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ECONOMIC IMPACTS OF AFRICAN SWINE FEVER EPIDEMIC AMONG PIG COOPERATIVE FARMERS IN OGUN STATE, NIGERIA

OYERONKE ADENIKE ADEKOLA[1], SOLA EMMANUEL KOMOLAFE[2*], MOYOSORE ABIDEMI RAJI [1]

[1]Department of Agricultural Extension and Rural Development, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria
[2]Department of Agricultural Extension and Rural Development, University of Ilorin, Ilorin, Kwara State, Nigeria

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ABSTRACT

The state of ill-being in swine production is a bad phenomenon that must be properly managed for food security's sake. Therefore, the study examined the economic impacts of African swine fever epidemic among pig cooperative farmers in Ogun State, Nigeria". Simple random sampling technique was used to select One hundred and twenty (120) pig cooperative farmers for this study. Descriptive statistics and inferential statistics were used to analyze data collected. Results showed that majority (94.3%) of respondents had former education. The mean pig farming experience was 11.5years. Majority of respondent (72.5%) of respondent had more than 20 pigs. Results further showed that 89.2%, 89.2%, 85.8%, 82.5%, and 84.2% were aware of ASF's specific symptoms such as sudden death, appetite loss, abortion, breathing difficulties, and redding of ears, respectively. Majority of the respondents strongly agreed that the outbreak of ASF pandemic has severely affected pig farmers' capital (78.3%), productivity (74.2%), and feed intake of swine (72.5%). The leading disposal management practices of infected pigs by respondents were disposal by bush burning (87.5%) and disposal by throwing in the bush (75.0%). Almost all, 97.5% agreed that non accessibility to disease database was a major hindrance, 97% agreed that lack of committed personnel and difficulty with vaccine development were constraints, while 88% indicated poor husbandry practices amongst farmers as constraint. The study concludes that ASF has greatly affected cooperative farmers economically. It is recommended that effort should be made by veterinary personnel, extension agent to further improve cooperative pig farmers' knowledge on ASF treatment and management.

1. INTRODUCTION

Pig (*Susscrofa*) otherwise known as swine is one of the major livestock animals raised for meat production and fat.

Swine is a prolific animal that has capacity to lift producers out of poverty but the bottleneck to this lucrative livestock business is recent diseases known as African swine fever. So many diseases are associated with swine production, theses disease are mostly retard their growth rate, slow down production or lead to mortality in most cases or

*Corresponding Author: kemmas04@yahoo.com

unintended culling. Some of these diseases are caused by bacteria, virus, coccidiosis, and fungi (Sanchex *et al.,* 2018) (Kirschner, 2016). African Swine Fever (ASF) is most current deadly diseases affecting pig production in Africa (Viltrop *et al.*, 2021) African swine fever is a highly infectious viral disease with devastating effect in pig production. According to (FAO, 2020), ASF is a complex disease that survives in pork products and persists in the environment for long periods, making control and eradication very difficult. Infected domestic pigs and wild boar excrete the virus with all body fluids and excretions including oronasal fluids, faeces and urine. The virus excretion starts about two days before onset of clinical signs. The virus load is particularly large in blood of infected animals, thus the haemorrhages and sometimes bloody diarrhoea caused by the infection result in extensive contamination of the environment. Some of the symptoms of ASF include; High fever, decreased appetite and weakness, Red, blotchy skin or skin lesions, diarrhea and vomiting, coughing and difficulty breathing. ASF manifests itself as a haemorrhagic fever and results in up to 100 percent mortality (Costard *et al.*, 2013).

Healthy pigs and boar usually become infected by contact with infected animals, including contact between free-ranging pigs and wild boar, ingestion of meat or meat products from infected animal kitchen waste, swill feed, infected wild boar (including offal), contact with anything contaminated by the virus such as clothing, vehicles and other equipment, and bites by infectious ticks (Olesen *et al.*, 2017). Movement of infected animals, contaminated pork products and the illegal disposal of carcasses are the most significant means of spread of the disease. African Swine Fever Virus (ASFV) is a large DNA virus that replicates in the cytoplasm and is the only member of the *Asfarviridae* family. The virus encodes 150-165 protein which have necessary functions in virus replication as less important roles in host interactions, including circumvention of host defences; for example, many proteins inhibit the early innate responses, including type I interferon and cell death pathway (Chenais *et al.*, 2019). Human activities in the domestic pig value chain involving pigs or pig derived products are the dominating driver of virus transmission in Africa as well as globally (Mulumba-Mfumu *et al.*, 2019).

The appalling effect of this African swine fever on pig production, from household to commercial level, has serious socio-economic consequences and implications for food security. Pig farmers are the most vulnerable of ASF in Nigeria especially in Ogun State where pig production is prevalent. ASF is a trending disease with devastating consequences. A data-based approaches and algorithms have been proposed to predict the spread of diseases (Quin et al., 2020). In the view of this, this research poses to assess the economic impacts of African swine fever epidemic among pig cooperative farmers in Ogun State, Nigeria. The specific objectives of this research study are to:

i. ascertain the respondent's awareness of the disease in the study area
ii. identify the perceived effects of the disease in the study area
iii. identify the preventive measures against the disease
iv. assess the constraints faced by swine farmers the study area

2. MATERIALS AND METHODS

Study area

Ogun is one of the six States in the South Western Region of Nigeria and it was created in 1976. Geographically, Ogun State lies between Longitude 2º 2' and 3º 55' E and latitudes 7º 01' and 7º 18' N with an annual growth rate of 3 percent per Annum. The land area is 1,640,926 square kilometers, a projected 2021 population of 158,702 on 2006 census and lies within the southern part of the country neighbored by Oyo, Ondo, and Lagos State.

The land area consists of natural resources such as extensive fertile soil suitable for the cultivation of a wide range of equatorial, tropical and savannah crops. The study area is well known for farming activities including both crop and livestock farming. Piggery is one of the major enterprises fetching the breeders, livestock keepers and sellers their daily income (National Bureau of Statistic, 2010).

Sampling techniques and sampling size

The study population comprises of all Cooperative Pig Farmers in Ogun State, Nigeria. The sampling frame of this study considers a list of the pig farmers in Ogun State from AFWAN cooperative farmers' societies. Simple random sampling technique was used in selecting 120 pig farmers from the list of pig farmers registered in AFWAN cooperative farmers' societies. Primary data was collected using structured interview guide.

Measurement of Variables and Data analyses technique

Farmer's awareness of the disease in the study area: This was measured at nominal level as; aware= 1, Not aware= 2. Perceived effects of the disease was measured at nominal level using a 5-points rating

scale of Strongly Agree (SA)= 1, Agree (A)= 2, Undecided (U)= 3, Strongly Disagree (SD)= 4, Disagree= 5. Constraints faced by swine farmers was measured at nominal level as; Yes= 1, No= 2. Descriptive statistics such as frequency counts percentage, mean and standard deviation was used to analyze the specific objectives of the study while inferential statistics such as Chi-square and Pearson Product Moment Correlation (PPMC) were used to test the hypotheses of the study.

3. RESULTS AND DISCUSSION

Socio-economic characteristics

Table 1 presents the socioeconomic characteristics of surveyed respondents. It reveals that the highest proportion (56.7%) of the respondents were older than 54 years. This shows the inactiveness of youths in pig farming, resulting in the sector being dominated by the older population, with the mean age of 53 years. This is in contrast with most findings generally from the agriculture sector where most of the farmers were in their active age (Ogunjinmi *et al.*, 2018); (Oladapo *et al*. 2017), but aligns with the findings of (Omowon *et al*. 2019) who found that the majority age group engaged in pig farming were those older than 54 years. The study further reveals that majority (75.0%) were male. This has always been the state of Nigerian agriculture which is usually dominated by the male, with female primarily involved in other value chains such as food processing, and distribution (Omowon *et al.,* 2019) [9]; (Ogunjinmi *et al.,* 2018). Results further indicated that almost all (90.8%) of the pig farmers were married. This could be associated with the fact that none of the farmers was younger than 18years – the minimum age for marriage in Nigeria. This also indicates that marriage was highly valued and cherished in the study area.

Results in Table 1 further reveals that the highest proportion (40.0%) of respondents had secondary education, followed by those with tertiary education (35.8%) then those with primary education (18.3%). This emphasizes that most swine farmers had appropriate level of education, thereby reiterating the findings of (Omowon *et al.,* 2019). Majority of respondent (72.5%) of respondent had more than 20 pigs, 24.2% had 10 - 20 pigs, while only 3.3% had less than 10 pigs. The mean number of pigs kept by the farmers was 23, showing that most farmers practiced on a small scale. The mean pig farming experience was 11.5years. Experience, they say is the best teacher. Coupled with the high level of education among farmers, they are enabled and properly equipped with needed knowledge to manage ASF and achieve profitability in pig production.

Table 1: Socioeconomic Characteristics of respondents

Socio–economic Characteristics	**Freq. (n=120)**	**%**
Age (years)		
<40	14	11.7
40-54	38	31.7
>54	68	56.7
Gender		
Male	90	75.0
Female	30	25.0
Marital Status		
Married	109	90.8
Divorced	11	9.2
Level of education		
No formal education	3	2.5
Adult Education	4	3.3
Primary Education	22	18.3
Secondary Education	48	40
Tertiary Education	43	35.8
Number of pigs kept		
<15	4	3.3
15-20	29	24.2
>20	87	72.5
Years of farm establishment		
<10	56	46.7
10-20	44	36.7
>20	20	16.7

Source: Field Survey, 2021

Pig Farming Characteristics of Respondents

The results in Table 2 expatiate on other pig related activities of respondents. All farmers were engaged in pig trading (buying and selling of pigs), almost all (96.7%) had pork kiosk and joints while three-quarter (75.8%) provided butchery service. The average number of pig kept were 4 breeding boars, 7 breading sows, 13 breading growers, and 18 breading piglets. This is an indication that majority of the farmers are investing into the continuity of their farm operations. In addition, all respondents adopt the confined breeding houses and had access to credit, the reason being attached to their membership in the cooperative society. Majority (91.7%) of the respondents had other sources of income.

Table 2: Respondents pig farming activities

Activities	**Freq.**	**%**	**Mean**
Other pig related activities of farmers			
Pig trading	120	100	
Pork processing	71	59.2	
Butchery	91	75.8	
Pork Kiosk	116	96.7	
Pork Joint	116	96.7	
Number of Breeding boars kept			4 breeding boars
Number of Breeding sows kept			7 breading sows
Number of Breeding growers kept			13 breading growers
Number of Breeding piglet kept			18 breading piglets
Housing type: Confined	120	100	
Access to credit facilities: Yes	120	100	
Other sources of farm income			
Yes	110	91.7	
No	10	8.3	

Source: Field Survey, 2021

Awareness on the Symptoms of African Swine Fever (ASF)

Conventionally, the level of awareness about the disease is a key determinant to possible treatment and prevention measures. Results Table 3 shows the level of knowledge of pig farmers about African swine fever. Results revealed that 89.2%, 89.2%, 85.8%, 82.5%, 84.2%, 57.5% had knowledge of ASF's general symptoms as well as specific symptoms such as; sudden death, appetite loss, abortion, breathing difficulties, and Redding of ears respectively. However, majority 93.3% of the swine farmers are still unaware of the possibilities of red loose skin as a symptom of ASF. This negates the findings of Omowon et al. (2019) were more than half of the surveyed respondents identified red loose skin as a symptom of ASF.

Table 3: Percentage distribution of respondents by awareness level of African swine fever

Symptoms	**Freq. (%)**
General Symptoms	107(89.2)
Sudden Death	107(89.2)
Appetite Loss	103(85.83)
Abortion	99(82.5)
Breathing Difficulty	101 (84.2)
Red Loose Skin	8(6.7)
Redding of Ears	69(57.5)

Source: Field Survey, 2021

Knowledge of Africa swine fever among pig farmers

Table 4 revealed results on farmers' knowledge about ASF. It was revealed that 91.7%, 63.3% had knowledge of ASF, its causes, and treatment measures. All the swine farmers know that ASF is contagious, causes decline in livelihoods and savings of farmers. More than half 55% knew that traditional control of ASF exists. This shows that farmers' had relatively appropriate knowledge about ASF, its causes and treatment measures.

Table 4: Percentage distribution of respondents based on knowledge on Africa swine fever

Knowledge of ASF	**Freq.(%)**
Knowledge of ASF	110(91.7)
Causes of ASF	76(63.3)
Treatment	73(60.8)
Farmer Loss due to Swine Fever	93(77.5)
Whether ASF is Contagious	120(100)
Decline in farmers savings due to ASF	120(100)
Decline in farmers livelihood	120(100)
Traditional Control of ASF	66(55.0)

Source: Field Survey, 2021

4.4 ***Carcass disposal management as a measure of ASF prevention***

Table 5 presents the results of pig farmers refuse disposal management systems. Less than half of the respondent (42.5%) had carcass disposal point (CDP). This puts most of the farmers at jeopardy whenever the fever strikes. The various types of CDP available to farmers are 87.5%, 42.5%, 15.8%, 75.0%, 54.5% for disposal of carcass by bush burning, burying, chemical use, throwing away in bush, and selling off respectively. This implies that

the measure of disposal put in place by most farmers are far from adequate to being an effective measure for the prevention of ASF.

Table 5: Distribution of pig farmers' carcass disposal management system

Method of Carcass disposal	Freq.	%
Availability of Carcass Disposal Point	51	42.5
Disposal by Bush burning	105	87.5
Disposal by burying	51	42.5
Disposal by Chemical Use	19	15.8
Disposal by throwing in the bush	90	75.0
Disposal by Selling off	69	57.5

Source: Field Survey, 2021

Economic Impact of ASF on Cooperative Farmers

Table 6 shows the economic impact of ASF on farmers who were members of the surveyed cooperative society. Results from the study revealed that the percentage of respondents usually affected by the outbreak of ASF is high. This is evident with the fact that swine farmer's capital before the fever showed that almost all (91.0%) respondent was not affected or slightly affected, and about three-quarter of the respondent's capital (78.0%) was severely affected after the fever struck. 43% of the boar swine were severely affected, 44% were averagely affected, while the remaining 12% were slightly affected. This shows that none of the animals had resistant against ASF. The same goes for the sow swine. The feed intake was severely affected by almost a three-quarter (73%), 22% averagely affected with the remaining 5% slightly affected. The animal's productivity was severely cut by almost a three-quarter (74%), 20% declined averagely, while the remaining 5% had slight reduction in productivity. The implication of this is that ASF had strong economic impact on farmers' capital, productivity and invariably livelihoods. This finding corroborates that of Swai and (Kirschner, 2016), who concluded after a survey of 1085 small-holders' farmers that ASF is a deadly and devastating disease that could disrupt the entire pig industry as well as the local economy.

Table 6: Economic impact of ASF epidemic on corporative farmers

Economic impact	SA	AA	SA	NA
Cooperative pig farmers capital affected before the outbreak	**11 (9.2)**	**6 (5.0)**	**31 (25.8)**	**72 (60.0)**
Pig farmers capital affected by the outbreak	**94 (78.3)**	**23 (19.2)**	**3 (2.5)**	**0 (0.00)**
Boar swine affected by ASF	**52 (43.3)**	**53 (44.2)**	**15 (12.5)**	**0 (0.00)**
Sow swine affected by ASF	**52 (43.3)**	**53 (44.2)**	**15 (12.5)**	**0 (0.00)**
Feed intake of swine	**87 (72.5)**	**27 (22.5)**	**6 (5.0)**	**0 (0.00)**
Productivity	**89(74.2)**	**34(20)**	**5(4.2)**	**0 (0.00)**

Source: Field Survey, 2021

Constraint to Treatment of ASF

Although the majority of farmers were aware of the fever, its causes and symptoms. However, majority is faced with a number of constraints to treating ASF ranking from inadequate knowledge about indigenous treatment measures that are cheap and easy to adopt, through non accessibility to disease database, difficulty with access to vaccine, lack of committed personnel in Virus lab to efficiently diagnose diseases, and finally poor carcass disposal system. The study revealed inadequate knowledge about indigenous treatment measures as the most concerning constraint as all the respondents voted yes for this variable. Almost all, 97.5% agreed that non accessibility to disease database was a major hindrance, 97% agreed that lack of committed personnel and difficulty with vaccine development were constraints, while 88%-pointed poor husbandry practices amongst farmers as constraint. This goes in line with the findings of (Swai & Lyimo, 2014) and (Omowon *et al.* 2019) who pinpointed good husbandry practices and biosecurity practices among pig farmers to be deficient among farmers.

Table 7: Percentage distribution of respondents on constraints to ASF treatment

Constraints to ASF treatment by cooperative farmers	Freq.(%)
Lack of committed personnel in Virus lab to efficiently diagnose disease	116(96.7)
Difficulty in access to vaccine development	116(96.7)
Non accessible disease database	117(97.5)
Poor carcass disposal	106(88.3)
Inadequate knowledge on indigenous treatment	120(100)

Source: Field Survey, 2021

Test of relationship between cooperative swine farmers' socio-economic characteristics and farmer's awareness, knowledge, and management of African swine fever

Table 8 tested the relationship between the socioeconomic characteristics of corporative swine and their awareness level to ASF. The results showed that age (χ^2= 88.173) sex (χ^2=49.389) marital status (χ^2=21.294) educational level (χ^2=169.235) religion (χ^2=54.431) primary occupation (χ^2=198.964) and primary source of income (χ^2= 355.085) were significant ($p<0.01$) determinants of farmers awareness and knowledge about African swine fever. The result showed that all variables are significant at 1% ($p\leq0.01$) level allowing the study to accept the alternative hypothesis that significant relationships exist between socioeconomic characteristics of respondents and the knowledge of African Swine Fever except for marital status which is significant at 5% levels ($P\leq0.05$). Only number of pigs owned and years of farm experience exhibit statistical insignificance with farmers ASF awareness levels. The implication of this is that whether or not a farmer's pig stock is large or small does not provide immunity against being strike by ASF. In another vein, the number of years of farmer's experience has no link with their level of awareness to ASF.

Test of correlation analysis of constraint to ASF treatment and swine productivity

Table 9 presented the correlation analysis of constraints to ASF treatment and swine productivity. Results from the analysis showed that both variables are statistically correlated to one another i.e. there is the presence of joint movements between the variables. The r-coefficient is -0.362, which indicates a negative relationship between constraints to ASF treatment and swine productivity. Thus, an increase in treatment constraints levels will result in a decrease in the economic benefits accruing to farmers. Also, the p-value stood at 0.000 ($P\leq0.01$) necessitating the acceptance of the alternative hypothesis that there is a statistical significant relationship between treatment constraint levels and economic factors.

Table 8: Test of relationship between cooperative swine farmers' socio-economic characteristics and farmers' awareness, knowledge and management of African swine fever

Variables	χ^2	df	p-value	Decision
Age	88.173	3	0.000*	S
Sex	49.389	2	0.000*	S
Marital status	21.294	3	0.019**	S
Educational level	169.235	3	0.000*	S
Primary Occupation	198.964	4	0.000*	S
Primary Source of Income	355.085	4	0.000*	S
Years of Farm Establishment	0.256		0.091	NS
Number of Pigs	0.101		0.271	NS

Table 9: Test of correlation between constraint to ASF treatment and economic factors

Hypothesis	r	p-value	Decision
Constraint factors to economic factors	-0.362	0.000*	S

*S=significant at 0.01

4. CONCLUSION

Based on the findings from the study, the following conclusions were: The cooperative pig farmers were aware of ASF pandemic in the study area, cooperative pig farmers had a negative economic impact of African Swine Fever on their income and livelihoods, there also exist a considerably significant levels of ignorance about ASF indigenous treatment measures among majority of pig-farmers and Cooperative pig farmers were constrained by the management of ASF.

Based on the foregoing, the following recommendations were made: The veterinary medical personnel, extension agents and research institutes that into should put more effort to sensitise the Pig farmers more on ASF to manage the spread of disease outbreak, efforts should be on top gear by the cooperative pig farmers to subsume the effects of ASF on pig production, cooperative pig farmers should imbibe the cultural practices and indigenous knowledge to tackle the ASF pandemic and cooperative pig farmers should be encourage and support by the government and NGOs for more facilities and contingency fund to protect the pig production.

5. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interests regarding the publication of this article.

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