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AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

*Afr. J. Food Agric. Nutr. Dev.* 2024; 24(3): 25919-25941 https://doi.org/10.18697/ajfand.128.24650

| Date | Submitted | Accepted | Published |
|---|---|---|---|
| | 11th March 2024 | 20th March 2024 | 6th April 2024 |

# IMPACT OF COVID-19 ON AGRI-FOOD SYSTEMS: AN ASSESSMENT OF ACTORS ALONG THE FOOD VALUE CHAIN IN ETHIOPIA, UGANDA, NIGERIA AND MALI

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Volume 24 No. 3
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## ABSTRACT

Food security in Africa was impacted as a result of supply chain disruptions and government lockdowns brought on by the Coronavirus Disease of 2019 (COVID-19) pandemic. With participation from important actors in the agricultural value chain, the Sasakawa Africa Association (SAA) assessed the effect of COVID-19 on agri-food system in Ethiopia, Mali, Nigeria, and Uganda. Farmers, agro-processors, private service providers, off-takers and merchants, input dealers, and Ministry of Agriculture Extension service personnel are among the value chain actors that took part in the study. The survey, which was held from April 13 to April 16, 2020, used semi-structured tools and questionnaires aimed at the different stakeholders. The study used a cluster sample technique. The data were analyzed using SPSS software, which included frequency counts, percentages, rank correlation, and categorical regression. Based on the severity of the lockdowns associated to COVID-19, the survey found that the outcomes differed by country. The analysis shows a negative association between e-extension and education during the COVID-19 epidemic, but a high and positive correlation ($p < 0.01$) between extension services and postharvest services, as well as credit availability. Factors such as transportation, labor availability, price fluctuations, output market activity, loan availability, and food and nutrition security were significantly and positively correlated with COVID-19 awareness. Additionally, the respondents indicated that price changes were favourably correlated with labour availability and transportation, and that farming activities were significantly and positively correlated with food and nutrition security, labour availability, and the output market. According to the perspective data collected in every country during the COVID-19 epidemic, postharvest services, agricultural input activities, and food and nutrition security all heavily relied on extension services, with postharvest services having a negative correlation with extension services. The results of the analysis show that COVID-19 impacted several variables that are associated with extension services across the four countries. For instance, the R2 value of the relationship between value chain variables and extension service delivery across Mali (0.485), Nigeria (0.621), Ethiopia (0.426), Uganda (0.529), and the combined countries (0.511) indicates that the variation of the dependent variables can account for 48.5% of the variation in the values of the independent variable (extension service delivery) in Mali, 62.1% in Nigeria, 42.6% in Ethiopia, 52.9% in Uganda, and 51.1% in the combined countries. Farmers' access to agricultural labour, credit services, inputs for agriculture, and output markets was restricted by the ban on travel and social gatherings. Smallholder farmers should employ digital solutions more to strengthen the agricultural value chain's actors' resilience against potential pandemics or conflicts, according to the study's implications for extension services. This will reduce the requirement for extensive personal touch and travel in the delivery of extension services. The study also highlights how crucial it is for extension services to show tangible outcomes and benefits in order to increase farming communities' and value chain actors' resilience in any difficult circumstances.

**Key words:** COVID-19, food systems, extension services, value chain actors, output markets

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## INTRODUCTION

The COVID-19 pandemic has significantly impacted the global economy, particularly Africa, with the agricultural sector playing a crucial role. The crisis has led to rising food costs and limited food supply, making it difficult to adjust and potentially causing a global food security catastrophe. Africa faces issues like decreased tourism, supply chain disruptions, and trade slowdowns. Governments face numerous challenges in mitigating the pandemic's effects, safeguarding livelihoods, and ensuring adequate food supply.

The COVID-19 pandemic has impacted African nations differently, with millions losing their means of subsistence and GDP predicted to decrease by 1.6%. The International Food Policy Research Institute (IFPRI) estimated that the global economic downturn could lead to over 140 million people becoming impoverished. The International Monetary Fund (IMF) also predicted a global recession, leading to food insecurity due to trade-related distortions and price spikes. Food exports from African nations were expected to fall by 3% in the worst-case scenario, resulting in a 1.4% contraction in the region's GDP [1]. The COVID-19 pandemic significantly impacted African nations' export earnings, particularly food items, due to lockdowns, travel bans, and health precautions. This led to delayed and higher export costs, and influenced consumer behavior and export trends. The pandemic underscored the importance of maintaining economic ties to minimize food supply disruptions. Food and nutrition security suffered directly as a result of COVID-19. Because of the pandemic, there was a rise in the incidence of poor nutrition as a result of altered consumption patterns and a loss of purchasing capacity [2, 3]. According to Beltrami [4], COVID-19 would cause an economic collapse in nations that depend heavily on imports of gasoline and food because imports would be more expensive and export revenue would be significantly lower. According to Nkanjeni [3], "Africans' purchasing power was eventually affected as a result of employment dropouts, income loss, and risk aversion behaviors." According to Hall [5], how each nation responds to the pandemic will decide how it affects food security and the resilience of livelihoods.

The COVID-19 transmission trajectory and scale in Africa remain unknown due to insufficient testing. With 258,884 deaths and 12,860,287 official cases [6, 7], governments prioritize minimizing the spread while focusing on economic well-being, food security, and nutrition. The pandemic has had a greater impact on agriculture than previous Ebola outbreaks in Uganda, the Democratic Republic of the Congo, Liberia, Sierra Leone, and Guinea. Restrictive measures, such as lockdowns and travel bans, have disrupted the region's educational system. COVID-19's severe effects on Africa, exacerbated by high poverty rates, inadequate healthcare systems, and densely populated cities, may lead to further

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declines in agricultural productivity and economic impact. The global South, particularly Africa, is most vulnerable to the effects of rising food costs and restricted supply, which could lead to a worldwide food security crisis if not addressed promptly. To prevent disruptions, policies should ensure access to food and nutrition, establish social safety nets, reduce obstacles to the safe movement and transportation, and maintain open trade routes for food and agriculture.

The Sasakawa Africa Association conducted an analysis of the COVID-19 pandemic's impact on African agricultural and food systems, in collaboration with their network of extension and advisory services actors throughout the agriculture value chain. The analysis aimed to determine the pandemic's impact on food systems and to ascertain whether rural producers and the input and output market systems have appropriate extension services during the government lockdowns associated with the pandemic.

### Objective of the study

The study aimed to assess the impact of COVID-19 related challenges on food systems in African countries, focusing on the agricultural value chain, public awareness, and mitigation strategies. It also examined the functionality of input and output systems and their interaction with extension and advisory services.

## MATERIALS AND METHODS

### Study area

The study was conducted in the SAA intervention zones in Ethiopia, Mali, Nigeria and Uganda.

### Research Design

The study utilized a cross-sectional research design, utilizing a phone survey and the Rapid Assessment Procedure. This approach combined elements from various approaches and critical elements, incorporating established implementation science frameworks into data collection and analysis [8]. Rapid Assessment is a brief, topic-specific collection of data from international development fields, typically conducted within 10 minutes or less. Rapid assessment is a team-based qualitative inquiry that uses triangulation, iterative data analysis, and additional data collection to quickly understand a situation from an insider's perspective [11]. It is ideal for practical outreach work because of its small scope and is used when time and resources are limited [10, 12].

### Population of Study, Sampling procedure and sample size

The study surveyed various stakeholders in the agriculture value chain, including farmers, off-takers/traders, input dealers, Agriculture extension personnel, private service providers, agro-processors, financial services, and development partners.

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Geographically, the assessment was carried out among the stakeholders in SAA operational regions/districts in Ethiopia, Nigeria, Mali and Uganda. The study used cluster sampling, selecting stakeholders based on geographical locations, institutions, and respondents. The study controlled frame error by excluding administrative and support staff, and eliminated selection error by focusing only on those involved in the activities. The sample size was 360, with 80% male and 20% female, with varying proportions across Ethiopia (98), Mali (89), Nigeria (83), and Uganda (90) (Tables 1 and 2).

### Data collection

A semi-structured questionnaire was used to gather data on socio-economic characteristics, COVID-19 awareness, knowledge, agricultural extension services, impact on input and output demand, and supply activities and mitigation measures. The instrument's validity was tested by comparing stakeholders' assessments of the same food system in the same country. SAA staff and thematic coordinators administered a questionnaire through telephone, e-mails, WhatsApp and skype from April 13-16, 2020, aiming to gather stakeholder responses on specific objectives through various communication methods.

## RESULTS AND DISCUSSIONS

### Socio-economic characteristics of respondents

Among the sample respondents, 80% of them were male, 50% between 30 and 50 years old, and 40% above 50 years old. The majority have tertiary education, possibly due to a skewness associated with the selection of the ministry of agriculture staff as part of the respondents (Figure 1). The sample structure selection, however, highlights the low proportion of women, and age groups involved in agricultural enterprises, and education levels [13].

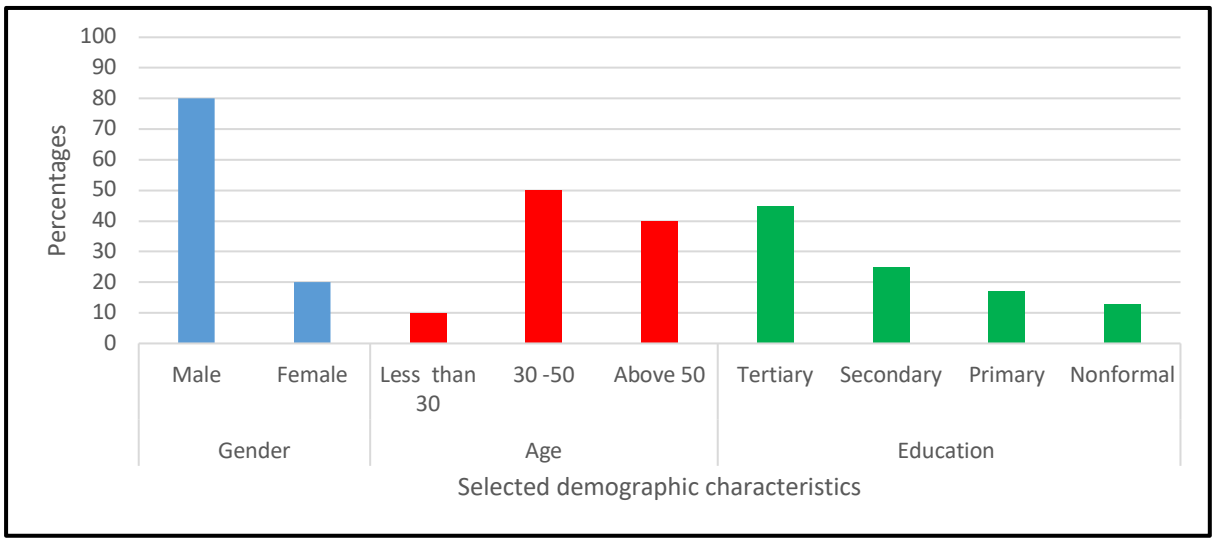


**Figure 1: Selected socio economic characteristics of respondents (n = 360)**

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**Respondents' awareness on the COVID-19 pandemic**

Table 2 shows that extension officers and Agriculture Ministry representatives have a higher knowledge of COVID-19 preventive measures, including hand washing, maintaining social distance, and abstaining from coughing, spitting, and sneezing. These precautions were prototypes for guidelines and methods published by the World Health Organization during the outbreak [14]. IFPRI [13] and WHO [14] suggest social distancing, handwashing, and avoiding coughing, spitting, and sneezing as effective strategies to prevent COVID-19 spread.

**Perceptions on overall effect of COVID-19 on the agricultural sector**

The quick assessment of COVID-19's effects on African food systems is presented in Table 3, focusing on various aspects of the value-chain such as the agricultural sector's state, farmers' impact, extension services, input and output markets, and off-takers' influence. The responses were disaggregated by country. COVID-19's effects differed by country. Based on the severity of the government lockdowns in each country—Uganda having the strictest lockdowns.

The pandemic significantly impacted the agriculture industry, limiting farmers' access to financial services, farm labor markets, and agricultural inputs (such as seed, fertilizer, and agrochemicals). The restrictions also hindered agricultural extension services, which curtailed farmers' access to capacity building, potentially affecting crop production and productivity, endangering Africa's food security and nutrition. The pandemic significantly impacted Nigeria's agricultural value chain, impacting training farmers and extension agents (84%), labor availability (68%), input availability, access, and distribution (92%), and food security and nutrition (78%). In Uganda, stakeholders were generally aware of the disease and preventive measures, largely through media, including radio, TV, social media, and community announcements (Table 3).

The government's standard operating procedures significantly impacted agricultural activities (100%), farmer trainings (75%), input availability and access (75%), output markets (63%), and food and nutrition security (50%) (Table 3). However, stakeholders were unaware of additional precautions, such as staying away from gatherings, reporting suspicious patients, wearing face masks, and using hand sanitizers, and thus highlighting the need for behavior modification and communication tactics.

Ethiopian farmers faced COVID-19 risks due to lack of access to credit services, extension services, input/output market access, and sufficient awareness, posing a threat to food and nutrition security and agricultural productivity (Table 3). The COVID-19 pandemic significantly impacted the provision of extension and advisory services for agriculture in Mali.

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## Effect on the farming communities

Table 3 shows the impact of COVID-19 on farmers in Nigeria, Uganda, Ethiopia, and Mali. Nigeria faced challenges in accessing pre- or post-harvest handling services (71%), farms (88%), extension services, and trainings (83%). Some 95% of farmers reported higher input prices, while 90% had limited access to labor, transportation services, and output markets. Ugandan farmers faced restricted access to inputs (100%), sales (86%), higher input prices (42%), transaction costs (29%), delayed delivery on imported inputs (29%), delayed debtor payment and higher food prices (33%), and increased producer prices for rice, beans, and maize (49%, 36%, and 14%, respectively).

Over 75% of Ethiopian farmers anticipated limited labor availability due to the COVID-19 pandemic, with 83% unable to access technical assistance and training. The Extension agents (EAs) (51%) were unable to provide training to farmers, 43% of the EAs were only able to assist 6% of farmers in accessing loans or inputs. The pandemic also hindered the transfer of information, skills, and knowledge to Extension Agents and farmers, hindered the implementation of community work campaigns like building canals for conserving water and soil, and stopped farmer group planning and resource mobilization efforts. The pandemic also made it more challenging for 55% of farmers to obtain inputs such as seed, fertilizer, and agrochemicals (Table 3).

The COVID-19 pandemic in Mali significantly impacted farmers' access to extension services (81%), farming activities (81%, labor availability (90%), postharvest activities (52%), input stock (40%), and output market access (100%). Furthermore, the pandemic caused a disruption to the regular schedule of the major planting season. The closure of borders with neighboring countries limited trade opportunities, such as access to imported agricultural inputs like fertilizers, agrochemicals, and vegetable seeds, leading to delays in agricultural activities (Table 3).

## Effect on access to agricultural inputs

COVID-19's main effects on agricultural input activities were limited sales (74%), limited stock (58%), and scarcity (92%) (Table 3). Government limitations and mobility restrictions may have disrupted food supply systems, leading to a lack of market for agricultural chemicals and delayed input supply. According to reports from IFPRI [13], the OECD [14], and the WTO [15], mobility restrictions during COVID-19 might have the unintended consequence of upsetting food supply systems. Agro-dealer merchants in Ethiopia were frustrated by the lack of a market for agricultural chemicals and the inability of importers to provide timely inputs (Table 3).

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The pandemic significantly impacted Nigeria's agricultural input distribution, accessibility, and availability, leading to increased costs and supply delays even after normalcy returned. In Uganda, limited stock and sales of targeted inputs were reported (68%), with transportation limitations making it difficult to obtain inputs. All respondents reported a shortage or restricted supply of inputs. On the other hand, eighty-two percent of Malians experienced a decline in commerce and sales due to the epidemic, disrupting the major agricultural season and activities, and potentially affecting cropping campaign performance (Table 3).

**Effect on agricultural extension service delivery**

COVID-19 has significantly impacted Extension services, causing reduced monitoring and technical support for farmers (70%), higher service delivery costs (58%), and discontinuation of activities (such as trainings, demonstrations, and data collection) (48%). These constraints were largely due to lockdown measures and non-implementation of development operations by governments (Table 3). AFAAS [16] and AESA [17] have reported that COVID-19 caused an interruption in extension services. Ethiopian Development agents (51%) faced challenges in providing extension services due to mobility constraints, staff shortages, and access to transportation services. They struggled with on-site technical support (43%), loan assistance (6%), and planning community rural development campaigns. In Mali, The COVID-19 pandemic disrupted agricultural extension services, limiting farmers' access to technology and oversight. (Table 3). Nigeria's Extension agents believe they could have used the e-extension system more successfully with internet connectivity. However, only 44% of respondents believe e-extension helped overcome pandemic limitations. In Uganda, limited access to extension services was due to restrictions on movements and banned gatherings. 75% of respondents believe farmers' suspension of activities was due to inadequate monitoring and service provision (Table 3).

The Mali Ministry of Agriculture confirmed that COVID-19 significantly impacted crop yield and production, with 92% of respondents stating this. Factors affected include face-to-face training (77%), capacity building of extension agents and farmers (85%), and access to high-quality seed (100%). E-extension was mentioned as a solution (85%). Travel restrictions have also reduced labor availability in farms, potentially leading to increased unemployment in rural areas and resulting in low crop productivity and production (Table 3).

**Effect on output markets**

The pandemic significantly impacted output markets, leading to limited stock (60%), produce scarcity (58%), high transport costs (42%), restricted market access (40%), business closures (33%), and income decline (39%), primarily due


https://doi.org/10.18697/ajfand.128.24650

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to nationwide curfews and movement restrictions (Table 3). Similar trends presented by IFPRI, OECD, and WTO [13, 14, 15] corroborate these conclusions.

COVID-19 has significantly impacted off-takers' output markets in Nigeria, with 56% having limited input supply, 60% experiencing poor market demand, 48% experiencing increased grain product costs, fewer markets (42%), increased input costs (23%), and limited transportation (51%) (Table 3). Uganda's output markets faced challenges due to high transportation costs (83%), resulting in increased transaction costs, lack of produce (67%), and closed traders (67%), affecting households' access to meals and food variety. Ethiopian agribusinesses faced significant challenges due to government-imposed movement restrictions, with 55% of output traders stating their grain stock was insufficient (Table 3).

### Effect on Food and Nutrition Security

The study reveals that over 70% of stakeholders in Ethiopia and Uganda believe COVID-19 will impact food security, compared to 80% in Nigeria and Mali (Figure 2). This aligns with previous studies which anticipated the impact, suggesting reduced food rations, poor nutrient consumption, and fewer daily meals may have jeopardized food security.

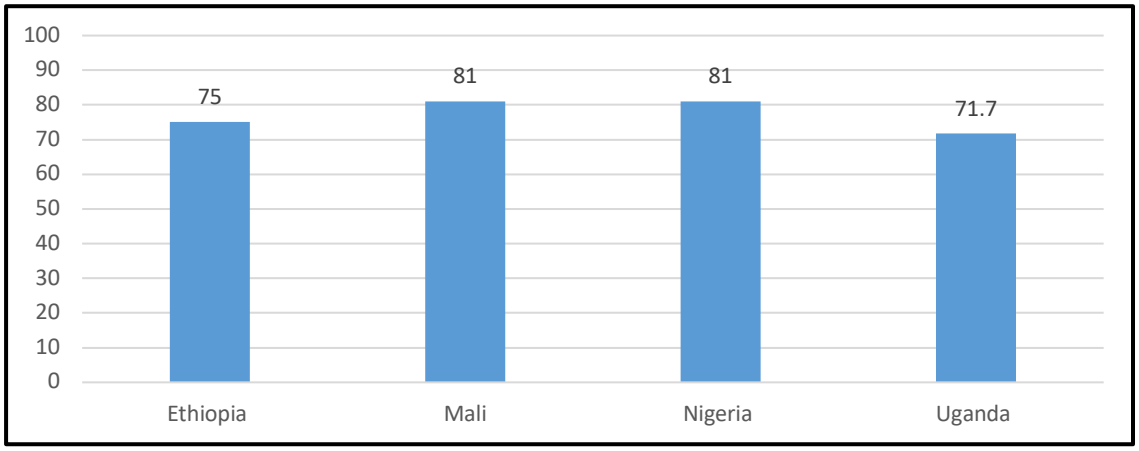


**Figure 2: Percentage response on COVID-19s effect on food and nutrition security**

### Effect on postharvest and agro-processing services

In Nigeria, agro-processors and private service providers faced low demand for grain milling (67%), as well as limited availability of input stocks (67%), processed grain products (73%), and processing raw materials (68%). During the lockout, agro-dealers faced constraints in obtaining inputs (67%), decreased stock levels (63%), and restricted access to input suppliers (85%) (Fig 3a). Private service supply and processing in Uganda decreased due to low demand (87%), expensive transportation (75%), and constrained working hours (37%) (Fig 3d). The impact of COVID-19 effects in Ethiopia was much less than the other countries largely

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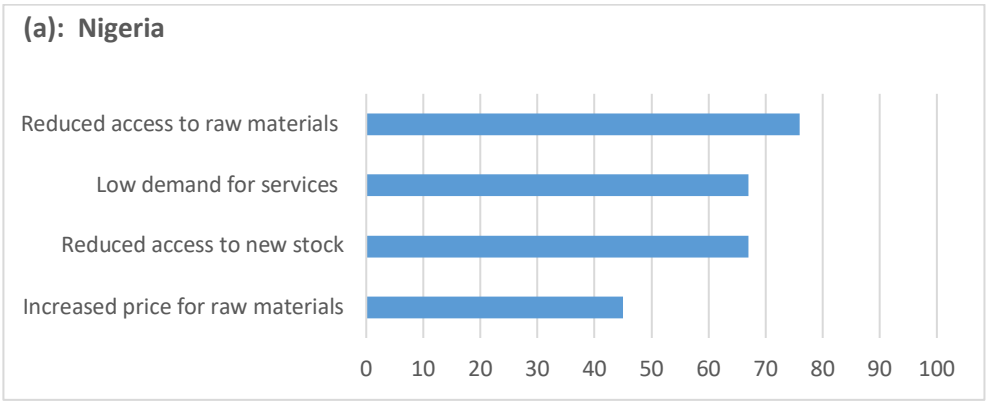
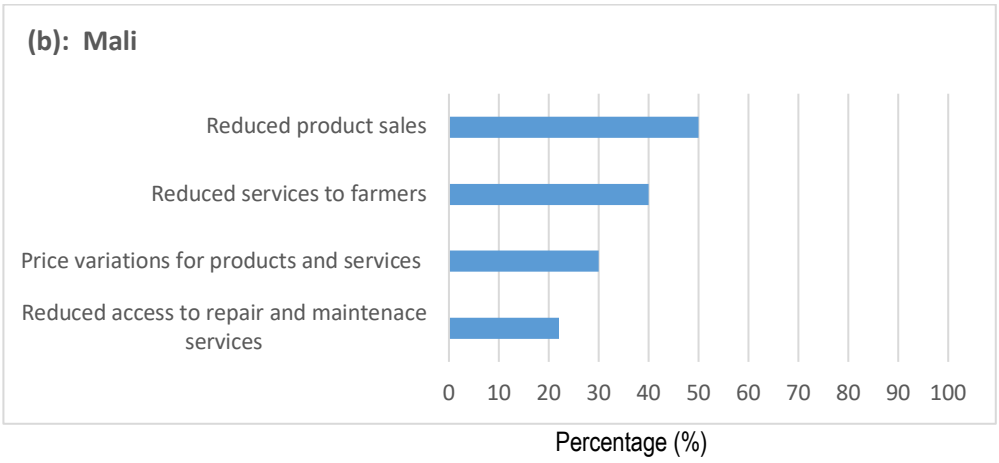
because in Ethiopia, there was partial lockdown, as compared to full lockdown in the other countries. Nevertheless, less than 20% of Ethiopian service providers reported a shortage and high cost of raw materials, affecting agro-processing capacity and grain sales. Transportation costs increased, forcing farmers to employ human and animal power, putting more burden on women and increasing labour drudgery. Agro-processors struggled with raw material shortages due to farmer movement restrictions and hoarding, while traders faced working capital deficits due to lack of credit access from financial institutions and thus unable to aggregate/retail agricultural products (Fig 3c).

The government's restrictive measures in Mali reduced market opening times, affecting all value chain actors (including. output traders, agro-dealers, processors and private service providers), leading to reduced business activities, particularly for input dealers (82%) and processors (50%), and affecting agricultural product availability (Fig 3b). Respondents found reduced access to raw materials in Nigeria (79%), product sales in Mali (55%), input supply decline in Ethiopia (19%), and low product demand in Uganda (90%) due to COVID-19, consistent with the overall impact of COVID-19 on extension services.



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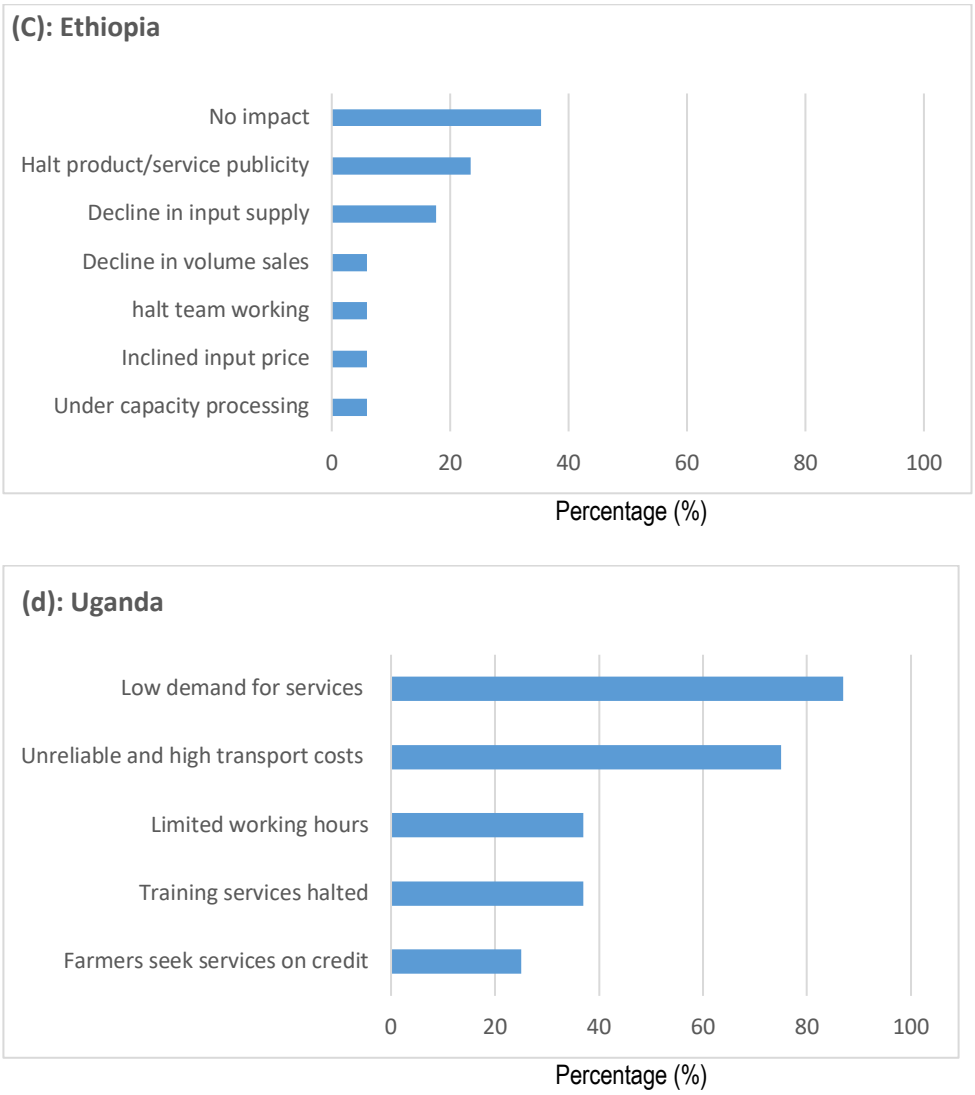


**Figure 3: Effect of COVID 19 on Post-harvest and handling (PHAP) Services (%)**

**Correlation analysis of the Stakeholder perceptions of the effects of COVID-19**

Table 4 displays the Spearman Rho rank order correlation matrix findings on value chain activities and extension services during the COVID-19 pandemic, based on stakeholder survey perspectives. The perception study reveals a strong positive correlation between e-extension, labour availability, price fluctuations, and farming activity during COVID-19 pandemic. Education was positively and significantly correlated to Post-harvest and handling services, transportation, and gender, while negatively correlated to loan availability. Factors such as transportation, labor availability, price fluctuations, output market activity, loan availability, and food and nutrition security were significantly and positively correlated with COVID-19 awareness. Farming operations and respondents' food security were also strongly associated to labor availability, transportation, and output markets.; while credit access was positively and strongly correlated to postharvest handling services,

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transportation, labour availability, price fluctuations and output markets. There seem to be a strong negative correlation between Gender and credit access as well as education and credit access. Morsy [30], points to the fact that worldwide, women's access to finance is disproportionately low, and in Africa, the gender gap in access to financial services is driven by women entrepreneurs' own self-perception. Similarly, the study revealed a negative correlation between extension services and education, as well as extension services and e-extension. Onyeaka *et al.* [31) examined the relationship between food security indicators (accessibility, availability, utilization, stability) and COVID-19 in Benin, Burkina Faso, Cameroon, Chad, Madagascar, Mali, Mauritania, Nigeria, and Senegal and found that a rise in COVID-19 levels negatively impacts all the 4 indicators of food security without exception. This study offers a bivariate perspective on the interactions between variables and suggests ways to improve the effectiveness of agricultural extension services during pandemics or other challenges. The linkages shows a public extension system which is not effective during a pandemic.

**Categorical regression analysis**

Table 5 presents strong associations between extension service provision and other factors across Ethiopia, Uganda, Nigeria, and Mali, as indicated by the categorical regression analysis. This study employed factors associated with food value chain and performed a multivariate regression analysis. The R2 value of the relationship between value chain variables and extension service delivery across Mali (0.485), Nigeria (0.621), Ethiopia (0.426), Uganda (0.529), and the combined countries (0.511) indicates that the variation of the dependent variables can account for 48.5% of the variation in the values of the independent variable (extension service delivery) in Mali, 62.1% in Nigeria, 42.6% in Ethiopia, 52.9% in Uganda, and 51.1% in the combined countries.

Factors such as gender, education, and output market were significant but negatively associated with extension services in Mali, while agricultural input activities had a significant but positive association in Mali. Food and nutrition security is positively associated and significant in Nigeria, while postharvest services, and output market activities are significant and positively associated with extension services in Uganda, while education is negatively associated with extension services in Uganda. The study indicates that in Ethiopia, extension service had a significant but a negative relations with postharvest services, and positive relationship with COVID-19 awareness. The data from all countries revealed that postharvest services, agricultural input activities, and food and nutrition security were the significant variables, with postharvest services negatively associated with extension service delivery. Conversely, it is believed that the direct effects of agricultural extension's paralysis—which primarily consists

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of in-person training—were not yet evident at the time of the study, but it is evident that farmers were worried about it, which implies that many of them have high expectations on extension programs. Extension services give farmers access to capital-boosting inputs, such as information flows that can raise household livelihoods and productivity, which can result in food security for the family [18, 19, 20, 21, 22].

Research has shown that investments on extension services, particularly in developing nations, can raise farmers' incomes and enhance agricultural output [23]. Education fosters a good mental attitude for accepting new practices, particularly information- and management-intensive practices, according to research by Ragasa *et al.* [24] and Boehene [25]. It has also been shown to positively relate to the provision of extension services. According to Danso-Abbeam *et al.* [26], farm-specific characteristics, socioeconomic, institutional, and extension program factors were found to have a substantial impact on farmers' income and productivity. According to Sebaggala and Matovu [27], efforts must be made to enhance the quality of extension services that have a direct impact on productivity in order to increase the impact of extension on agricultural productivity, while Cawley *et al.* [29] show that extension had a positive influence on farm income engagement. On the other hand, Asres *et al.* [28] revealed that involvement in extension programs increased farm production among Three Peasant Associations in Ethiopia's Highlands.

## CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The study highlights the immediate impact of COVID-19 pandemic on food systems, including input, production, distribution and consumption, and the more delayed impact on agricultural technology extension, based on the perceptions of the different actors in the food value chain. It highlights the need for better information, preventative measures, availability of credit services, extension services, and input/output markets. Agriculture Ministries warn of government-imposed limitations on crop productivity, but e-extension could help overcome these restrictions.

During the pandemic, farmers and value chain participants in target countries experienced restricted access to inputs, sales, and an inaccessible output market. Higher input prices, increased transaction costs, and delayed importation led to higher food prices, reduced food rations, and fewer daily meals. COVID-19 led to farm inaccessibility, lack of extension services and training, shortage of pre- and post-harvest handling services, and decreased demand for private service providers and agro-processors, resulting in lower loan deposits, repayments, and servicing.

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The COVID-19 pandemic significantly impacted the food market and systems, potentially affecting food and nutrition security, price stability, supply chain, agricultural inputs, labor availability, and livelihoods of smallholder farmers. However, it can be assumed that while the impact of the restricted access to agricultural inputs from upstream food value chains was significant, the extent of the lockdowns in each country had varied effects and the impact of the subsequent prolonged downstream shrinkage in demand for agricultural products did not immediately become apparent in Ethiopia where there was partial lockdown.

What has become apparent with the spread of COVID-19 is the fragility of the food value chains and agricultural technology extension systems in African countries. More resilient food value chains and agricultural technology extension systems need to be built, which may include strengthening access to agricultural inputs, finance and postharvest services in rural areas and accelerating remote technology extension (digital solutions) using ICT. The study across the four countries recommend addressing the effects COVID-19's through building more resilient measures such as using e-extension, alternative extension delivery methods like WhatsApp groups, TV and radio use, local language manuals, and postharvest labor-saving technologies and services. This would help build the resilience of agricultural value chain actors in the event of COVID or any other pandemic or conflict that may occur in the future with related restrictions in the movement of people and goods. The SAA will continue “walking with the farmer” in Africa to introduce resilient measures that helps the African farmer to withstand shocks in the event of future disease outbreaks, climate change and conflicts.

## ACKNOWLEDGEMENTS

We would like to thank the Sasakawa Africa Association (SAA) for sponsoring the study. We also recognize the significant support received from SAA Technical Coordinators and Program officers in carrying out the survey.

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

## Table 1: Respondents by category and countries

| Respondents Category | Ethiopia | Mali | Nigeria | Uganda | Total |
|---|---|---|---|---|---|
| Agro-processors & Private Service Providers | 10 | 10 | 10 | 8 | 38 |
| Extension Service (Extension/Development Agents) | 26 | 15 | 14 | 11 | 66 |
| Farmers | 24 | 20 | 30 | 46 | 129 |
| Financial Institutions | 8 | 6 | 2 | 4 | 20 |
| Input dealers (seeds, fertilizer and agro-chemicals) | 13 | 11 | 5 | 7 | 35 |
| Ministry of Agriculture & related Partners | 4 | 17 | 3 | 8 | 32 |
| Off-takers & Traders | 13 | 10 | 19 | 6 | 48 |
| Total | 98 | 89 | 83 | 90 | 360 |

## Table 2: Stakeholders' awareness level on COVID-19 and prevention measures (percentage responses)

| Country | Stakeholders' Category | Hand washing | Social distancing | Avoid gatherings/ stay at home | Report suspected persons | Avoid touching eyes, nose and mouth | Hand sanitizer | Wear Mask | Avoid Sneezing, coughing & spitting etiquettes |
|---|---|---|---|---|---|---|---|---|---|
| Ethiopia | Agro-Input dealers | 100 | 100 | 20 | 60 | 70 | NA | NA | NA |
| | Extension Agents | 100 | 100 | 5 | 75 | 90 | NA | NA | NA |
| | Farmers | 100 | 100 | 4 | 39 | 89 | NA | NA | NA |
| | Financial Service Providers | 100 | 100 | 25 | 75 | 100 | NA | NA | NA |
| | Off-takers | 100 | 100 | 8 | 33 | 100 | NA | NA | NA |
| | Processors | 100 | 100 | 25 | 58 | 91 | NA | NA | NA |
| Mali | Ministry of Agriculture | 100 | 100 | NA | NA | 100 | NA | 100 | NA |
| | Farmers | 100 | 86 | NA | NA | 76 | NA | 86 | NA |
| | Extension Agents | 100 | 100 | NA | NA | 100 | NA | 100 | NA |
| | Agro-processors and PSP | 90 | 100 | NA | NA | 0 | NA | 70 | NA |
| | Agro dealers | 91 | 73 | NA | NA | 55 | NA | 73 | NA |
| | Output traders | 80 | 60 | NA | NA | 10 | NA | 50 | NA |
| | Financial Institutions | 83 | 83 | NA | NA | 33 | NA | 67 | NA |
| Nigeria | Agro-input Dealers | 93 | 90 | NA | NA | 0 | 85 | 86 | 70 |
| | Extension Agents | 100 | 100 | NA | NA | 85 | 58 | 80 | 100 |
| | Farmers | 100 | 45 | NA | NA | 38 | 40 | 16 | 18 |
| | Financial Institutions | 100 | 100 | NA | NA | 100 | 100 | 100 | 100 |
| | MoA /ADPs | 100 | 100 | NA | NA | 100 | 100 | 100 | 100 |
| | Off-takers & Traders | 82 | 56 | NA | NA | 50 | 100 | 28 | 65 |
| | Private Service Provision and Processing | 80 | 29 | NA | NA | 50 | 86 | 57 | 29 |
| Uganda | Extension Agents | 100 | 13 | 100 | 0 | 88 | 13 | 13 | NA |
| | Farmers | 95 | 64 | 21 | 2 | 10 | 2 | 5 | 2 |
| | Financial Institutions | 100 | 100 | NA | NA | 100 | NA | 75 | NA |
| | Input traders | 100 | 86 | 29 | NA | 57 | 29 | 29 | NA |
| | Off-takers | 100 | 100 | NA | 50 | 100 | NA | 83 | NA |
| | Private Service Provision | 82 | 100 | 27 | 18 | 9 | 45 | NA | NA |

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## Table 3: Stakeholders' perceptions on the effect of COVID-19

| | Ethiopia | Mali | Nigeria | Uganda |
|---|---|---|---|---|
| Overall agricultural sector | | | | |
| Food and nutrition security | 75 | 81 | 78 | 50 |
| Labour availability and mobility | 58 | 91 | 68 | 13 |
| Input availability and access | 41 | 100 | 92 | 75 |
| Trainings for Farmers and EAs | 75 | 77 | 84 | 75 |
| Agricultural activities | 86 | 92 | 100 | 100 |
| Output markets | 64 | 100 | 68 | 63 |
| Limited access to credit | 46 | 62 | 44 | 25 |
| Effect of COVID-19 on farmers | | | | |
| Access to extension | 83 | 81 | 83.3 | 82.6 |
| access to PHH | NA | 52 | 71.4 | 23.9 |
| Transportation | NA | 100 | 95.2 | 52.2 |
| Labour availability | 75 | 90 | 90.5 | 63 |
| Price changes | NA | 67 | 95.2 | 76.1 |
| Output markets | NA | 100 | 92.9 | 82.6 |
| Access to credit | NA | 62 | 90.5 | 87 |
| Access to farms | NA | 52.4 | 88.1 | NA |
| Food and nutrition security | 75 | 81 | 81 | 71.7 |
| Reduced farming activities | NA | 81 | 67 | NA |
| Access to inputs | 90 | 76 | 72 | NA |
| Agricultural input and product | | | | |
| Delayed delivery of imported inputs | NA | 40 | 54.2 | 33.3 |
| Delayed payments by debtors | NA | 60 | 63 | 16.7 |
| Increased cost of business | NA | 82 | 55.6 | 16.7 |
| Increased prices | 18 | 30 | 67 | 16.7 |
| Limited sales | NA | 40 | 81 | 66.7 |
| Scarcity of inputs/lack of access to supply | NA | 91 | 85 | 100.0 |
| Limited stock/shortage of inputs | 55 | 46 | 63 | 66.7 |
| Transport | 36 | 40 | 66 | NA |
| Lack of access to loans | 18 | 70 | 30 | NA |
| Out of stock | NA | 46 | 80 | 16.7 |
| Extension service provision | | | | |
| Limited monitoring/technical support to farmers | 42.3 | 81 | 92 | 75 |
| Suspended activities (trainings, demonstrations, data collection) | 51.3 | 67 | 60 | 33 |
| Inability to facilitate input delivery/distribution | 5.7 | 100 | NA | 20 |


https://doi.org/10.18697/ajfand.128.24650

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
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| | | | | |
|---|---|---|---|---|
| Increased cost of service delivery | NA | 71.4 | 90 | 25 |
| Output markets | | | | |
| Increased input & Post Harvest Handling materials prices | NA | NA | 23 | 12 |
| Scarcity of produce | 15 | 60 | 60 | 67 |
| Increase food prices and other essentials | 15 | 20 | 48 | 45 |
| Limited market access due to ban of weekly markets | 8 | 20 | 51 | 81 |
| Access to finance | | | | |
| Decline on debtors | NA | 65 | 69 | 80 |
| Decline on savers/deposits | 40 | 70 | 89 | NA |
| Poor loan servicing | 30 | 67 | 67 | 60 |
| Suspension of loan disbursement | 20 | 60 | 58 | 40 |
| Deficit in loanable funds | 10 | 67 | 62 | 20 |
| Constrained credit flow | NA | 10 | 72 | 60 |
| Effects on Off-takers' output markets | | | | |
| Closure of business | NA | 55 | 51.0 | 33.3 |
| High transport | 7.7 | 40 | NA | 66.7 |
| Scarcity of produce | 15.4 | 60.0 | 56.0 | 100.0 |
| Limited stock | NA | 40.0 | 48.0 | 83.3 |
| Price variation | 15.4 | 20.0 | 33.2 | 100.0 |
| increased sales | 15.4 | 10 | 44.6 | NA |
| Decline in income | 38.5 | 70 | 52 | NA |
| Lack of access to loans | 7.7 | 70 | NA | NA |



https://doi.org/10.18697/ajfand.128.24650

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**Table 4: Spearman's rho correlations analysis matrix for extension services and value chain activities during COVID 19 ( n=125)**

| | Postharvest & handling services | Transportation | Labour availability | Price changes | Output Markets | Credit access | Food and nutrition security | Farming activity | e-extension | Gender | Age | Education | Awareness of COVID-19 | Extension services |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Postharvest & Handling Services | 1.000 | .144 | .176* | .035 | .020 | .308** | -.001 | -.003 | .042 | -.007 | .264** | .295** | -.007 | .225* |
| Transportation | | 1.000 | .427** | .293** | .630** | .226* | .474** | .399** | .138 | -.115 | .000 | .195* | .359** | .069 |
| Labour availability | | | 1.000 | .318** | .331** | .216* | .466** | .493** | .268** | -.146 | -.050 | .061 | .392** | .007 |
| Price changes | | | | 1.000 | .308** | .206* | .194* | .144 | .198* | -.059 | .015 | -.028 | .430** | .011 |
| Output Market | | | | | 1.000 | .325** | .515** | .424** | .114 | -.105 | .020 | -.041 | .507** | .027 |
| Credit access | | | | | | 1.000 | .282** | -.008 | .135 | -.237** | -.036 | -.222* | .414** | .331** |
| Food & Nutrition Security | | | | | | | 1.000 | .280** | -.012 | -.099 | -.114 | .056 | .430** | -.024 |
| Farming activity | | | | | | | | 1.000 | .191* | -.137 | -.018 | .074 | .027 | -.031 |
| e-extension | | | | | | | | | 1.000 | -.007 | -.056 | .060 | -.001 | -.189* |
| Gender | | | | | | | | | | 1.000 | .262** | .261** | -.163 | -.132 |
| Age | | | | | | | | | | | 1.000 | .131 | -.031 | .105 |
| Education | | | | | | | | | | | | 1.000 | -.162 | -.251** |
| Awareness of COVID-19 | | | | | | | | | | | | | 1.000 | .137 |
| Extension services | | | | | | | | | | | | | | 1.000 |

*Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)



https://doi.org/10.18697/ajfand.128.24650

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
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**Table 5: Categorical regression analysis of relationships between extension service delivery and other variables across Mali, Uganda, Nigeria and Ethiopia during COVID-19 Pandemic**

| Variable | Mali | Nigeria | Ethiopia | Uganda | All countries |
|---|---|---|---|---|---|
| | (Beta (Bootstrap Estimate of Std. Error)). | | | | |
| Postharvest handling & services | -.145(.386 ) | .288(.226 ) | -.159(.101) * | .324(.096)*** | -.440(.285 )* |
| Input market | .340(.157 ) ** | -.054(.304 ) | -.174(.113 ) | .195(.132 ) | .489(.273 ) * |
| Output market | -.377(.121 ) *** | -.268(.233 ) | .129(.287 ) | .381(.181 )** | .134(.239 ) |
| Credit access | .424(.401 ) | .194(.157 ) | .070(.169 ) | .002(.133 ) | -.080(.347 ) |
| Food & Nutrition security | -.220(.306 ) | .710(.191 ) *** | .258(.267 ) | -.103(.180 ) | .686(.333 ) *** |
| Gender | -.139(.089 ) * | .139(.413 ) | -.348(.263 ) | -.152(.125 ) | -.026(.040 ) |
| Age | -.144(.186 ) | .108(.121 ) | .157(.183 ) | -.152(.167 ) | -.034(.079 ) |
| Education | -.264(.151 ) ** | -.061(.145 ) | -.270(.181 ) | -.185(.086 ) ** | -.058(.046 ) |
| Awareness of COVID-19 | .085(.165 ) | -.128(.128 ) | .178(.064 ) *** | .166(.129 ) | -.008(.100 ) |
| Multiple R | 0.697 | 0.788 | 0.653 | 0.727 | 0.715 |
| R Square | 0.485 | 0.621 | 0.426 | 0.529 | 0.511 |
| Adjusted R Square | 0.297 | 0.522 | 0.270 | 0.421 | 0.487 |
| Ftest | 2.57 | 6.268 | 2.725 | 4.934 | 22.053 |
| Pvalue | 0.00 | 0.00 | 0.002 | 0.00 | 0.00 |



https://doi.org/10.18697/ajfand.128.24650

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