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Assessment of Extent of Bio-Security Awareness and Implementation among Pig Farms in Enugu North Local Government Area of Enugu State. Nigeria

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Abstract: *The study was carried out to assess the extent of bio-security awareness and implementation among pig farmers in Enugu North Local Government Area of Enugu State. The research focused on three bio-security goals. They include; Pathogen Isolation, pathogen Traffic Control and Sanitation/Disease control. The research adopted a survey design which sought information from 100 Small Scale and 100 Large Scale pig Farms in the area. Thirty questionnaire items were constructed after a review of the related literature. The data collected were analyzed with descriptive statistics involving the use of means and standard deviation. T-test was used to test the hypotheses formulated to guide the study. Results of analyses reveal no significant difference ($p>0.05$) in the mean scores of both Small Scale and Large Scale pig Farms on their extent of awareness and application/implementation of bio-security measures. However the results reveal some lapses on bio-security applications in all the farms visited as many areas of bio-security were neglected. Some crucial bio-security principles and measures were grossly abused. These include enquiring to know if visitors had visited other farms before coming to the farm, provision of insect screens to ward off flies and other insects, provision of farm canteen at the farm entrance, provision of separate clothings and boots for each pen, provision of footbaths and hand washing facilities and a host of others, On pathogen traffic control, the farms were found to do well in such areas as provision of waste management area far away from the farm and separation of pigs according to age. However, other areas were also neglected. These include, provision of sign-in/sign-out register for visitors, bio-security warning signs, provision of load-out parks, restriction of movement of other vehicles into the farm etc.*

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I. Introduction

Keeping livestock healthy is the keystone to any livestock production. Healthy animals grow better, reproduce more efficiently and produce more economically valuable products. Unhealthy animals cause the producer to spend more money on health inputs and veterinary bills as well as more time in managing the stock, and often produce less or poor quality products which may lead to economic loss. Thus, diseases make production and profitability in livestock ventures impossible. Bio-security refers to procedures, efforts or programs aimed at reducing the risk of disease infection and spread in livestock farms (Conner, 2001; Dorea*et al*, 2010). Following the natural presence of pathogens everywhere, it is not possible to exclude disease totally from a herd,. The aim of any bio-security program is therefore to keep out pathogens that the herd has not been exposed to, and to minimize the impact of endemic pathogens (Conner, 2001; Defra, 2005a).

Chiduwa*et al*, (2008), identified Internal Bio-security as measures used to protect a farm from both entry of disease pathogens and internal transfer among different areas of the farm, ie efforts performed to prevent the spread of a disease within the farm herd and to other farms. These authors also identified External Bio-security as all activities done to preclude the introduction of disease to the farm. Hence, bio-security is presented under two components; Bio-exclusive (external bio-security) and Bio-containment (internal bio-security). External bio-security is concerned with keeping pathogens off the herd (Segregation), while internal bio-security or disease control (Cleaning and Disinfection) prevents the spread of disease mainly from older to younger animals within the herd (Dee et al, .2004).. In general, geographical location of the farm and pig density in a given areas are two significant factors in the epidemiology of several disease transmissions. These factors will influence the planning of a bio-security program within a herd (Anderson, 2002).

Most livestock pests are capable of introducing and spreading disease on a farm. It is important to control rodents and insects. Both flying and crawling insects can serve as intermediate hosts for some internal parasites.

Rodents can feed on spilled feed and may leave behind feces containing agents that can infect both humans and livestock, hence keeping a clean feed store and environment will ensure that you identify potential pest problems quickly and respond with control measures in a timely manner, (webinar on bio-security-https://learn.extension.or/events/1995.2. Purpose of the Study

The main purpose of this study is to assess the extent of bio-security awareness among pig farmers in Enugu North Local Government Area of Enugu State.

Specifically, the study will assess;

I. The extent of application of pathogen isolation measures in pig farms.
II. The extent of application of pathogen traffic control measures in pig farms.
III. The extent of application of disease control / sanitation measures in pig farms.

3. Research Questions

The following research questions guided the study;

I. What is the extent of pathogen isolation measures in large and small scale pig farms in Enugu North Local Government Area o Enugu State?
II. What is the extent of pathogen traffic control measures in pig farms in Enugu North Local government Area of Enugu State?.
III. What is the extent of disease control measures in pig farms in Enugu North Local Government Area of Enugu State?.

4. Hypothesis

The following null hypothesis guided the study:

HO1, There is no significant difference in pathogen isolation measures in both large and small scale pig farms in Enugu North Local Government Area of Enugu State.

HO2, There is no significant difference in pathogen traffic control measures in both large and small scale pig farms in Enugu North Local Government Area of Enugu State.

HO3, There is no significant difference in disease control measures in both large and small scale pig farms in Enugu North Local Government Area of Enugu State

II. Research Methodology

Research Design: The study adopted a Survey Research Design. A survey research according to Awokeni, (2002) is one in which a group of people is studied by collecting data through the use of questionnaires on a few people considered to be representatives sample of the entire group. The design was considered to be a suitable since the study intends to seek information on the level of bio-security awareness and implementation by pig farmers in the area.

Population of the Study: The population comprised of at one hundred (100) Small Scale Farms and one hundred (100) Large Scale Farms in Enugu North Local Government Area of Enugu State, Nigeria. Farms with less than fifty (50) pigs were regarded as Small Scale while farms with fifty (50) pigs and above were regarded as Large Scale.

Method of Data Collection: The researcher administered the questionnaire to the respondents and made sure the questionnaire were filled in-situ (on the spot) to avoid missing questionnaire or the issue of non-returned questionnaire. It was designed in simple English Language to enable the farmers understand all the questions asked.

Instrumentation: The instrument for data collection was a structured questionnaire identified as Bio-security Awareness Survey Questionnaire (BASQ). The questionnaire items were generated after a review of literature on bio-security. The questionnaire consisted of two (2) sections A and B. Section A solicited for personal information on the respondents while Section B sought information on research questions which consisted of 30 items on a 4 points grade scale of; Very Great Extent (VGE), Great Extent (GE), Little Extent (LE), and Very Little Extent (VLE).

Method of Data Analysis: Descriptive statistics involving the use of means and standard deviation were used to answer the research questions while t-test was used to test the null hypotheses formulated to guide the study. The decision rule is that any item that has a mean value of up to 3.5 were regarded as "Very Great Extent", mean values from 2.5 to 3.4 were regarded as "Great Extent", while values from 1.5 to 2.4 were regarded as "Little Extent". Mean values of less than 1.5 were regarded as "Very Little Extent".

For hypothesis, if the t-calculated (t-cal) is equal to or greater than the t-tabulated (t-tab) of 1.96, the hypothesis is said to be significant. But if the t-cal is less than the t-tab of 2.03, the hypothesis is not significant and so the null hypothesis holds.

III. Results and Discussion

Research Question 1:

What is the extent of Pathogen isolation measure in pig farms in Enugu North Local Government Area of Enugu State?

Table Ia; Mean scores for Small and Large Scale Pig farms on the extent of their implementation of Pathogen Isolation Measures

S/No	ITEMS	Mean score for small scale farm	Mean score for large scale farm	Mean	Standard Deviation	Decision
1.	The farm has a very high perimeter fence that keeps off both wild animals and humans?	1.97	3.17	2.57	0.6	G.E
2.	The farm has a quarantine unit?	1.27	2.5	1.89	0.62	L.E
3.	There are farm cloths and shoes for visitors?	1.16	2.17	1.66	0.51	L.E
4.	Farm workers and visitors never have contacts with other farms before entering the farm?	1.49	1.39	1.44	0.05	VLE
5.	The farm is located at least 500 yards away from other pig farms?	2.51	2.89	2.70	0.19	GE
6.	The farm has insect screen that ward off flies and other insects?	1.54	1.89	1.71	0.18	LE
7.	The nearby environment is constantly weeded to keep out rodents?	3.57	3.67	3.62	0.05	VGE
8.	There is farm canteen or kitchen at the farm entrance?	1.49	1.17	1.33	0.16	VLE
9.	The farm has a well established sick pen for sick animals?	1.86	3.22	2.54	0.68	LE
10.	There are separate cloths and boots for each pen?	1.38	2.06	1.72	0.34	LE
GRAND MEAN		**1.82**	**2.41**	**2.12**	**3.38**	**LE**

Table 1 presents the extent of awareness and implementation of pathogen isolation measures in pig farms in Enugu Urban Area of Enugu State. The results from the table reveal poor awareness or implementation this most important bio-security measure. The overall score was to a little extent. It is only one (weeding of nearby bushes) out of the ten items in pathogen isolation measures that the farms were rated to a Very Great Extent (VGE). In two items they were rated to a Great Extent (GE), while in five items, they scored Little Extent and in two items, they were rated to a Very Little Extent (VLE).

Hypothesis Analysis and Results;

A t-test of significance was carried out to test the first hypothesis on the farms implementation of pathogen Isolation Measures;

Table 1b; Showing the t-test results of farmers' implementation of Pathogen Isolation Measures

	Small Scale Farms	Large Scale Farms	Mean	SD	T-tab	T-cal	Decision
Grand Mean	**1.82**	**2.41**	**2.12**	**3.38**	**2.03**	0.62	Accepted

From table 1b above, the t-calculated is 0.62. This is less than the t-tabulated of 2.03. Therefore, the null hypothesis holds, and so there is no significant difference ($p>0.05$) in the implementation of pathogen isolation measures in both Small and large Scale pig farms in Enugu North Local Government Area of Enugu State.

Research Question2:

What is the extent of Pathogen traffic control measures in pig farms in Enugu North Local Government Area of Enugu State?

Table 2a; Mean scores for Small and Large Scale Pig farms on the extent of their implementation of Pathogen Traffic Control Measures

S/no	Items	Mean score for small scale farm	Mean score for large scale farm	Mean	Standard Deviation	Decision
1.	There is a large bio-security sign at the entrance of the farm?	1.68	3.22	2.45	0.77	LE
2.	Enquiry is always made to know if visitors had visited other farms within 24 hours?	1.05	2.44	1.75	0.70	LE
3.	The farm has footbaths at the entrance of each pen?	1.24	2.44	1.84	0.6	LE
4.	The farm has waste management area very far away from the farm?	2.84	3.17	3.00	0.17	GE
5.	Only farm vehicles are allowed to move between the load out park and production units?	1.35	2.33	1.84	0.48	LE
6.	The farm has load out park outside the farm?	1.27	2.39	1.83	0.56	LE
7.	The cleaning of the load out park is always done after close of work?	1.16	2.22	1.69	0.53	LE
8.	There a sign-in-book for visitors containing where they had visited in the last 24hours?	1.0270	1	1.0135	0.02	VLE
9.	The pigs are always separated according to their age and not by size?	3.3783	3.8888	3.63355	0.26	VGE
10.	Feed and water sources of the animal are always scrutinized for infection before giving it to the animals?	3.38	3.83	3.89	0.06	VGE
Grand Mean		**1.89**	**2.69**	**2.29**	**4.15**	**LE**

The above table also reveals poor awareness or implementation of pathogen traffic control measures pig farms in Enugu North Local Government Area. It was only in one area did farms score Very Great Extent (VGE) and in one item, the farms were rated to a Great Extent (GE), while in six items, the farms were rated Little Extent (LE). On one item, they were rated Very Little Extent (VLE). The overall rating on Traffic Control was Little Extent.

Hypothesis Analysis and Results:

A t-test of significance was carried out to test the second hypothesis on the farms implementation of pathogen Traffic Control Measures;

Table 2b; Showing the t-test results of farmers' implementation of Pathogen Traffic Control Measures

	Small Scale Farms	Large Scale Farms	Mean	SD	T-tab	T-cal	Decision
Grand Mean	**1.89**	**2.69**	**2.29**	**4.15**	**2.03**	0.78	Accepted

From table 2b above, the t-calculated is 0.78. This is far less than the t-tabulated of 2.03. Thus the null hypothesis is accepted and so there is no significant difference ($p>0.05$) in the implementation of Pathogen Traffic Control in both Small and Large Scale pig farms in Enugu Urban Area of Enugu State.

Research Question 3:

What is the extent of disease control and sanitation measure in pig farms in Enugu North Local Government Area of Enugu State?

Table 3: Mean scores of Small and Large Scale pig farms on the extent of their implementation of Sanitation/Disease Control Measures

S/no	Items	Mean score for small scale farm	Mean score for large scale farm	Mean	Standard Deviation	Decision
1.	The sick pen is located at least 500 yards away from the healthy pen	1.27	1.61	1.44	0.17	VLE
2.	The farm has a well established rendering service for dead carcass?	1.68	3.01	2.34	0.66	L E
3.	Waste removal is done by farm personnel and with farm vehicle only?	3.03	3.78	3.40	0.38	GE
4.	There are separate cloths and boots for each pen?	1.24	2.17	1.70	0.47	LE
5.	The farm has daily chores schedule from highest to the lowest health status?	2.73	3.67	3.20	0.47	GE
6.	All vehicles entering the farm are thoroughly washed, cleaned and disinfected	1.38	2.06	1.72	0.34	LE
7.	There is provision for hand washing and foot dips for all visitors at the farm entrance?	1.49	2.89	2.19	0.7	LE
8.	Personal hygiene of the staff and workers are encouraged	1.76	2.94	2.35	0.59	LE
9.	The farm has showers and dryers for farm personnel and visitors usage	1.39	2.22	1.81	0.42	LE
10.	The farm personnel attend to the younger pigs first before attending to the older ones.	2.86	3.67	3.27	0.41	GE
Grand Mean		**1.88**	**2.80**	**2.34**	**4.61**	**LE**

Table 3b above also show poor awareness and implementation of disease control/sanitation in pig farms visited, the farms were rated to a Great Extent (GE) in only three items. While in six items, they were rated to a Little Extent (LE). In one item, they scored Very Little Extent (VLE). The overall rating in Sanitation was also "Little Extent"

Hypothesis Analysis and Results;

A t-test of significance was carried out to test the third hypothesis on the farms' implementation of Sanitation/Disease Control Measures;

Table 3b; Showing the t-test results of farmers' implementation of Sanitation/Disease Control Measures

	Small Scale Farms	Large Scale Farms	Mean	SD	T-tab	T-cal	Decision
Grand Mean	**1.88**	**2.80**	**2.34**	**4.61**	**2.03**	0.901	Accepted

From table 3b above, the t-calculated is 0.901. This is less than the t-tabulated of 2.03 for the ten question items and so the null hypothesis is accepted. Thus there is no significant difference ($p>0.05$) in the implementation of sanitation/disease control measures in both small and large scale pig farms in Enugu Urban Area of Enugu State

IV. Discussions

The results from the table 1 reveal poor awareness or implementation of pathogen isolation measures in Enugu North Local Government Area of Enugu State. The overall score was "Little Extent". It is only in weeding of nearby bushes that the farms were rated "Very Great Extent" (VGE). They were rated "Great Extent" (GE) in two areas of having very high perimeter fence and location of the farm at least 500 yards away from other pig farms. However, they were rated very poor in the other areas such as: having a quarantine unit, having a well established sick pen, having farm clothing and shoes for visitors, having insect screen, and provision of separate cloths and boot for each pen, enquiring to know if visitors had contacts with other pig

farms before entering the farm and establishment of farm canteen or kitchen at the farm entrance. These findings were not encouraging as most pig disease are spread from farm to farm through these roots (Stringham 2003). Kingborg (2008), states that most disease outbreak in pig farms are as a result of farmers poor application of pathogen isolation measure. Also, Gifford (1987), Thomson (1997), Garry (2000), etc maintain that consistent use of high quality bio-security system is essential to the success of any type of livestock in any sector of agriculture.

Table 2 presents a fair rating for the farmers in the application of pathogen traffic control measures. In two areas, they were rated "Very Great Extent" (VGE) such as separation of pigs according to age and not by size, and securitization of feed and water. They were also rated "Great Extent" (GE) in provision of waste management area far away from the farm. However, the farmers application of pathogen traffic control measures were rated very poor in the other areas such as: provision of large bio-security notice at the entrance of the farm, enquiring to know if visitors had visited other farms in the 24 hours, having footbaths at the farm entrance, allowing vehicles to move between the load out park and production unit, having a load out park outside the farm, cleaning of the load out park always, having a sign-in-book for visitors. These findings agree with Amass S.F. (2008) that the un-controllable spread of diseases witnessed in Nigeria pig farms, were as a result of farmers' neglect of the basic bio-security principles. It follows that the first step towards disease eradication and control is adequate adherence to the traffic control measures identified in this work.

Table 3 presents a disappointing rating in farmers' application of disease control and sanitation measures. The areas where they were rated "Great Extent" (GE) include: having waste removal done by farm personnel and farm vehicles only, having their daily chores schedule from highest to the lowest status, farm personnel attending to the younger pigs first before the older ones. However, in some other areas, the farmers' level of disease control and sanitation were rated very poor. These include: presence a well established rendering service for dead carcass, having a separate cloths and boots for each pen, having all vehicles entering the farm thoroughly washed, cleaned and disinfected, provision of hand washing and foot dips for all visitors at the farm entrance, having a personal hygiene of staffs or workers well encouraged, provision of showers and dryers for personal and visitors usage, location of sick pen at least 500 yards far away from the healthy pen. These findings were very disappointing in the Agricultural sector and this is in consonance with Kingborg (2008), who reported that most of the disease transmissions in animal farms is as a result of farmers' ignorance on the application of adequate sanitation and disease control measures coupled with improper establishment of boundaries between two farms. Therefore, in order to avert disease infestation in the farms, farmers should maintain adequate disease control and good sanitation measures (Regland, *et al* 2008).

V. Conclusions

This study which was designed to assess the extent of awareness and application of bio-security measures in pig farms in Enugu Urban Area of Enugu State revealed major lapses in the implementation and application of the three important areas of bio-security which includes Pathogen Isolation, Pathogen Traffic Control and Sanitation/Disease Control. The score of the farms in these areas were highly disappointing. This explains the reasons for rapid spread and high incidence of swine epidemics in Nigeria. There is therefore the need to enlighten the farmers on the importance of bio-security in disease control and eradication. The findings of this study will help farmers in the study area and other areas to make proper plans for disease prevention before investing in any livestock enterprise, especially pig production. The study will serve as a source of information to livestock farmers and to other researchers. Most of all, the study is a source of dependable information in minimizing the economic losses following disease infestation leading to economic losses and animal product insecurity.

VI. Recommendations

The study revealed lapses on farmers implementation of biosecurity principles in disease prevention and eradication. Healthy animals grow better, reproduce more efficiently and produce more economically valuable products and saves the producer money on health inputs and veterinary bills as well as more time in managing the stock.

It therefore implies that there is need to educate livestock farmers to introduce preventive practices in order to limit the incidences and prevalence of disease infestation in their various farms. Training should be organized for all categories of livestock farmers particularly those operating on small scale, to keep them abreast of livestock bio-security measures.

Extension agents should make trainings on bio-security practices part of their livestock extension packages, and also, Government should recruit more and competent agricultural extension agents especially livestock extension personnel.Furthermore, the study focused on pig production. Thus there is the need for similar studies to be conducted on poultry and other areas of livestock production so as solve the problem of animal protein in the country.

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