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Impact of Covid 19 Outbreak on Livestock Production: A Review

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ABSTRACT

For centuries, disease outbreak has posed a threat to livestock production. Corona virus disease, also known as COVID-19 is a novel disease that brought with it economic havoc and affected the livestock industry adversely. Animal Production and processing plants were heavily affected as a result of difficulty buying production inputs such as feed for animals, transportation of live animals including inter border crossing restrictions, assess to professional care, reduced workforce and decrease in supply of meat and meat products to the market. With the pandemic, importation and exportation of animals and livestock products were affected. There was reduction in the number of animals slaughtered daily and also a reduction in processing plant capacity across all species. Majority of workers in the livestock industry were infected with corona virus, which resulted to financial instability, loss of jobs as well as loss of animals. Better policies to reduce the economic loss through partial or full opening of both intra and interstate borders, providing funds to farmers, opening up processing plants and slaughtering houses will aid in cushioning the effects of the COVID-19 pandemic on the livestock industry.

Key words: Animal, Corona virus, Disease, Pandemic.

Corona virus also known as COVID-19 is an infectious disease caused by a novel corona virus called severe acute respiratory syndrome corona virus 2 (SARS-CoV-2; initially called 2019-nCoV), identified firstly in Wuhan city, Hubei Province in China (NCIRD, 2020) as a respiratory illness called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; formerly called 2019-nCoV). The first human case of Covid-19 was reported in December 1, 2019 and reported to World Health Organisation (WHO) on 31st December, 2019, by January 31, WHO declared Covid-19 a Pandemic (PAHO, 2020; Ramzy and McNiel, 2020). According to clinicians, the disease is suspected to be caused by a virus- induced pneumonia due to its clinical symptoms and other criteria such as high fever, decrease in the number of lymphocytes and white blood cells (though sometimes normal), pulmonary infiltrates on the chest and no obvious improvement with antibiotics for three days (Zhou *et al.,* 2020). About 213 countries and territories have been infected globally (Mansi, 2021) with over 50 million death cases have been recorded (CDC, 2020). It is said to be a zoonotic virus, bats serving as carriers (Mansi, 2021). It is a contagious disease as it is being spread from person to person through respiratory droplets, close contacts with persons, surfaces or objects tainted by the virus (Ramesh *et al.,* 2020).

Restrictions in travel and halt in trade were introduced by countries to limit the spread of the virus and subsequently, major economic sectors such as tourisms, entertainment, sports and the agricultural sectors were adversely affected. Agricultural sector which serves as a backbone to food security, source of livelihood and nutrition was threatened globally by Covid-19 (Senthilvelan and Sugantha, 2023: Goel *et al.,* 2021. Movement restrictions and lockdown policies by the government affected local and national food production heavily as farmers could not access their farms leading to inadequate/unavailability of raw food items because cultivation and harvesting of food was reduced. Lockdown interstate closure of borders affected movement of food products from farms and local companies to the market (Gulsia, 2024).

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Origin and spread of COVID 19

COVID 19 has been reported to have originated from animals. Bats are known as the natural hosts of Alpha (α) and Beta (β) coronavirus, while livestock such as; pigs, chicken and cows are the natural hosts of Gamma (γ) and Delta (δ) coronavirus (Velavan *et al.,* 2020). The mutation ability of the coronaviruses upsurges their rate of

transmission from animals to humans (Woo *et al.,* 2009). The first reported case in Wuhan was linked with the Hunan seafood wholesale market (Zhu *et al.,* 2020), were live animals such as bats, poultry, snakes, frogs, rabbits, marmots and hedgehogs are traded for human consumption which resulted to zoonotic infections from animals to humans (Malik *et al.,* 2020). Thus, the COVID-19 pandemic was widely spread among humans and certain species of animals were infected through close interaction with infected humans (Mahdy, 2020). Clinical symptoms such as fever, cough, shortness of breath, bloody diarrhoea, high mortality among others have been reported for humans (Pazhanivel, 2023: Groth, 2020) and livestock animals (Burimuah *et al.,* 2020.). Similarly, cats were reported as the most susceptible species for the COVID-19 pandemic among all the animal species (OIE, 2020).

Impact of Coronavirus pandemic on livestock and poultry

Bovine coronavirus (BCoV) affects cattle, sheep, goat, buffalo, llamas, alpacas (Table 1) and can cause respiratory distress in this ruminants (Decaro *et al.,* 2008a). Similarly, bubaline coronavirus (BuCoV) affects water buffalo, alpaca coronavirus (ACoV) affects alpaca while dromedary camel coronavirus (DcCoV) and MERS-CoV both affect the camel (Cebra *et al.,* 2003; Decaro *et al.,* 2008b; Sabir *et al.,* 2016). In addition, MERS-CoV causes infections in respiratory tracts of camels. The seroprevalence of MERS-CoV in dromedaries was reported to be more than 90% in different countries in Africa, Asia and the Middle East (Hemida *et al.,* 2017). There is not enough evidence to suggest that cattle might have played any significant role in the COVID-19 pandemic. Ulrich *et al.* (2020) reported low susceptibility of cattle to SARS-CoV-2 infection due to low expression of ACE2 in the respiratory tracts of these ruminants (Zhai *et al.,* 2020). However, close contact of infected humans with large number of cattle may still lead to anthropozoonotic infections in cattle.

Coronaviruses infections in poultry have been reported to cause enteric, respiratory and kidney disease (Rahimi *et al.,* 2022). Different types of coronavirus has been discovered such as Turkey coronavirus (TCoV) (Panigrahy *et al.,* 1973), Quail coronavirus (QCoV) (Pascucci *et al.,* 1983), Guineafowl coronavirus (GfCoV) (Ito *et al.,* 1991) and Pheasant coronavirus (PhCoV) (Spackman and Cameron, 1983). Furthermore, Infectious bronchitis in a poultry viral disease, genus Gammacoronavirus and family Coronaviridae. It is a prominent respiratory disease of poultry which affects the lungs, kidneys and the reproductive tract and causes great economic losses such as kidney damage, decrease in egg production and poor egg quality to farmers

Table 1: Coronavirus strains and symptoms in various animals.

Virus symptoms (CoVs)	Genus	Host	Symptoms	Reference
Infectious Bronchitis Virus (IBV)	Gamma coronavirus	Avian/Poultry	Respiratory illness, urinary tract infection, reproductive disturbances	Rodriguez-Morales *et al.,* 2020; Burimuah *et al.,* 2020.
Bovine coronavirus (BCoV)	Beta coronavirus	Bovine species (cattle) horses and camels	Bloody diarrhoea, respiratory form of shipping fever, high mortality	Rodriguez-Morales *et al.,* 2020; Burimuah *et al.,* 2020
Severe acute respiratory syndrome coronavirus -2 (SAS-CoV-2)	Beta coronavirus	Humans, rodents, civets, cats, pangolins, mink, dogs and cats	Fever, dry cough, tiredness, shortness of breath, sore throat, headache, diarrhoea and vomiting	Zhang *et al.,* 2020; Shi *et al.,* 2020
Swine enteric CoVs: Transmissible gastroenteritis	Alpha coronavirus	Swine	Diarrhoea, vomiting, rapid weight loss, high mortality (young Pigs)	Tiwari *et al.,* 2020.
Swine enteric CoVs: Porcine epidemic diarrhoea virus (PEDV)	Alpha coronavirus	Swine	Same TGEV symptoms but with lower spreading and mortality rates	Burimuah *et al.,* 2020.
Mouse hepatitis (MHV)	Beta coronavirus	Mice, ferrets and cats	Respiratory illness, neurotropic symptoms, damages in vascular endothelium, hemopoietic tissue and liver	Malik *et al.,* 2020

(Najimudeen *et al.,* 2020). This disease equally spreads very fast and rapidly such that within a short period, the entire flock can be infected and the flock remains as a reservoir, even after recovery. The infection can spread from hen to hen and also transmitted through contaminated eggshells in the hatcheries (Roberts *et al.,* 2011). Even though chickens are not known to be infected with SARS-CoV-2 through the intranasal route, COVID-19 outbreak still causes great economic losses in the poultry industry (Hafez and Attia, 2020).

Covid-19 implications on animal production

The COVID-19 pandemic created economic havoc and also impacted directly on global food systems through altering the demand- supply chain and indirectly on the purchasing power, food distribution and marketing, as well as increased health care task (Bahadur *et al.,* 2020). Every country around the world took precautionary steps to curb the pandemic especially using non- pharmaceutical approach such as social distancing, use of face mask and hand sanitizers spread and self-isolation if need be (Mansi, 2021). In all these measures, movement restriction policies were introduced to curb rate of infection. This measures resulted to decrease in food supply and invariably created a hike in food prices, unavailability of labour for farming activities thereby halting operational activities in agricultural production houses (Ejeromedoghene *et al.,* 2020).

Livestock farming promotes economic alterations by improving human and financial capital creating employment, making available various goods and services (Bekuma, 2020). Animal production is being faced with issues affecting production such as threats from emerging zoonosis diseases from wild life especially in areas high in wildlife biodiversity and occurring change in land use (Allen *et al.,* 2017), climate change, food security and safety (Marchant-Forde, 2015) and antimicrobials use and resistance (Chantziaras *et al.,* 2014). With this pandemic, importation and exportation of animals and livestock products were affected. Production of meat and meat products decreased while demand increase due to the initial panic (Table 2) buying but later on, when the government imposed lockdown, both meat production and consumers purchasing power also decreased thus leading to decrease in meat prices (Ijaz *et al.,* 2021).

Production and processing plants were heavily affected as a result of difficulty in buying inputs such as animal feed, transportation of livestock including inter border crossing restrictions, assess to professional care, reduced workforce and a reduction in supply of meat and meat products to the market (ILO, 2020; IPC, 2020; USDA, 2016). Investigations on Spanish small ruminant flock production by Vidaurreta *et al.* (2020) observed a decrease of 25.9% and 28.5% in slaughtering of lambs and goats respectively in April 2020 when likened to the data from April 2019. In Kuwait, loss in sales for live birds were 100%, frozen birds were 75% and 100% for table eggs during full lockdown. 60%, 40% and 40% were reduced respectively for the sales for live birds, frozen birds and table eggs by during partial lockdown (Al-Khalaifah *et al.,* 2020). In international market price, sharp drop was reported for ovine and poultry meat, pork and beef (FAO, 2020b; Pal, 2020; Phelps, 2020). The United States experienced 45% reduction in pig processing capacity. The implication is that 250,000 pigs were not slaughtered daily, resulting to overcrowding of the farms (Marchant-Forde and Boyle, 2020). There are methods in which animals are slaughtered (Berg, 2012) but since the outbreak of covid-19, those methods have not been in used because of reduction in processing plant (Fig 1) capacity across all species (Marchant-Forde and Boyle, 2020). There is little handling and use of killing method that either causes instant death, or sedation, stunning, unconsciousness followed by death (Berg, 2012). Though these methods are difficult to achieve when the population are much. The best method of killing poultry in this critical time is by foam method (Marchant-Forde and Boyle, 2020).

Impacts of COVID-19 on animal feed supply chain

The COVID 19 pandemic-triggered lockdown caused a drastic negative effect in the livestock industry by interrupting the regular patterns of production, supply and consumption of animal feed and raw materials supply chain (Guan *et al.,* 2020). International restrictions in exports and imports of animals' feeds hampered the supply of several

Table 2: World meat production trade and percentage year on year (Y-O-Y) change (million tons).

	2018	2019	2020	Y-O-Y (%)
Production	342.2	338.9	333.0	-1.7
Bovine meat	71.5	72.6	72.0	-0.8
Poultry meat	127.3	133.6	136.8	2.4
Pig meat	120.9	109.8	101.0	8.0
Ovine	15.8	16.0	16.2	0.9
Trade	33.8	36.1	37	2.4
Bovine	10.5	11.2	11.1	-1.0
Poultry meat	13.5	13.9	13.8	0.3
Pig meat	8.4	9.5	10.6	11.2
Ovine	1.0	1.0	1.0	-2.9

Source:(FAO, 2020a)

basic raw ingredients that are important for raising and managing livestock (Deeh *et al.,* 2020). Countries like Argentina in order to cope with the pandemic reduced its exports of soybean into the feed manufacturing factories by half, while Brazil and U.S. also met with serious challenges in their soymeal and corn exports (Hashem *et al.,* 2020; Seleiman *et al.,* 2020). In Pakistan, dairy farms were faced with shortage of dry feed for their flock. In Africa, local restrictions affected pastoralists as they were unable to graze their animals (FAO, 2020c). These restrictions equally led to increased costs of animal feed materials for example, Uddin *et al.* (2021) reported a 3.7% hike in dairy feed price In Bangladesh, while India and many regions in Africa, experienced up to 15% hike in the prices of key animal feed ingredients as a result of COVID-19 pandemic.

Furthermore, industries involved in production and supply of vaccines, animal health products and feed additives to small-scale livestock producers have specified that the reductions in foreign exchange have significantly affected the sustainability of the livestock supply chain, especially in developing countries (AGRILINKs, 2020).

Implications on animal workers

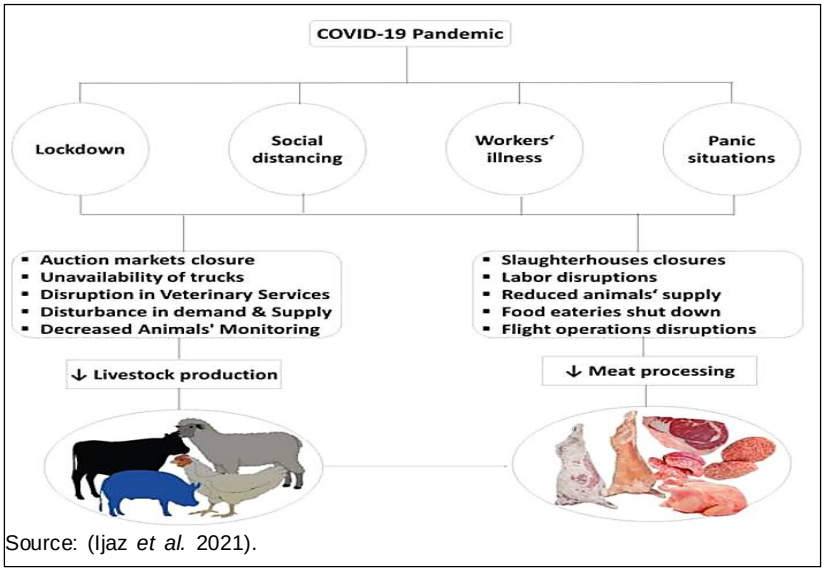
The welfare of animal workers is very vital in animal production system. The disease affected not only the physical health of workers in the farm but also the mental wellbeing was also affected. More than 1500 workers in the largest meat processing plants were infected with corona virus in Germany (Connolly, 2020). United States recorded 39,000 meat packaging workers infected with covid-19 in at least 417 plants across 40 states, 184 were reported dead in at least 50 plants in 27 states (Chadde, 2020). Workers were faced with financial instability, loss of animals as well as loss job as a result of lock down, some meat processing plants were working but with fewer staff thereby increasing the work load of available staff and this could likely lead to high risk of injury among workers (Marchant-Forde and Boyle, 2020). Gases such as hydrogen sulphides, ammonia, particulate matter and bacteria found in abundance around pig and poultry farms predisposes workers to diseases such as (Wilson and Serre, 2007) eye and respiratory irritants among workers, (Thorne, 2007), asthma and other respiratory disease (Schultz *et al.,* 2019), mental stress (Horton *et al.,* 2009) and elevated blood pressure (Wing *et al.,* 2013) leading to greater threat of grave complications which might result to death when infected with covid-19 (USDA, 2020).

Covid-19 effect on animal wellbeing

The closure of slaughtering and meat processing plants resulted to overcrowding of the animals which in turn affects the welfare and psychology of the animal and also causes mental stress. Overcrowding in animal can result to poor walking ability, bad leg health, increase in fretfulness, footpad and hock dermatitis as well as mortality (Berg *et al.,* 2012). Marchant-Forde and Boyle (2020) reported that heat produced from animals due to overcrowding can lead to poorer quality in air and litter or bedding material in the animal house. In pigs, overcrowding can lead to restlessness, increased aggression, skin lesions, body injuries, disease infestation, impaired growth and physiological function (EFSA, 2005) leading to increase in the use of antibiotics, which in turn exposes the animals to the risk of antimicrobials resistance (Marchant-Forde and Boyle, 2020). All these effects can lead to poor quality products in animals.

Change in livestock marketing due to Covid-19

The stopping of movement resulted in the shortfall of closures of dairy food outlets and restaurants, as well as the prohibition of all types of social and cultural activities.



Source: (Ijaz *et al.* 2021).

Fig 1: Impact of Covid-19 on meat production and supply chain.

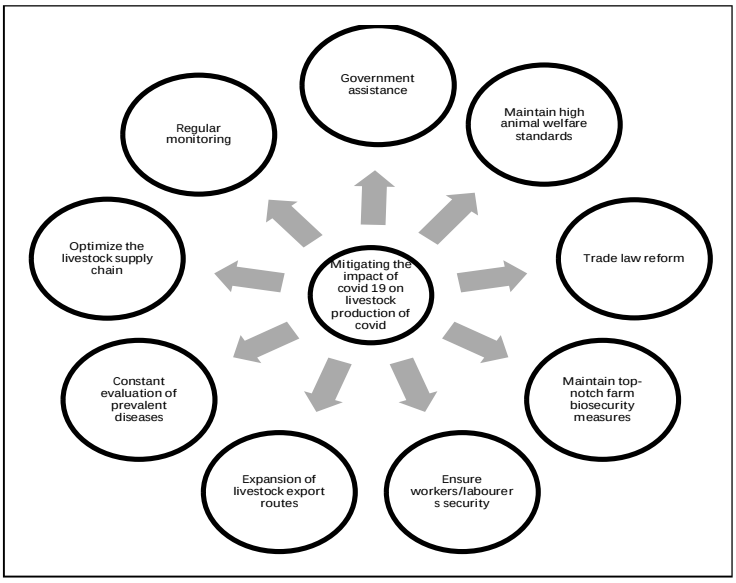


Fig 2: Measures to mitigating the impact of COVID 19 on livestock production.

Farmers were forced to discover alternate means of sales and distributions such as the use of online platforms and direct marketing (Darnhofer, 2020). together with farmers market, This method brought about increased economic gains to the farmer, high quality food at affordable prices to the consumer (Holden, 2020) and healthier meals as consumption of homemade meals increased (Cranfield, 2020). A diet rich in unprocessed plant-based food will be more beneficial and would impact human, animal and environmental welfare thereby increasing the sustainability of food production and consumption (Sáez-Almendros *et al.,* 2013).

Implication of Covid-19 on the processing and export of livestock products

The impact of Covid-19 on the processing and export of livestock products has been significant, affecting various aspects of the livestock industry globally. Because of the epidemic, the meat sector experienced negative impacts, including limits on import and export, interruptions in the market and a lack of available labour in processing factories in the first place. A number of different sectors of the food production chain, particularly agriculture and livestock, were seriously impacted in terms of the economic losses and the sustainability of production. Amidst the outbreak and spread of COVID-19 pandemic, different kind of transportation routine was restricted from any corner of the globe consequently livestock import- export chain was disrupted (Chimde, 2020; Nzeyimana *et al.,* 2022). When processing plants were shut down, movement limitations were implemented and quarantine protocols were implemented, the outcome was scarcity of labour, which had an effect on animal production sectors such as processing, transportation, sales and consuming behaviour (Rahman *et al.,* 2022). This led the global farming systems into a state of crisis which in turn affected the production of livestock, human livelihoods, food supply chains and the economy of the entire world adversely.

Mitigating the impact of COVID I9 on Livestock production

The COVID 19 pandemic had adverse effects on livestock companies and farmers all over the world by decreasing the size of the available farm workers, closing processing plants, reducing the capacity of processing and creating difficulties for slaughtering and processing livestock for consumption (Chen and Yang, 2021). There is need for livestock producers, animal healthcare professionals, human healthcare professionals, livestock companies, governmental and non-governmental agencies to join forces during and before any future pandemics that may impact global health (Rahimi *et al.,* 2022). Animal producers should take the essential preventive measures to alleviate and mitigate the COVID-19-triggered crisis in animals and animal production as shown in Fig 2 (Sharma and Sinha 2020).

CONCLUSION

The animal industry was adversely affected at the peak of covid-19 outbreak, in that effect, government sought for better policies to reduce the economic loss through partial/ full opening of both intra and interstate borders, providing funds to the farmers to cushion the loss, opening up of processing plants and slaughtering houses.

Conflict of Interest

The authors declared no conflicts of interest with respect to the research, authorship and publication of this article.

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