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# Climatic Vagary and COVID-19 Pandemic: Influence on Livestock Production and Household Performance in South Western Nigeria

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**Abstract**

*This research was aimed at investigating the recent climatic vagary on livestock production and household performance with the subsequent effect of COVID -19 pandemic in the South-Western Nigeria. Online survey was employed using a structured questionnaire as the test instrument. A total of 100 respondents was examined on how the recent climate change affect household performance, food consumption, farming (livestock production) with associated effects of COVID -19 pandemic. Data generated were subjected to descriptive statistics. Results depicted that 95.1% of respondents had tertiary education, 68.2% and 50.0% were male and self-employed, respectively. Majority (98.8%) of the respondents were aware of the recent effect of climate change on livestock and 77.9% had been victims of it. About 56.5% kept livestock under intensive system. It was observed that 90.7% confirmed severe effect of climate change on availability of feed and the price. About 43.5% and 32.1% indicated that recent climate change had severe effects on level of production and mortality respectively. Report on household performance showed that 61.6% engaged in farming, in which livestock was 33.3% and mixed farming was 38.6%. Severity of the effect of climate change was confirmed by 80% of the respondents with subsequent effect on price of food commodity (94%), with family level of production (78.8%) and cost of production (90.5%). Pandemic decreased effect on the purchasing power of respondents (54.7%) which equally affected the family food intake as confirmed by 73.6% and consequently affected the family protein consumption. It was observed that salary alone will not be enough to cope with future effect of pandemic but farming and side businesses are of vital values. These findings necessitate the adoption of agricultural production in every household to limit the effect of climatic change and financial crises posed by the pandemic. Conclusively, to curb the negative effect of climate change cum COVID-19 pandemic, agricultural practices should be encouraged among the youths and females to abate the impending food insecurity. Also, the rural agriculture should be encouraged through various agricultural aids to spur farmers' interest and boost their production potentials.*

**Keywords:** Climate change, livestock and agricultural production, household performance, feed and feeding and COVID-19 pandemic

# Vagary climatique et pandémie de COVID-19: influence sur la production animale et la performance des ménages dans le sud-ouest du Nigéria

**Résumé**

*Cette recherche visait à enquêter sur les récents aléas climatiques sur la production animale et les performances des ménages avec l'effet consécutif de la pandémie COVID -19 dans le sud-ouest du Nigéria. L'enquête en ligne a été utilisée en utilisant un questionnaire structuré comme instrument de test. Un total de 100 répondants a été examiné sur la façon dont le récent changement climatique affecte les performances des ménages, la consommation alimentaire, l'agriculture (production animale) avec les effets associés de la pandémie COVID -19. Les données générées ont été soumises à des statistiques descriptives. Les*

*résultats ont montré que 95,1% des personnes interrogées avaient fait des études supérieures, 68,2% et 50,0% étaient des hommes et des travailleurs indépendants, respectivement. La majorité (98,8%) des répondants étaient au courant de l'effet récent du changement climatique sur le bétail et 77,9% en avaient été victimes. Environ 56,5% ont gardé le bétail dans un système intensif. Il a été observé que 90,7% confirmaient un effet grave du changement climatique sur la disponibilité des aliments pour animaux et le prix. Environ 43,5% et 32,1% ont indiqué que les changements climatiques récents ont eu des effets graves sur le niveau de production et la mortalité respectivement. Le rapport sur la performance des ménages a montré que 61,6% étaient engagés dans l'agriculture, dans laquelle le bétail était de 33,3% et l'agriculture mixte était de 38,6%. La gravité de l'effet du changement climatique a été confirmée par 80% des répondants avec un effet ultérieur sur le prix des denrées alimentaires (94%), avec le niveau de production familial (78,8%) et le coût de production (90,5%). La pandémie a diminué l'effet sur le pouvoir d'achat des répondants (54,7%), ce qui a également affecté l'apport alimentaire de la famille comme le confirme 73,6% et a par conséquent affecté la consommation de protéines de la famille. Il a été observé que le salaire à lui seul ne suffira pas pour faire face aux effets futurs de la pandémie, mais l'agriculture et les activités annexes sont des valeurs vitales. Ces constats nécessitent l'adoption de la production agricole dans chaque ménage pour limiter les effets du changement climatique et des crises financières posés par la pandémie. En conclusion, pour freiner l'effet négatif du changement climatique et de la pandémie de COVID-19, les pratiques agricoles devraient être encouragées chez les jeunes et les femmes afin de réduire l'insécurité alimentaire imminente. En outre, l'agriculture rurale devrait être encouragée par diverses aides agricoles pour stimuler l'intérêt des agriculteurs et accroître leur potentiel de production.*

**Mots clés:** Changement climatique, bétail et production agricole, performance des ménages, alimentation animale et pandémie COVID-19

## Introduction

Climate has been the most important determinant of cropping seasons in non-irrigated farming system, and availability of some food/feedstuff for both man and animals. The greenhouse effect further worsens the situation thereby disrupting the normal known seasons through protracted dry period accompanied with increased temperature and excessive rainfall with accompanying flooding (Midgley *et al*., 2005; Ribot *et al*., 1996). In some places, the temperature extremes lead to heat stress which affects both crop performance and livestock productivity, while in some region the extended winter/coldest season leads to cold stress (Nardone *et al*., 2013; Rasoul *et al*., 2011). In Nigeria, the flooding that follows excessive rainfall affect the food crops/plant yield by either washing away both seeds and seedlings or cause leaching of nutrients, hence, affecting the overall plant yield. The temperature extremes have both direct and indirect effects on crop yield as most of the seeds and seedlings are dry-off thereby reducing the plant population, stunted growth of the surviving plants as well as reduction in the overall plant productivity. In extreme temperature, pasture plants, especially grasses become lignified, thereby reducing the quantity and quality of the available grasses (Dumont *et al*., 2015). The temperature further impairs pattern of appearance of both beneficial (pollinating) insects and non-beneficial organisms (pest and locust) (Yihdego *et al*., 2019). Furthermore, high environmental temperature leads to heat and nutritional stress in domestic animals (He *et al., 2018*; Das *et al.,* 2016; Seijan *et al.,*2010;). The

nutritional stress leadsto reduced growth rate and delay in attainment of puberty thereby affecting the reproduction potentials (Pradhan and Nakagoshi, 2008) as well as lower the overall productivity of the affected animals; This is further exacerbated by the effect of heat stress which leads to disruption of immune system of the affected animals. The immune system is broken down through the actions of reactive oxygen and nitrogen species causing oxidative stress, thus, impairing the normal physiological functions of the animals (Rahal *et al.,* 2014). Consequently, climatic change through reduction in overall productivity of both plants and animals leads to food insecurity. Low yield from crop plants leads to competition between man animals for the available food/feedstuff, while the senescence pastures further worsen the situation through low productivity of livestock and other domestic animal species. Food insecurity sets in when the amount of food produced cannot meet the demands of growing population. This leads to food deficit, poor nutrition, malnutrition and subsequently food insecurity. With the recent COVID-19 pandemic, which resulted in the closure of most international borders and movement restrictions in some regions, further worsen the importation of food/feedstuff into low producing country like Nigeria. This research therefore seeks to identify the plurality effects of climate change and COVID-19 pandemic on livestock and food production as well as household performance in Nigeria.

## Methodology

### *Research instrument*

The instrument used in this research was a four-sectioned questionnaire. Section A of the questionnaire requested information on the demographic parameters of respondents; Section B sought to know the effect of climate change on livestock production; Section C focused on knowing the effect of climate change on household performance, food consumption and farming pattern while Section D sought to determine the effects of COVID-19 on household performance and food consumption.

### *Method of data collection and analysis*

The research method used for this study was online survey and the sample size pulled was 100 respondents. The main data collection technique was through structured questionnaire targeting livestock farmers in South Western Nigeria to obtain qualitative data on effect of climate change on livestock production, effect of climate change on household performance, food consumption and farming pattern as well as the effects of COVID-19 on household performance and food consumption. The method of distribution of questionnaire was through online Google form link (https://forms.gle/PBkgDcqnSFKTWgMQ6). Data generated were subjected to descriptive statistics using SPSS (2016) statistical software.

## Results and discussion

### *Demographic parameters*

About 95.1% of the respondents were educated farmers possessing tertiary education, 2.6% has no formal education, 2.3% of the respondents did not disclose their educational status while none of the respondents claimed to have primary and secondary education as their highest level of educational attainment (Figure 1). The highest number of learned individuals observed can be attributed to the mode of administration of questionnaire which is online. The 2.6% respondents with no formal education might have access the questionnaire through their wards that are educated. Sixty-five-point nine percent of the respondents (65.9%) were married, 33.0% were single, while 1.1% did not disclose their marital status. None of the

respondents were divorced and widowed (Figure 2). About 68.2% of the respondents were male and 30.7% were female while 1.1% did not disclose their sex. High number of male involvement justifies the reported major roles of men/male in Agricultural production. FAO (2010) stated that agriculture is underperforming because women do not have equal access to opportunities and resources needed to contribute more to food production. This showed that sustainable food production cannot be attained with less involvement of women in livestock and agricultural activities. Half (50.0%) of the total number of respondents were self-employed, 38.6% were civil servants, 10.2% were unemployed while 1.1% were silent on their employment status. (Figure 3). From the foregoing, livestock production in particular and agriculture generally seems to be providing succor both for the unemployed, employed and under-employed populations in the research area. About 39.8% of the respondents had less than 5years of farming experience, 34.1% had 10years of experience, 13.6% had between 11- and 20-years farming experience while 5.7% did not disclose their farming experience. This result showed that a higher proportion of the respondents are recent entrants into the agricultural activities especially in the last 5 – 10 years. This implies that government efforts in returning to livestock production and agriculture through the agricultural transformation agenda and more recently, agricultural promotion policy, are yielding positive results.

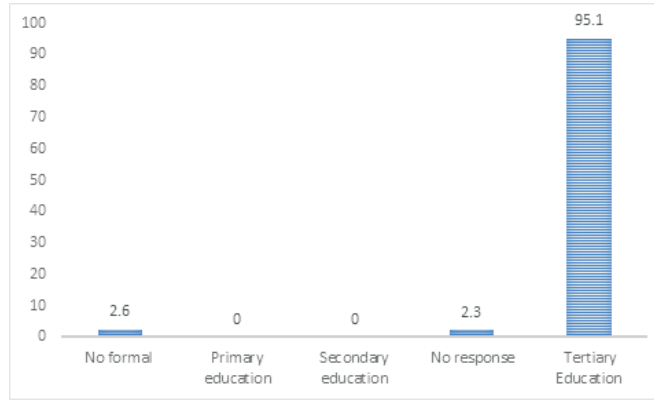


**Figure 1. Academic status of respondent**

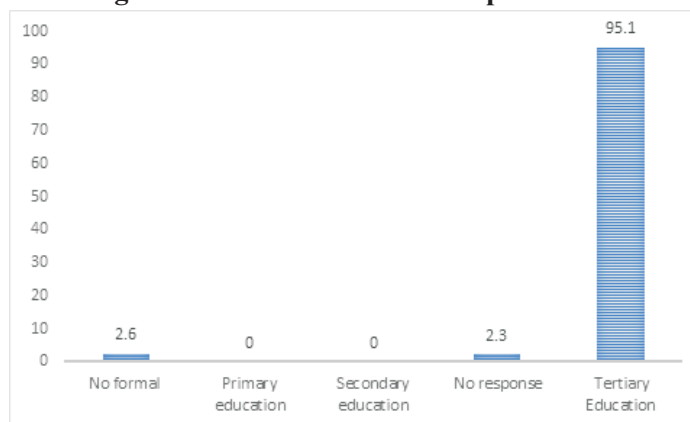


**Figure 2: Marital status of respondent**

***Climate change and livestock production***

Majority (98.8%) of the respondents were aware of the recent trends of climatic changes and its associated effects on livestock production (Table 1) because they would have had the knowledge about the recent climatic change through weather forecast on mobile phones, social media interactions, electronic media agricultural extension activities, personal reading of news items and possibly based of their years of experience in livestock production activities. As documented in this study more than half of the respondents had farming experience of 1 – 10 years. This corroborated the report of Ado *et al*. (2019) which stated that84.4% of sampled respondents were aware of detrimental effect of weather changes in their climate awareness research. In addition, Ajayi (2014) documented that farmers at some point in their farming years had access to media mostly radio as source of awareness of events related to them. Results by Shukla et al. (2016); and Mandleni and Anim (2011) further corroborated the results of this present study where they depicted that 85% of their respondent were aware of weather changes over time. Climatic change phenomenon has been a bar to favorable livestock and agricultural production in Africa, and this is further worsened by the recent increase in temperature and excessive rainfall (Dumont *et al*., 2015). This justifies the reported seventy-seven-point nine percent (77.9%) of the respondents that had experienced an outbreak of disease either due to heat or cold stress. In poultry production the heat stress has been the most limiting factor to optimum growth and productivity as it affects the immune function of this class of animals thereby affecting their overall performance. Monogastric animals (chickens) were kept in large numbers (59.5%) compared to other livestock, with ruminant animal production taking about 15.5% and fisheries 4.8% among the respondents. Most of the respondents employed intensive system (56.5%) Only 2.4% keep their animals in extensive system while 10.6% employed semi-intensive system. Higher number of monogastric animals kept and the intensive production system employed further justify the reported heat stress experienced by the farmers. Consequently, high temperature extremes with high relative humidity are detrimental to both commercial crop and livestock production (Morrison 1983). Adopting intensive production system is premised on the pressure on livestock production to meet the increasing demand for animal protein consequent upon increasing population. Recent report (Rust, 2019) indicated that intensive livestock production is favoured compared to extensive method and that monogastric production (poultry and pig) would have more value than ruminant livestock production under the current climate change scenario. It was discovered that the fluctuation in climatic pattern greatly affect the availability of forage and other feed ingredients with attendant increase in price of feed and feed ingredients for the livestock as 96.5% of the respondents attested to it. The scarcity of feed resource supported the earlier report that during the period of temperature extremes, pasture plants, especially grasses are lignified, thereby reducing the quantity and quality of the available grasses (Dumont *et al*., 2015). During this period, the price of feed increased than expected as confirmed by 91.6% of the respondents which resulted in high cost of production as indicated by 90.7% of the respondents. About 54.4% (severe) and 20.3% (very severe) of the respondents attested that availability of feed and feed ingredients was negatively and severely affected by the weather pattern (Figure 4). The increase in price reported was occasion by the scarcity of feed

resource and an attempt by farmers to feed their animals at all cost compelled to buy feed at exorbitant prices. This is further exacerbated through the competition between man and animals for the scarce food/feed resource (Wilkinson and Lee, 2018). Polaski (2008) further stated that incidence of drought, high demand owing to increase in household income and government neglects in some developing countries are part of mixed factors affecting the price of feed resources in livestock production.

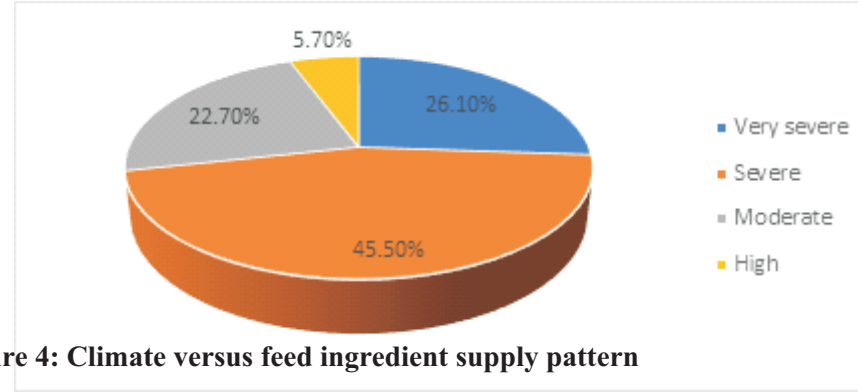


**Figure 4: Climate versus feed ingredient supply pattern**

For all classes of livestock, 42% of the respondents confirmed experiencing disease outbreak mostly during the dry season while 34.9% of the respondents documented that their experience of health challenges was at its peak during the wet season. Other respondents (20.5%) reported the case of health impairment during both wet and dry seasons. The proportion of respondents who agreed that climatic change occasionally affected their livestock performance was (51.8%) while 40% of the respondents confirmed that climatic change regularly affect the performance of their animals. The impact of weather has been reported to greatly affect agricultural production. In relation to livestock production, the direct effect of climate extremes includes reduced animal production efficiency, reproductive performance, milk yield and disruption in physiological performance, while the indirect effect of livestock are through reductions or non-availability of feed and water resources (Nardone *et al*.,2010). This further confirms the results of this study where the respondent reported that climatic change resulted in unavailability of feed. Inadequate nourishment of animals would predispose them to various health challenges, anorexia sets in, hence the animal would become emaciated. Consequently, the animal growth and reproductive performance will be greatly hindered. As confirmed by 79.1% of the respondents, feed has the highest influence on cost of production compare to health (15.1%) and housing management (2.3%). Feed/feeding was the major limiting factor to livestock production, taking about 70% of the cost of production. With the recent weather extremes and inadequate rainfall, there is the tendency that more livestock farmers would be affected as price of feed and feed ingredients continue to increase with possibility of some of the livestock farms shutting down. Various health challenges experienced by livestock farmers also impact on cost of production; research documented that it is not as high in terms feed cost value (Thornton, 2010; NRC, 2003). Most of the respondents (43.5%) established that the level of their animal productivity was severely affected by the recent climatic change while 38.8% of the respondents reported a mild effect of

climactic change on the level of animal productivity. Mortality rate was reported to be high by 32.1% of the respondents while 42.3% reported mild mortality rate as a result of climatic vagary. Further to this, ppastoralists and livestock farmers in tropical and sub-tropical Africa have related fluctuations in temperature and rainfall patterns with unavailability of feed sources, increased animal mortality and reduced herd or flock sizes (Liverpool-Tasie *et al*., 2019).

***Climatic change, household performance, food consumption and farming interest***

Of the 100 respondents, 61.6% were engaged in farming (Table 2). In order to boost household food production, there is need for several individuals to engage in farming activities be it crop or livestock production so as to increase the nutritional intake of the family. It was documented that the most rural dwellers cannot meet their nutrient requirements (FAO, 2020). This would further increase health challenges, reproductive failure and the incidence of child mortality in most rural community. The engagement of several farmers in farming would abate this food insecurity occasioned by the prevailing climatic changes (FAO, 2020). Thirty-three-point three percent (33.3%) of the respondents were involved in livestock production 28.1% in crop production while 38.6% of the respondents were involved in mixed farming. The variation in agricultural practices is dependent on farmers' location as occasioned by prevailing weather condition of certain environments. This would be further determined by interest and/or expertise of the farmers. About 80% of the respondents confirmed that the climatic change had severe effect on price of food commodities. Approximately 60% of the respondent confirmed that the increase in food prices had severe effects on the quantity and quality of food consumed. This is line with the previous reports (FAO, 1993; Zhu and Zhong2005) that established significant effect of food prices on family nutritional welfare, which invariably affect the quality and quantity of food consumption. Rise in price of food commodities can be linked to complex of mixed factors (Nardone *et al*., 2010). However, as the effect of climatic changes deepens, it would further disrupt the rainfall pattern with associated increased temperature in various zones. This would subsequently affect food/feed supply as earlier mentioned (Nardone *et al*., 2010; NRC 2003). Of all the produce obtained from family farm, 60% of the produce contributed to family feeding while 40% was offered for sale. Family level of production (78.8%) and cost of production (90.5%) were affected by the effect of climatic change.

***Household performance and food consumption as affected by COVID-19 pandemic***

Fifty-four-point seven percent (54.7%) of the respondents attested that family purchasing power decreased due to the effect of COVID-19 pandemic (Table 3). Some family head lost their well-paid jobs due to the new-normal working from home rule as occasioned by the pandemic. Loss of job or payable employment led to reduction in family income with attendant decrease in family purchasing power. This could be attributed to massive economic shock posed by the COVID -19 pandemic through business interruptions and shutdowns arising from social-distancing measures (Khan *et al*., 2019; Guddad and Terdal, 2020). Family food intake was negatively affected (73.6% of respondents) while 65.5% of the respondents indicated that the pandemic affected their animal protein intake which further negatively affected meeting the family nutritional requirements (67.8% of respondents). Very large proportion (82.6%) of the respondents affirmed that the pandemic negatively

**Table** 1: **Climatic Change and its associated effect on Livestock Production**

| Parameters | Monogastric | Ruminants | Fisheries | Others |
|---|---|---|---|---|
| Types of livestock kept | 59,50% | 15,50% | 4,80% | 20,20% |
| | Intensive | Semi-intensive | Backyard farming | Extensive |
| System of production employed | 56,50% | 10,60% | 25,90% | 2,40% |
| | Yes | No | | |
| Climate change vs cold or heat stress occurrence | 77,90% | 20,10% | | |
| climate change vs feed/food availability | 96,50% | 3,50% | | |
| climate change vs feed/food cost | 91,60% | 9,40% | | |
| climate change vs cost of production | 90,70% | 9,30% | | |
| | Dry season | Wet season | All of the above | None of the above |
| Climate vs disease invasion in livestock production | 42% | 35,20% | 20,50% | 2,30% |
| | Occasionally | Regularly | Never | Indifferent |
| Climate change vs performance of livestock | 51.8% | 40% | 4,60% | 3.6% |
| | High | Mild | No response | |
| Climate change vs mortality | 32,10% | 42.30% | | |

**Table 2: Climatic change versus household performance as depicted by the respondents**

| Parameters | Yes | No | |
|---|---|---|---|
| Household vs farming | 61.6% | 38.40% | |
| | Livestock | Crop | Mixed |
| Household vs Agricultural Production | 28.1% | 38.6% | 33.3 |
| | High | Low | |
| Climate change vs food prices | 80% | 20% | |
| | High | Low | |
| Prices vs food consumption | 60% | 40% | |
| | Consumption | Sales | |
| Household Production vs Use | 60% | 40% | |
| | High | Low | |
| Household vs Production level | 78.8% | 21.2% | |
| Household vs Production Cost | 90.5% | 9.5% | |

affected the family business and income. Effect of the pandemic on the prices of food commodities as stated by 98.9% of respondents indicated that the COVID-19 pandemic raised the prices of food commodities. This was the consequent effect of the pandemic and the accompanying restrictions which obstructed all stages of the food supply chain, including production, distribution, processing, and consumption (Siche, 2020, Torero, 2020), and damage of perishable agricultural commodities such as meat and vegetables (Nicola et al., 2020). Similar results were also documented by Kansiime *et al.* (2021) who reported change in household dietary patterns in response to the COVID-19 outbreak by consuming less diverse diets, skipping meals, and reducing portions of food consumed. The results

point to the detrimental impacts of the pandemic on household food and nutrition security. To minimize the effect of the pandemic on the family, about 49.4% of the respondents engaged in side businesses as a coping strategy during the pandemic while. 18.8%. 17.6% and 14.1% of the respondents, respectively depended on loans and gifts from families and friends as a coping strategy. To survive the effect of COVID-19 pandemic lockdown, 35.3% of the respondents depended on salary + side business, while 32.9% depended solely on business and 16.5% solely depended on salary. Others depended on farming (1.2%). spouses (1.2%). and pension (1.2%) amongst others as a way out of hunger. After the ease of pandemic lockdown, similar trend of survival was observed by the respondents with 44% of them depending on salary + side business, 39.3% only on business and 13.1% on salary alone. About 88.1% engaged in agricultural production to aid food sustainability during the pandemic. Of these, 32.9% engaged in backyard farming. 23.7% on livestock production. 22.4% on crop production and 21.1% engaged in mixed farming. With the COVID-19 pandemic causing delays in payments of wages and salaries as well as job losses, the results of this study show majority of the respondents involved in farming, side businesses as well as receiving gifts and taking loans as a means of coping with income loss as a result of the lockdown imposed by the pandemic. These findings are similar to those reported in Kenya and Uganda (Kansiime *et al*., 2021) where obtaining credit or in-kind support from family and friends and selling of assets were documented as coping strategies. The report further opined that savings/loans became an important resource for smoothing household consumption and that participating in savings groups was significantly associated with a reduction in the perceived effect of COVID-19 on income sources. Various studies have also found that households in Kenya and Uganda as well as other developing countries rely on similar coping strategies to buffer the effects of unexpected income shocks during pandemic (Amendah *et al*., 2014, Mawejje, 2019, Opiyo *et al*., 2015, Yilma *et al*., 2014). About 51.8% of respondents experienced low level of availability of feed/foodstuffs while about 48.2% had high availability of feed/foodstuffs. Eighty percent (80%) of respondents reported that transportation of feed/food items for both man and animals was negatively and highly affected by the pandemic lockdown while about 20% claimed low effect of transportation. This further affected the prices of commodities in the market with about 94.1% of respondents attesting to high prices of food commodities. About 47.1% of respondents predicted that the pandemic would l have a high negative effect on the availability of food/feedstuffs in the future while 52.9% predicted otherwise. About 56.5% also attested that the pandemic affected the quantity and quality of food consumed at home while 11.8% claimed otherwise. The reduced food/feed availability was based on the hardship posed by the pandemic through disruption of food supply, movement restriction, food spoilage among others (Nicola et al., 2020). On a general note, mmajor natural occurrences (disaster/pandemic) can or do have severe negative short-run economic impacts. They also appear to have adverse and longer-term consequences on economic growth, development and poverty rate (Benson and Clay, 2003).

**Table 3: Household performance as affected by COVID-19 pandemic**

| Parameters | High | Low | | |
|---|---|---|---|---|
| Pandemic vs purchasing power | 45.3% | 54.7% | | |
| Pandemic vs food intake | 26.4% | 73.6% | | |
| Pandemic vs protein intake | 34.5% | 65.5% | | |
| Pandemic vs nutritional requirements | 32.2% | 67.8% | | |
| Pandemic vs family income | 17.4% | 82.6% | | |
| Pandemic vs food prices | 98.9% | 1.1% | | |
| Pandemic vs food availability | 48.2% | 51.8% | | |
| Pandemic vs transportation of food | 80% | 20% | | |
| Pandemic vs future food availability | 47.1% | 52.9% | | |
| | Side business | Farming | Gifts | Loans |
| Pandemic vs coping strategy | 49.4% | 18.8% | 14.1% | 17.6% |
| | salary + side business | Business | salary | others |
| Pandemic vs income | 35.3% | 32.9% | 16.5% | 15.3% |
| Post pandemic vs income | 44.0% | 39.3% | 13.1% | 3.6% |
| | Yes | No | | |
| Pandemic vs farming | 88.1% | 11.9% | | |
| | Livestock | Crop | Mixed | Backyard |
| Pandemic vs agricultural production | 23.7% | 22.4% | 21.1% | 32.9% |

## Conclusion

The study showed that the recent climatic phenomenon is hitting hard on various forms of agricultural practices particularly, livestock production which was further worsened by the COVID-19 pandemic leading to reduced livestock productivity, crop failure, loss of jobs, hike in food prices, food insecurity and increased poverty rate. In this case, efforts should be intensified by government and other stakeholders involved in agricultural policies to put in place policies that would promote adoption of mitigation strategies as well as modification of livestock and crop production systems to suit the changing climate, encourage youths and adults to engage more in all forms of agriculture (both rural and urban farming) to cope with increasing demand for food especially animal protein and boost agricultural production through implementation of different forms of agricultural aids.

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