

The characteristics of small-scale pig production at peri-urban and rural locations in Imo State, Southeast Nigeria

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ABSTRACT: This study aimed to examine the socio-cultural characteristics of farmers, farming structure, reproductive and health practices in small-scale pig farms at peri-urban and rural areas in Imo State, southeast Nigeria. Primary data were collected through questionnaires distributed to 25 pig farmers at the peri-urban farms and rural farms of Imo State. The results of the survey revealed that pig houses were mostly made of concrete block (96.89%), and corrugated iron roofs. Labour demand was higher at the peri-urban than rural farms (82.35 and 53.33% respectively), while there was a general low engagement of experts for diet formulation (25.5% overall). The stocking rate was mostly 11 - 50 pigs (50.00%) and above 100 (40.63%), and are mostly exotic large white breed (65.63 %), landrace and duroc Jessie breeds (12.50% each). peri-urban farmers mostly stock 1 - 3 boars (76.47%) compared to 46.67% in the rural farms. The distribution of sows, gilts and in-pigs in the farms was, however, relatively similar across both locations. The major health conditions encountered were diarrhea (96.75% mention here), worm infestation (78.13%), and foot rot (96.88% overall respectively), trypanosomosis (50.00% in peri-urban), mange and mites (46.88% overall), swine fever (58.82 and 20.00% respectively), bacterial and respiratory infections (52.94 and 13.33% respectively). The common drugs used in the management of health conditions included ivermectin (96.88% overall), iron dextran (96.88% overall), vitamins, and antibiotics injections (87.50% overall each), and trypanosides (60.00% rural farms), among others. There are, therefore, significant variations in farming practices between peri-urban and rural farms in Imo state, which require careful consideration before implementing reproductive and health management interventions.

Keywords: Animal diseases, peri-urban farming, pig farmers, select the most appropriate.

INTRODUCTION

Pig production has increased in recent times in the southern and north-central states of Nigeria in response to the animal protein needs of an increasingly urbanising population. The World Bank (2017) estimates show that about 10 million rural and peri-urban households in Nigeria are engaged in pig farming and allied activities, indicating its important role in the economic well-being and food security in the country (World Bank, 2017).

Pig production is particularly popular in southern Nigeria because of the inherent ability of the animal to convert the abundant and cheap agro-industrial by-products or wastes such as palm kernel cake, palm oil sludge, brewers' spent grain, abattoir wastes and cereal offal, among others, into relatively cheap animal protein (Tonukari *et al.*, 2016;

Ohanaka *et al.*, 2017; Ume *et al.*, 2018). Pig production is attractive to small-scale farmers because pigs are polytocous and multiparous in nature, and therefore guarantee a quicker return on investment when compared to other livestock (Ume *et al.*, 2019; Ajibo *et al.*, 2020). Small-scale piggeries have therefore become an important source of employment, poverty alleviation and food security among rural and peri-urban populations in most southern states of Nigeria (Kadurumba *et al.*, 2019; Ume *et al.*, 2019; Onyekuru *et al.*, 2020).

Several studies have specifically reported the increasing importance of piggery in Imo state, southeastern Nigeria (Ume *et al.*, 2018; Kadurumba *et al.*, 2020; Ewuziem, 2021; Edo *et al.*, 2021a). Pig production approaches in the

state tend toward input-driven small and medium-scale intensive commercial operations that require the use of locally available raw materials as feed for the animals (Okoli *et al.*, 2009; Ohanaka *et al.*, 2017). An increasing rate of transition from many small farms to a handful of very large farms in the state has, however, been observed in recent times (Edo *et al.*, 2021a). The most popular breeds reared in the farms in recent years are the exotic breeds (Izunobi, 2006; Okoliet *al.*, 2009), which are adapted to the intensive production practices of the farmers. The stocking, feeding, and labour costs are significant factors that influence pig production in the state, with the enterprise being profitable even with little capital investment (Edo, 2023). Disease outbreaks, high cost of feedstuffs and waste disposal challenges are the major constraints to profitable pig farming in southern Nigeria (Bawa *et al.*, 2004; Uddin and Osasogie, 2016; Edo *et al.*, 2021b). Other constraining factors include poor access and high interest rates on credit facilities, poor animal healthcare service delivery, and labour, inefficient reproductive practices, poor access to research information and extension services, lack of market organisation and low technology adoption by farmers (Abiola *et al.*, 2015; Kadurumba *et al.*, 2020). Exotic breeder pigs fed such feeds in small, medium and large-scale farms in Imo State recorded significant variations in weight gain during gestation, birth weight of piglets, litter size, and little change in body weight during lactation, indicating variations in reproductive practices and outcomes across farms (Okoli *et al.* (2018). Edo *et al.* (2021a) have also reported that disease burden is a major constraint to profitable pig production in Imo State. Nwanta *et al.* (2011) had earlier listed piglet diarrhoea, helminthiasis and ectoparasitism as the major disease problems among the pig populations in southeastern Nigeria, and linked their incidence to poor health management practices. Nigeria has also experienced repeated outbreaks of African swine fever among the pig population at several locations in southern Nigeria, including Imo, Abia, Enugu and Ebonyi states in Southeastern Nigeria (Awosanya *et al.*, 2021; Masembe *et al.*, 2022; Okoli and Mogaji, 2022).

As urbanisation and urban populations increase in sub-Saharan Africa, the tendency for livestock intensification practices to increase at locations surrounding the urban centres that boast of improved infrastructure and nearby ready markets has been observed (Amadou *et al.*, 2012; Dossa *et al.*, 2015). Although there are no specific published reports comparing urban and rural pig farming in Nigeria, Idoko (2023) reported differences in productivity and yield, economic viability and financial sustainability as well as social and environmental impacts among urban and rural farming enterprises in Nigeria. There is therefore a need to study the dynamics of pig production at these two types of farming environments in order to generate the essential data for intervention strategies.

This paper determined the socio-cultural characteristics

of farmers, farming structure, reproductive and health practices in small-scale pig farms at peri-urban and rural sites in Imo State, Nigeria.

MATERIALS AND METHODS

Study area

The study was carried out at peri-urban sites in Owerri West Local Government Area (LGA) in the western part of Imo State, and rural sites in Aboh-Mbaise LGA, located in the south-western part of the state in the southeastern agro-ecological zone of Nigeria (Figure 1). The LGAs are separated by Owerri North and Ngo-Okpala LGAs. Imo state is located between latitude 6 and 8°N of the equator, and longitude 5.83 and 6°E of the Greenwich meridian. It has a land area of about 5,530 Km², a population of about 5.4 million persons and a population density of 1063/Km² (NPC, 2006 Projections, 2022). Aboh-Mbaise LGA hosts an estimated population of 270,700 persons on a land area of 183.0 km² and has a population density of 1063/km², while Owerri West LGA has a population of 141,400 residing on a land area of 286.8 km² and has a population density of 493.1/km².

Data collection

An informal survey was carried out prior to the actual study, during which the researchers made themselves known to pig farmers and extension officers in the state and discussed the details of the work with them. Based on this study, two LGAs in the state were purposively selected for the actual study based on their high population of pig farms and proximity to the researcher. The purposively selected LGAs were Owerri West and Aboh-Mbaise. At each of these locations, 25 pig farms were again purposively selected based on their willingness to participate in the study, and having at least 10 pigs in the farm at the time of the study, thus making 50 farms for the state. Primary data were collected through the aid of a well-structured questionnaire, farm observations, contact with farmers, and on-site measurements. The questionnaires were distributed to the farmers irrespective of gender, although there were more male pig farmers at the locations than females. The farms were visited twice, firstly to distribute the questionnaires and secondly to retrieve them. On the whole, only 32 questionnaires were returned by the farmers out of the 50 distributed.

Data analysis

The data generated were subjected to descriptive statistics such as frequency counts, means and percentages, and presented in tables.

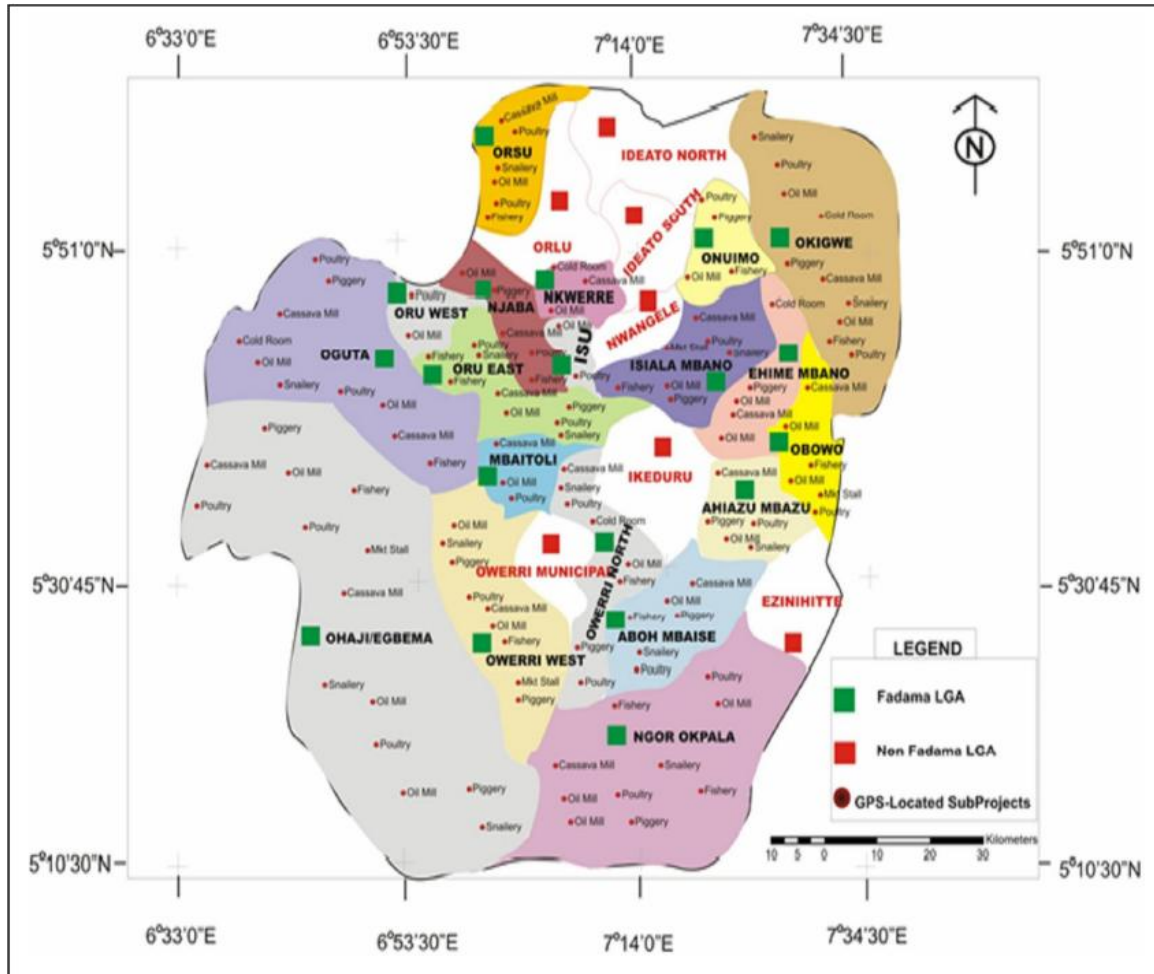


Figure 1. Map of Imo State FADAMA III Project (Source: FSCO, Imo State Record, 2010).

RESULTS AND DISCUSSION

Socio-cultural characteristics of farmers

The socio-cultural characteristics of pig farmers at the peri-urban and rural locations in Imo state are shown in Table 1. Of the 25 farms surveyed at each location, only 17 and 15 farmers, respectively, returned the survey instruments, making a total of 32 farms. Overall, the farmers were mostly males (93.75%), with no female farmers featured at the rural location. Edo *et al.* (2021a) reported a slightly different 66.67 and 33.33% male and female pig farmers, respectively, in a broader study covering three agro-ecological zones of the state. Male dominance of pig farming has also been consistently reported in the state (Okoli *et al.*, 2009; Kadurumba *et al.*, 2020) and has been attributed to the labour-intensive nature of the enterprise, which females may not be able to cope with (Ume *et al.*, 2018).

The age of the farmers fell mostly within the 31 -60 years cohort (70.59, 73.33 and 71.88% for peri-urban, rural and overall, respectively), indicating similarities at the two

study locations. Most of the farmers were married (76.47, 80.00, 78.13% for peri-urban, rural and overall, respectively). Okoli *et al.* (2009) and Ume *et al.* (2018) have also reported similar age and marital status results for pig farmers in the Owerri and Okigwe areas of the state, respectively. The popularity of pig farming among the youth age bracket in the country in general has been attributed to its profitability, such that married persons view it as a viable means of enhancing family income (Chah *et al.*, 2014; Kadurumba *et al.*, 2020; Edo *et al.*, 2021a).

The peri-urban farmers were mostly educated at the tertiary level (64.71%), while the rural farmers were mostly educated at the secondary school level (73.33%), indicating a disparity in the educational qualifications of the farmers. None of the farmers were illiterate, while only 9.38% were educated at the primary school level, indicating that the pig farmers are literate and will therefore be responsive to innovations and new technologies needed in modern pig farming (Kadurumba *et al.*, 2020). Pig farmers in the state have been generally reported to be literate (Ewuzie *et al.*, 2009; Okoli *et al.*, 2009; Ume *et al.*, 2018), although Edo *et al.* (2021a) reported a much

Table 1. Socio-cultural characteristics of pig farmers at the peri-urban and rural sites.

Parameters	Peri-urban (n=17) Frequency (%)	Rural (n=15) Frequency (%)	Overall (N=32) Mean Frequency (%)
Sex			
Male	15 (88.24)	15 (100.00)	30 (93.75)
Female	2 (11.77)	—	2 (6.25)
Age			
20–30	1 (5.88)	3 (20.00)	4 (12.50)
31–40	5 (29.41)	4 (26.67)	9 (28.13)
41–50	3 (17.65)	3 (20.00)	6 (18.75)
51–60	4 (23.53)	4 (26.67)	8 (25.00)
Above 60	4 (23.53)	1 (6.67)	5 (15.63)
Marital status			
Married	13 (76.47)	12 (80.00)	25 (78.13)
Single	4 (23.53)	3 (20.00)	7 (21.88)
Education qualification			
Primary	1 (5.88)	2 (13.33)	3 (9.38)
Secondary	5 (29.41)	11 (73.33)	16 (50.00)
Tertiary	11 (64.71)	2 (13.33)	13 (40.63)
Nil	—	—	—
Tertiary education	n=11	n=2	n=13
Agriculture	—	—	—
Animal science	—	—	—
Animal health	1 (9.09)	—	1 (7.69)
Others	10 (90.91)	2 (100.00)	12 (92.31)
Years of experience			
1–5	8 (47.06)	3 (20.00)	11 (34.38)
6–10	3 (17.65)	1 (6.67)	4 (12.50)
11–15	2 (11.77)	10 (66.67)	12 (37.50)
16–20	2 (11.77)	1 (6.67)	3 (9.38)
Above 20	2 (11.77)	—	2 (6.25)
Carrier in pig production			
Full time	13 (76.47)	9 (60.00)	22 (68.75)
Part time	4 (23.53)	6 (40.00)	10 (31.25)

higher value (21.65%) for primary education than the values obtained in the present study, while Anyanwu *et al.* (2016) reported a preponderant 83.30% secondary school level among FADAMA livestock farmers in the state. It is, however, interesting to observe that 92.31% of the farmers did not specialise in agriculture or related disciplines, contrary to the reports of Okoli *et al.* (2004 and 2006) for poultry and turkey farmers in the state, respectively. Education enhances farmers' managerial ability in terms of record keeping, financial decisions, basic animal health care, and participation in agricultural governance and projects such as the FADAMA projects (Okoli *et al.*, 2002;

Anyanwu *et al.*, 2016; Kadurumba *et al.*, 2020).

Disparity was also observed in the farming experience of the respondents, with the peri-urban farmers being mostly new entrants with 1 - 5 years of experience (47.06%), while most of the rural farmers have been in the business for 11 - 15 years (66.67%). Specifically, 80.00% of the rural farmers had 6 - 20 years of experience, against 41.18% that had similar experience at the peri-urban site. The rural area result therefore shows a high rate of sustenance in the business over the years, similar to several earlier reports on pig farming experience in the state (Okoli *et al.*, 2009; Ume *et al.*, 2018; Edo *et al.*,

Table 2. The pig farm structures at the peri-urban and rural sites.

Parameters	Peri-urban (n=17) Frequency (%)	Rural (n=15) Frequency (%)	Overall (N=32) MeanFrequency (%)
Type of housing			
Block house	16 (94.12)	15 (100.00)	31 (96.89)
Mud house	1 (5.88)	—	1 (3.13)
Type of roofing			
Corrugated iron sheet	14 (82.35)	12 (80.00)	26 (81.25)
Thatched	1 (6.67)	—	1 (3.13)
No roof	—	—	—
Semi roof	2 (13.33)	3 (20.00)	5 (15.63)
Use of farm laborers			
Yes	14 (82.35)	8 (53.33)	22 (68.75)
No	3 (17.65)	7 (46.67)	10 (31.25)
Number of laborers	n=14	n=8	n=22
1–3	13 (92.86)	8 (100.00)	21 (95.45)
4–6	1 (7.14)	—	1 (4.55)
7–10	—	—	—
Above 10	—	—	—
Engage experts in diet formulation			
Yes	3 (17.65)	5 (33.33)	8 (25.00)
No	14 (82.35)	10 (66.67)	24 (75.00)

2021a) and in Delta state (Ajieh and Okwoha, 2015). Most of the respondents were full-time farmers (68.75% overall), with the rural farms having more part-time farmers (40.00%) than the peri-urban farms (23.53%), indicating that pig farming is a popular economic venture in the state. The result is, however, different from the 60.00% part-time pig farmers reported by Edo *et al.* (2021) for the state. Anyanwu *et al.* (2016), highlighted that part-time livestock farmers in the state are usually traders, civil servants and teachers who engage in the enterprise as a business investment, and to enhance their family income and livelihood, and as a source of animal protein for their family (Kadurumba *et al.*, 2019).

Farm structures

The results in Table 2 show that most of the pig houses in the study area (96.89%) were built with cement blocks and roofed with corrugated iron sheets (81.25%), while only 15.63% were semi-roofed. Only one farm in a peri-urban area was built with mud walls and roofed with thatch. Cement block-walled and floored open-sided pens, roofed with corrugated iron or asbestos sheets, are ideal for tropical pig production since such building designs are relatively cheap and confer a significant level of protection from extreme weather conditions such as direct sunlight

and rain, as well as being easy to clean (Okoli *et al.*, 2007). Most of the farms at the peri-urban site (82.35%) employed extra labour to run their farms, while at the rural site, 46.67% of the farmers managed their farms without extra labour. The farms could only afford to pay mostly 1 - 3 labourers (95.45%), while only 17.65 and 33.33% of them at the peri-urban and rural sites, respectively, could engage the services of nutritionists for diet formulation. Similar housing designs have been reported by other workers as the preferred approach for intensive piggery in the region, probably because it is cheap and easy to achieve (Izunobi, 2006). Again, the small-scale size of the farms and the high cost of farm labour in southeastern Nigeria reported by Nwachukwu and Udegbonam (2020) and Onyekuru *et al.* (2020) may be responsible for the low labour demand by the farmers.

Pig stocking practices

The pig stocking characteristics at the farms are shown in Table 3. Most of the farms stocked more than 100 pigs (40.63 % overall average), followed by those that stocked 31 - 50 pigs (29.41 and 46.67% at the peri-urban and rural farms, respectively), while only the farms at the peri-urban sites stocked between 51 - 100 pigs (17.65%). These results show that farms stocking between 51 and >100

Table 3. The pig stocking characteristics in the peri-urban and rural pig farms.

Parameters	Peri-urban (n=17) Frequency (%)	Rural (n=15) Frequency (%)	Overall (N=32) MeanFrequency (%)
Number of pigs in the farms			
1–10	—	—	—
11–30	2 (11.76)	2 (13.33)	4 (12.50)
31–50	5 (29.41)	7 (46.67)	12 (37.50)
51–100	3 (17.65)	—	3 (9.38)
Above 100	7 (41.18)	6 (40.00)	13 (40.63)
Number of weaner pigs in the farms			
1–10	3 (17.65)	2 (13.33)	5 (15.63)
11–20	6 (35.29)	7 (46.67)	13 (40.63)
21–50	5 (29.41)	1 (6.67)	6 (18.75)
51–100	3 (17.65)	3 (20.00)	6 (18.75)
Above 100	—	2 (13.33)	2 (6.25)
Number of porkers in the farms			
1–10	5 (29.41)	2 (13.33)	7 (21.88)
11–20	2 (11.77)	4 (26.67)	6 (18.75)
21–50	7 (41.18)	3 (20.00)	10 (31.25)
51–100	3 (17.65)	3 (20.00)	6 (18.75)
Above 100	—	3 (20.00)	3 (9.38)
Breeds of pigs reared			
Large white	11 (64.71)	10 (66.67)	21 (65.63)
Landrace	4 (23.53)	—	4 (12.50)
Duroc Jessie	4 (23.53)	—	4 (12.50)
Hybrids	5 (29.41)	9 (60.00)	14 (43.75)
Locals	—	—	—
Purchase of pure breeds			
Yes	4 (23.53)	—	4 (12.50)
No	13 (76.47)	15 (100.00)	28 (87.50)

pigs were more in the peri-urban (58.83%) than in the rural site (40.00%). The farms are therefore mostly small-scale and confirm the earlier reports by Okoli *et al.* (2009 and 2018), and Edo *et al.* (2021a) that pig farming in the state is mostly small-scale in size. Generally, more farms stocked between 31 and 50 weaner pigs (40.63%), followed by those that stocked between 21 and 50, 51 and 100 weaner pigs (18.75% each). Much more peri-urban farms, however, stocked 21 and 50 weaner pigs (29.41%) than rural farms (6.67%). Again, more farms stocked 21 to 50 porkers (31.25%) and 1 to 10 porkers (21.88%) at the time of the study. More farms stocked 1 - 10 and 21 - 50 porkers at the peri-urban site (29.41 and 41.18% respectively, while the farms that stocked 11 - 20 and above 100 porkers were more at the rural site (26.67 and 20.00% respectively).

The present results are in agreement with reports of Edo *et al.* (2021a) that 70.00% of farms in Imo state stock from

50 to 100 pigs, and that the breeder, grower and weaner pig populations in these farms are evenly distributed at 33.33, 31.67 and 35.00% respectively. Ideally, the weaner and grower pig populations in the farms should be more than that of the breeders since these generate the immediate income that sustains the running cost of the farms (Okoli, 2006). The stock distribution in the farms also reflects the lucrative market for weaner and finisher pigs reported earlier in the state by Uhuegbu (2008) and Moses (2019).

The farmers raised mostly exotic pigs such as large white (65.63%), hybrids (43.75%), landrace and Duroc (12.50% each), indicating that large white and their hybrids were the popular stocks, in agreement with earlier reports by Okoli *et al.* (2009). The study also showed that only 23.53% of the farmers at the peri-urban site and none at the rural site have had cause to introduce pure breeds of these exotic pigs in their farms, indicating that some level

Table 4. Breeder stock characteristics of the peri-urban and rural pig farms.

Parameters	Peri-urban (n=17) Frequency (%)	Rural (n=15) Frequency (%)	Overall (N=32) MeanFrequency (%)
Number of boars			
1–3	13 (76.47)	7 (46.67)	20 (65.50)
4–6	3 (17.65)	4 (26.67)	7 (21.88)
7–10	—	2 (13.33)	2 (6.25)
Above 10	1 (5.88)	—	1 (3.13)
None	—	2 (13.33)	2 (6.25)
Number of sows			
1–10	7 (41.18)	4 (26.67)	11 (34.38)
11–20	2 (11.77)	3 (20.00)	5 (15.63)
21–50	8 (47.06)	4 (26.67)	12 (37.50)
51–100	—	1 (6.67)	1 (3.13)
None	—	3 (20.00)	3 (9.38)
Number of gilts			
1–10	10 (58.82)	7 (46.67)	17 (53.13)
11–20	3 (17.65)	4 (26.67)	7 (21.88)
21–50	2 (11.77)	4 (26.67)	6 (18.75)
None	2 (11.77)	—	2 (6.25)
Number of in-pigs			
1–10	7 (41.18)	8 (53.33)	15 (46.88)
11–20	5 (29.41)	7 (46.67)	12 (37.50)
21–30	4 (23.53)	—	4 (12.50)
41–50	1 (5.88)	—	1 (3.13)

of inbreeding and genetic depreciation may be taking place in the study area. Many studies have associated inbreeding in pigs with a significant reduction in reproductive traits such as the number of live piglets at birth and gestation length (Farkas *et al.*, 2007; Zhang *et al.*, 2022). Reducing the relatedness allowed in mating and selection inside a farm by introducing new bloodlines has been suggested as a good method of controlling inbreeding in pig farms (Lopes *et al.*, 2019). Growth and reproductive performance in pigs have also been shown to be strongly influenced by the breed, feed and farm structure (Kouam *et al.*, 2015; Okoli *et al.*, 2018).

Reproductive practices in the farms

The breeder stock characteristics results presented in Table 4 showed that most of the farms stocked 1 - 3 boars for breeding purposes (65.50% overall). More farms, however, stocked 1-3 boars at the peri-urban site (76.47%) than at the rural site (47.67%), while more rural farms stocked 4-6 boars (26.67%) than peri-urban farms (13.65%). Two farms at the rural site did not, however, stock any boar at the time of the study.

The sow distribution results showed that 1 - 10 and 21 - 50 sow stocking rates were the most popular, with the peri-urban farms recording higher percentages (41.18 and 47.06% respectively) than the rural farms (26.67% each). Again, 3 rural farms did not have any breeding sows at the time of the study. The gilt distribution showed that the stocking of 1 - 10 gilts was the most popular in the farms (58.82, 46.67 and 53.13% of the peri-urban farms, rural farms and overall, respectively). The stocking of 11 - 20 and 21 - 50 gilts was practised by 26.67% of the rural farms, while two peri-urban farms did not have gilts at the time of the study. Similarly, more farms had 1 - 10 in-pigs in their pens (46.88% overall) at the time of the study, with the value being higher at the rural site (53.33%) than the peri-urban site (41.18%). More rural farms also stocked 11 - 20 in-pigs (46.67%) than the peri-urban farms (29.41%), while four and one peri-urban farms also stocked 21 - 30 and 41 - 50 pregnant pigs, respectively, at the time of the study. These results show that breeding and multiplication are a critical component of small-scale intensive pig production in the study area. Indeed, all the farms had in-pigs at the time of the study. The high percentage of weaners and in-pigs in these farms confirms the earlier report by Okoli *et al.* (2018) that weaner pig production and

Table 5. Reproductive performances small-scale pig farms at the peri-urban and rural sites.

Parameters	Peri-urban (n=17) Frequency (%)	Rural (n=15) Frequency (%)	Overall (N=32) Mean Frequency (%)
Average litter size			
1–3	2 (11.77)	—	2 (6.25)
4–6	6 (35.29)	—	6 (18.75)
7–10	8 (47.06)	13 (86.67)	21 (65.63)
11–15	1 (5.88)	2 (13.33)	3 (9.38)
Age at weaning (weeks)			
1–4	—	2 (13.33)	2 (6.25)
4–6	12 (70.59)	13 (86.67)	25 (78.13)
6–8	5 (29.41)	—	5 (15.63)
Average weaning weight (kg)			
2–5	2 (11.77)	2 (13.33)	4 (12.50)
6–9	7 (41.18)	6 (40.00)	13 (40.63)
10–15	4 (23.53)	—	4 (12.50)
No information	4 (23.53)	7 (46.67)	11 (34.38)

sales are popular in Imo State. The large white and duroc breeds have specifically been reported to have good reproductive performance under the local feeding and housing management practised by the small-scale farmers in the study area (Okoli *et al.*, 2011; Okoli *et al.*, 2018).

The results in Table 5 highlight the reproductive performance of pigs reared in the peri-urban and rural farms. The average litter size was generally high at 7 - 10 piglets (47.06% in the peri-urban farms, 86.67% in the rural farms, and 65.63% overall). The rural farms, therefore, recorded better litter size, although cumulatively, 82.35% of the peri-urban farms had 4 - 10 piglets per litter. The majority of the farms weaned their piglets at between 4 and 6 weeks of age (78.13% overall), although 29.41% of the peri-urban farms preferred to wean from 6 - 8 weeks. Again, the most common average weaning weight of the piglets ranged from 6 to 9 kg (40.63%), although 23.53% of the peri-urban farms reported 10 -15 Kg weaning weight, probably among the piglets weaned at 8 weeks. Some of the farmers (23.53% at the peri-urban site, 46.67% at the rural site and 34.38% overall) did not have any information on the weaning weight of their piglets, indicating poor record keeping of reproductive performance in these farms. Okoli *et al.* (2018) reported litter size and weaning weights range values of 6 - 12 piglets and 8.75 -10.27 Kg, respectively, in similar pig farms in the state managed by educated farmers. Njoga *et al.* (2021) also reported similar litter size among breeder pigs in the neighbouring Enugu state, while Ate and Oyedipe (2011) reported a litter size of 9 - 11 piglets and weaning weight of 6.18 - 8.5 Kg, probably at 8 weeks of age, among pig populations in Benue state, North Central Nigeria.

Low plane of nutrition has been identified as a major constraint to optimal reproductive performance of exotic

pigs in small-scale intensive farms in southern Nigeria (Okoli *et al.*, 2011; 2018; Edo *et al.*, 2021a) and other parts of West Africa (Dotche *et al.*, 2020). Nutrition affects reproductive performance indirectly through several processes, such as changes in nutrient metabolites and metabolic hormones (Pettigrew and Tokach, 1991; Che *et al.*, 2011; Yang *et al.*, 2021). A low plane of nutrition may generally decrease the secretion of important reproductive hormones, which in turn affects follicular development and fertility of the sow (Feyera *et al.*, 2021). Okoli *et al.* (2018), for example, studied the impact of on-site feeding practices on the reproductive indices of pigs reared by small and medium-scale farmers in Imo State, and reported that most of the farmers practised the flushing techniques. This invariably results in the dams gaining more weight during gestation, producing a larger litter size, and shedding limited weight during lactation. The practice of adding extra nutrients in the diets of pregnant gilts/sows has also been used to improve birth weights and other reproductive parameters of pigs (Fanimu *et al.*, 2002; Soto *et al.*, 2011), indicating that good nutrition positively impacts pig reproduction.

Animal health status and practices in the farms

The information in Table 6 highlights the health conditions and disease management practices at the pig farms. Most of the farmers (75.00%) regarded pig disease as a major problem militating against profitable pig production in the study area, although most of them (64.71% of the peri-urban farms, 100.0% of the rural farms and 81.25% overall) did not find it needful to utilise the services of animal health workers. The major health conditions

Table 6. Health status and disease management practice in the peri-urban and rural farms.

Parameters	Peri-urban (n=17) Frequency (%)	Rural (n=15) Frequency (%)	Overall (n=32) Mean Frequency (%)
Serious disease problems in pig production			
Yes	13(76.47)	11(73.33)	24(75.00)
No	—	—	—
Not sure	4(23.53)	4(26.67)	8(25.00)
Utilization of the services of animal health workers			
Yes	6 (35.29)	—	6 (18.75)
No	11 (64.71)	15 (100.00)	26 (81.25)
Common pig diseases/problems			
Diarrhea	15 (88.24)	15 (100.00)	30 (93.75)
Foot rot	13 (76.47)	12 (80.00)	25 (78.13)
Mange	9 (52.94)	6 (40.00)	15 (46.88)
Trypanosomiasis/tsetse fly	1 (5.88)	15 (100.00)	16 (50.00)
Worms	16 (94.12)	15 (100.00)	31 (96.88)
Respiratory infections	8 (47.06)	3 (20.00)	11 (34.38)
Bacterial infections	9 (52.94)	2 (13.33)	11 (34.38)
Swine fever	10 (58.82)	3 (20.00)	13 (40.63)
Others	1 (5.88)	—	1 (3.13)
Common drugs used for treatment			
Ivermectin	17 (100.00)	14 (93.33)	31 (96.88)
Iron dextran	16 (94.12)	15 (100.00)	31 (96.88)
Vitamin	13 (76.47)	15 (100.00)	28 (87.50)
Long acting antibiotics	15 (88.24)	13 (86.67)	28 (87.50)
Tylosin	10 (58.82)	2 (13.33)	12 (37.50)
Trypanocides	—	9 (60.00)	9 (28.13)
Use of ethno-veterinary approaches			
Yes	5 (29.41)	5 (33.33)	10 (31.25)
No	12 (70.59)	10 (66.67)	22 (68.75)

encountered at the peri-urban farms were diarrhoea, foot rot and worm infestation (88.24, 76.47 and 94.12%, respectively), similar to the results from the rural farms, with the exception of trypanosomiasis and tsetse fly infestation, which were mentioned in all the rural farms.

Other health conditions such as respiratory infections, bacterial infections and swine fever were however more frequent at the peri-urban farms (47.06, 52.94 and 58.82% respectively) than in the rural farms (20.00, 13.33 and 20.00% respectively), indicating a probable strong disparity in presence of disease predisposing factors or management at the two sites (Ola-Fadunsin, 2017; Igbokwe and Maduka, 2018). The high frequency of trypanosomiasis and tsetse fly in the rural farms is corroborated by the earlier report by Okoli (2003) that trypanosomiasis is highly prevalent in livestock populations in Imo state. The overall disease picture presented in this study also agrees with the reports of Edo *et al.* (2021a) that disease burden is a major constraint to

profitable pig production in the state. The high frequency of diarrhoea, foot rot and worm infestation at the two farming locations suggests general poor hygiene in the farms since these health conditions are predisposed by an unhygienic environment (Nwanta *et al.*, 2011; Asambe *et al.*, 2019; Adebowale *et al.*, 2020).

Drugs such as Ivermectin, iron dextran, vitamins, and long-acting antibiotics were commonly used for the treatment of disease conditions in the farms (96.88, 96.88, 87.50 and 87.50% overall, respectively). This is probably because these are routine management drugs administered for the sustenance of the health of the animals. Only a few of the farmers (31.25% overall), however, have had experience with the use of ethno-veterinary healthcare interventions. The obvious disparity in the utilisation of the services of animal healthcare workers at the two sites could be explained by the reported poor access of rural livestock farmers to such services in the study area (Okoli *et al.*, 2002). The low income level of

the rural farmers has also been reported to influence their demand for animal healthcare services (Bassey *et al.*, 2018). The 58.82 and 60.00% utilisation of tylosin and trypanocides in the peri-urban and rural farms, respectively, probably reflects their uses in the treatment of respiratory infections and trypanosomiasis in these farms.

Conclusions and Recommendations

The small-scale pig farmers at the studied peri-urban and rural locations in Imo State were mostly male and educated and had many years of experience in pig farming. The pigs were mostly exotic breeds and were housed in pens built with concrete blocks and corrugated iron roofs. The significant populations of pregnant and growing pigs in the farms highlighted the thriving nature of the farms. There were significant variations in disease occurrence, reproductive and disease management practices at the two farming locations. These variations should be considered carefully before giving any reproductive and health management advice for the improvement the productivity of the farms.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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