet. Med.* **2021**, *191*, 105367. [CrossRef] [PubMed]
- Campbell, S.; Greenwood, M.; Prior, S.; Shearer, T.; Walkem, K.; Young, S.; Bywaters, D.; Walker, K. Purposive sampling: Complex or simple? Research case examples. *J. Res. Nurs.* **2020**, *25*, 652–661. [CrossRef] [PubMed]
- Etikan, I.; Alkassim, R.; Abubakar, S. Comparison of Snowball Sampling and Sequential Sampling Technique. *Biom. Biostat. Int. J.* **2015**, *3*, 55. [CrossRef]
- Patton, M.Q. *Qualitative Research and Evaluation Methods*, 3rd ed.; Sage: Thousand Oaks, CA, USA, 2014.
- Suri, H. Purposeful Sampling in Qualitative Research Synthesis. *Qual. Res. J.* **2011**, *11*, 63–75. [CrossRef]
- Green, J.; Thorogood, N. *Qualitative Methods for Health Research*, 3rd ed.; SAGE: London, UK, 2014.
- Given, L.M. *The SAGE Encyclopedia of Qualitative Research Methods (Vols. 1-0)*; SAGE: Thousand Oaks, CA, USA, 2008.
- Smith, J.A.; Flowers, P.; Larkin, M. *Interpretative Phenomenological Analysis*; Sage: London, UK, 2019.
- Douglas, E.P. Beyond the interpretive: Finding meaning in qualitative data. In Proceedings of the ASEE Conferences, Columbus, OH, USA, 15 June 2019. [CrossRef]
- Ose, S.O. Using Excel and Word to Structure Qualitative Data. *J. Appl. Soc. Sci.* **2016**, *10*, 147–162. [CrossRef]
- Pietkiewicz, I.; Smith, J.A. A practical guide to using Interpretative Phenomenological Analysis in qualitative research psychology. *Psychol. J.* **2012**, *18*, 361–369.
- Rates and Directory: Poultry Bazar. Broiler Rates Gujarat. Available online: <https://www.poultrybazaar.net/daily-rate-sheet/Broiler-Rates-Gujarat/> (accessed on 13 June 2023).
- Rates and Directory: Poultry Bazar. Egg Rates (General). Available online: <https://www.poultrybazaar.net/daily-rate-sheet/Egg-Rates-General/> (accessed on 13 June 2023).
- Suarez, D.L.; Pantin-Jackwood, M.J.; Swayne, D.E.; Lee, S.A.; DeBlois, S.M.; Spackman, E. Lack of Susceptibility to SARS-CoV-2 and MERS-CoV in Poultry. *Emerg. Infect. Dis.* **2020**, *26*, 3074–3076. [CrossRef] [PubMed]
- Palouj, M.; Adaryani, R.L.; Alambeigi, A.; Movarej, M.; Sis, Y.S. Surveying the impact of the coronavirus (COVID-19) on the poultry supply chain: A mixed methods study. *Food Control* **2012**, *126*, 108084. [CrossRef] [PubMed]

25. Chapot, L.; Whatford, L.; Compston, P.; Tak, M.; Cuevas, S.; Garza, M.; Bennani, H.; Bin Aslam, H.; Hennessey, M.; Limon, G.; et al. A Global Media Analysis of the Impact of the COVID-19 Pandemic on Chicken Meat Food Systems: Key Vulnerabilities and Opportunities for Building Resilience. *Sustainability* **2021**, *13*, 9435. [CrossRef]
26. Al Sattar, A.; Mahmud, R.; Mohsin, A.S.; Chisty, N.N.; Uddin, H.; Irin, N.; Barnett, T.; Fournie, G.; Houghton, E.; Hoque, A. COVID-19 Impact on Poultry Production and Distribution Networks in Bangladesh. *Front. Sustain. Food Syst.* **2021**, *5*, 714649. [CrossRef]
27. Zaime, Z.; Ouahi, I. Impact of COVID-19 on the Poultry Sector in Morocco: An Empirical Analysis. *IBIMA Bus. Rev.* **2023**, *2023*, 963486. [CrossRef]
28. International Food Policy Research Institute. Impacts of COVID-19 on Myanmar's Poultry Sector: Implications for Achieving the Sustainable Development. Available online: <https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/134080/filename/134292.pdf> (accessed on 13 June 2023).
29. WATTPOULTRY. How Coronavirus Is Affecting China's Poultry Industry. Available online: <https://www.wattagnet.com/regions/china/article/15530478/how-coronavirus-is-affecting-chinas-poultry-industry-wattagnet> (accessed on 13 June 2023).
30. Akure, C.O.; Vantsawa, P.A.; Balogun SO Omodona, S.; Emeghara, U.U.; Olafemi, S.O. Impact of COVID-19 and associated lockdown on livestock and poultry sector in Nigeria. *Niger. J. Anim. Prod.* **2021**, *48*, 121–128. [CrossRef]
31. Biswal, J.; Vijayalakshmy, K.; Rahman, H. Impact of COVID-19 and associated lockdown on livestock and poultry sectors in India. *Vet. World* **2020**, *13*, 1928–1933. [CrossRef] [PubMed]
32. Hafez, H.M.; Attia, Y.A. Challenges to the Poultry Industry: Current Perspectives and Strategic Future After the COVID-19 Outbreak. *Front. Vet. Sci.* **2020**, *7*, 516. [CrossRef] [PubMed]
33. Asian Development Bank. ADB, Suguna Sign \$15 Million Deal to Sustain Rural Livelihoods in India during Pandemic. Available online: <https://www.adb.org/news/adb-suguna-sign-15-million-deal-sustain-rural-livelihoods-india-during-pandemic> (accessed on 20 May 2021).
34. Singh, R. Small Scale Commercial Broiler Farming for Production of Meat. Available online: <https://www.pashudhanpraharee.com/small-scale-commercial-broiler-farming-for-production-of-meat/> (accessed on 14 June 2023).
35. Dev, S.M. COVID-19 and global food security. In *Addressing COVID-19 Impacts on Agriculture, Food Security, and Livelihoods in India*; International Food Policy Research Institute (IFPRI): New Delhi, India, 2020.
36. Singh, S.; Kumar, R.; Panchal, R.; Tiwari, M.K. Impact of COVID-19 on logistics systems and disruptions in food supply chain. *Int. J. Prod. Res.* **2020**, *59*, 1993–2008. [CrossRef]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.