KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS AFRICAN SWINE FEVER IN UTHUKELA DISTRICT, KWAZULU NATAL, SOUTH AFRICA: A COMMUNITY BASED CROSS-SECTIONAL STUDY

THUSI, N. M.[1,2] – MALEPE, K.[1] – MBAJIORGU, C. A.[1] – OGUTTU, J. W.[1*]

[1]*Department of Agriculture and Animal Health, College of Agriculture and Environmental Sciences, University of South Africa, Johannesburg, South Africa*

[2]*Department of Agriculture and Rural Development, KwaZulu Natal, South Africa*

[*]*Corresponding author*
e-mail: joguttu@unisa.ac.za; address: Science Campus Corner of Christiaan de Wet Road & Pioneer Avenue, Florida, 1709, South Africa

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Abstract. The risk of outbreaks of African Swine Fever (ASF) is minimized when farmers are knowledgeable and have a positive perception of risk factors associated with the spread of ASF. This study assesses the knowledge, attitude, and practices with respect to ASF among emerging pig farmers in uThukela District. A cross-sectional study design was conducted on all emerging pig farmers (n=426) in the study area. A pre-tested structured questionnaire was used to collect data. Data was analysed using descriptive and inferential statistics. Pig rearing in the study area is dominated by middle aged men with no formal education, low income, and >5 years of experience of rearing pigs. The main reason for rearing pigs, is to provide meat for the family. Knowledge of some aspects of ASF was very low. However, most farmers displayed a good attitude towards ASF. Feeding pigs on swill and hunting wild pigs were practiced in the stud area. Residence, sex, age and reason for rearing pigs were significantly correlated with a high knowledge score for ASF. Authorities in charge of controlling livestock diseases should consider findings of the present study when designing interventions to improve on the knowledge of ASF and to limit outbreaks of ASF.
Keywords: *wild pigs, warthogs, swill, biosecurity, ASF*

Introduction

African Swine Fever (ASF) is a highly contagious haemorrhagic viral disease that affects pigs and other hosts belonging to the family Suidae (pigs, warthogs, European wild boar, and American wild pigs) (Pautienius et al., 2018). It is listed as a Notifiable disease by the World Organisation for Animal Health (WOAH), previously known as the Office International des Epizooties (OIE) (Penrith and Vosloo, 2009).

The virus that causes ASF, is a large double stranded DNA Virus, which belongs to the genus Asfivirus of the family Asfarviridae. The virus is highly stable and temperature resistant. It can survive in a suitable protein environment and in serum at room temperature for 18 months, and in blood at 37 degrees Celsius for a month. The ASF virus is stable in a pH range of 4-10.

Domestic pigs may shed the ASF virus for 24-48 hours before showing clinical signs after infection (Geering et al., 2011). The *Ornithodorus* ticks also known as tampans, and the African wild suis, are the natural hosts of the ASF virus.

Over the last decade there has been an increase in the number of people leaving poverty, which has led to an increase in demand for meat and livestock products in sub-Saharan Africa. The pig sector has the potential to contribute not only to poverty

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eradication but to also bridge the gap between the growing demand and supply of meat and other livestock products (Chenais, 2017). However, an outbreak of ASF can have devasting effects on both the country and individual farmers if it is not controlled adequately and timeously. Moreover, there is no vaccine or effective treatment for the disease (Dixon et al., 2019).

Between 1993 and 2012, 1309 cases of ASF were reported from 71 outbreaks that occurred in South Africa. Mpumalanga and Gauteng Provinces recorded their first outbreaks of ASF in 2011. In January 2012, a total of 172 farms were affected by ASF. In 2020 an outbreak occurred in a communal pig farming area of the Amathole District Municipality in the Eastern Cape (Makgopa et al., 2020). The latest outbreak was reported in Mqanduli area in King Sabata Dalindyebo local Municipality in Eastern Cape February 2021 (Supplementary material A). This outbreak was reported in the free-roaming small holder pig sector (Directorate: Animal Health, 2021).

The only way to prevent the introduction of ASF on a farm, is to restrict the movement of pigs in and out of the farm without first ascertaining if they are free from the disease. Movement of vehicles in and out of farms must be restricted and vehicles must also be sprayed to prevent the spread of the disease. Farmers must follow proper biosecurity, avoid feeding of swill on the farm, and entering of wild boars onto farms must be prohibited, especially in high ASF risk areas (Schulz et al., 2017; Dione et al., 2020; Yoo et al., 2021).

In south Africa ASF has been controlled and defined to the northern South Africa over the past 80s by means of a well-defined boundary line (Supplementary material A) (Magadla et al., 2016; AgriOrbit, 2020). The controlled Zone covers parts of Limpopo, Mpumalanga, Northwest, and KwaZulu Natal Provinces (AgriOrbit, 2020). In these areas the disease occurs in wild pigs all the time, and restriction of movements to and from and within the area for all wild and domestic pigs and their products apply. This is aimed at preventing the disease from spreading to the unaffected areas of the country. However, since 2012, the first outbreak of ASF outside the control zone was recorded (Magadla et al., 2016; AgriOrbit, 2020).

Furthermore, in South Africa, ASF is classified under the Animal Disease Act 35 of 1984 as a Controlled Animal Disease. Therefore, in event of an outbreak of ASF in the republic, the Act prescribes measures that must be taken to bring the disease under control, and these include: A suspected case of ASF must be reported to the nearest State Veterinary Services or police station. When the outbreak of ASF is confirmed on the farm, all the pigs in that farm must be culled and the area where the pigs were kept disinfected, and for about 5-7 days there should not be any pigs kept on the premises. Furthermore, movement of pigs in and out of the farm should be restricted (AgriOrbit, 2020).

When farmers are knowledgeable and have a positive perception of the risk factors of ASF, the risk of the disease spreading is minimized (Penrith et al., 2007). Studies have also shown that education of farmers is an important tool for improving production among smallholder pig producers in rural settings (Chilundo et al., 2020). However, there is no evidence of studies that have assessed the knowledge, attitude, and practices towards ASF among rural communal farmers uThukela District in KZN. Therefore, there is a need for studies in the study area that investigate the knowledge of farmers, their attitude, and practices with regards to ASF, given its proximity to the Free State province of South Africa that recently experienced an outbreak of ASF.

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Method and Materials

Study area

The study was carried out in uThukela District which is located on the Western boundary of the KwaZulu Natal (KZN). The study area is made up of privately owned commercial farmlands, small holder settlements, and urban areas, and it is one of 10 District Municipalities in the Province of KZN (*Figure 1*). Administratively, uThukela District has 24 Local House of Traditional Authorities, and the district has an area of approximately 11500km^2. In 2016, the district had a population of about 706,589 people. uThukela District shares boundaries with the three other districts which are Amajuba (North), uMzinyathi (East) and uMgungundlovu (South). uThukela District is made up of three local Municipalities namely, Inkosi Langalibalele, Okhahlamba and Alfred Duma Local Municipality. Alfred Duma is the largest local municipality with an area of 3957,63 km^2, followed by Inkosi Langalibalele (2958.59 km^2) and Okhahlamba (3540.63 km^3).

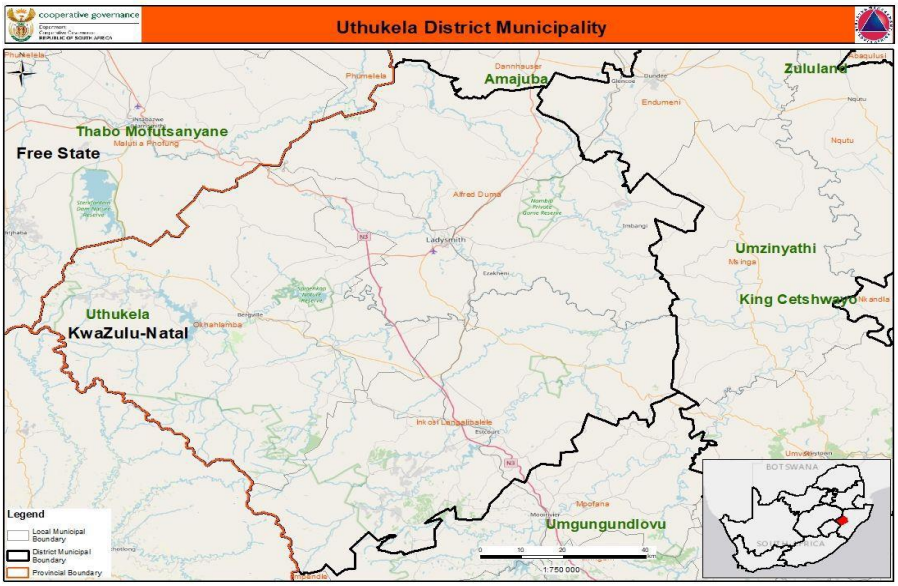

Figure 1. *Map showing the location of uThukela District, KwaZulu-Natal Province, South Africa (Retrieved from: www.municipalities.co.za)*

Study design and study population

A prospective cross-sectional study design was adopted to conduct a Knowledge, Attitude and Practices (KAP) survey on ASF among emerging pigs farmers in uThukela District.

In 2015, there were 56 000 pigs in uThukela district, of which 10% were small scale farmers, while 90% were largescale commercial farms. According to Sibongiseni (2013), uThukela District is a communal area with approximately 2643 pigs and 533 communal pig farmers. Alfred Duma/ Ladysmith local Municipality had 985 pigs, followed by Okhahlamba (n= 387), Imbabazane (n=289) and Indaka (Inkosi Langalibalele) (n=885). The number of pigs kept by emerging pig farmers ranges between 2 and 38 pigs.

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All emerging pig farmers in the study area were targeted and invited to participate in the study. However, only 426 pig farmers agreed to voluntarily participate in the study. To be included in the study, the farmer had to own pigs and be willing to participate in the study voluntarily. Pig farmers who resided outside the study area and/or were large-scale commercial pig farmers were excluded from the study.

Data collection and management, and statistical analysis

The survey was conducted between June and September 2020. The principal researcher drafted the Knowledge Attitude and Practices (KAP) questionnaire. The questionnaire was written in English language and translated into isiZulu, the language spoken by the indigenous people in the study area. The Questionnaire was pre-tested using a pilot study, and results used to improve on the questionnaire. Each interview lasted for 30-45 minutes.

The data was captured into a Microsoft Excel 2010 Spreadsheet, and then imported into the Statistical Package for Social Science (SPSS) Version 27 27 (SPSS for Windows, version 27, SPSS, Inc, Chicago, Illinois, the USA) that was used to analyse the data. Before analysis, the data was checked for missing values and any consistencies.

Each farmer was asked a series of questions that summed to a total of 19 marks if the respondents provided correct answers for all the questions. The score obtained by each participant was converted to a percentage. If a participant obtained a grade of 60%, the participant was considered to be knowledgeable about ASF. This was coded as 1. On the other hand, if a farmer obtained a grade below 60% such a respondent was considered not to be knowledgeable and was coded as 0.

Data was summarised using descriptive statistics and presented as tables. Binary logistic regression models were fit to the data to determine predictors of a high knowledge score for ASF (i.e., being knowledgeable). Statistical significance was set at $p < 0.05$.

Ethical consideration

The Ethical approval was obtained from the University of South Africa Ethics (REF: 2020/ CAES_HREC/063) and the KZN Department of Agriculture and Rural Development (KZNDAEA) research committee. Participants in this study were informed that participation was voluntary, and they were free to withdraw from the study any time. All participants signed the consent form before completing the questionnaire. To ensure anonymity, no personal identification information was collected.

Result

Demographic profile of farmers

A total of 426 pig farmers participated in this study. Majority of the respondents were males (60.80%, n=259) (*Table 1*). In addition, majority of the respondents were from Alfred Duma Municipality (42.25%; n=180), followed by the Okhahlamba (37.79%, n=161) and Inkosi Langalibalele (19.92%; n=85) local Municipality (*Table 1*). Most respondents (35.68%; n=152) were aged 36-53 years, this was followed by respondents aged 54-71 years old (34.74%; n=148). Respondents aged over 71 were the minority (9.15%, n=39). Most (28.64%; n=122) respondents did not have formal education. Approximately the same number of farmers indicated that they had either completed Matric (22.07%; n=94) or Primary School (22.54; n=96), or had Not completed High

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School (21.83%, n=93). A high number of respondents were unemployed (47.89%, n=204), and majority (85.92%, n=366) earned R 0-3500 per month. Respondents who had over 5 years of experience of keeping or rearing pigs, were the majority (42.02%; n=179), followed by those who had 2-5 years of experience. When asked why they rare pigs, majority (87.79%; n=374) of farmer's reared pigs solely as a source of meat for their family.

Table 1. *Demographic profile of respondents from the three municipalities who responded to the questionnaire*

Variables	Level	Frequency (n)	%	95% CI	
Residence	Alfred Duma	180	42.25	37.51	47.10
	Inkosi Langalibalele	85	19.95	16.26	24.07
	Okhahlamba	161	37.79	33.17	42.59
Age	18-35	87	20.42	16.69	24.57
	36-53	152	35.68	31.13	40.43
	54-71	148	34.74	30.22	39.47
	Over 71	39	9.15	6.59	12.30
Gender	Female	167	39.20	34.54	44.02
	Male	259	60.80	55.98	65.46
Education	Completed Matric	94	22.07	18.22	26.31
	Completed Primary School	96	22.54	18.65	26.80
	Completed Tertiary	21	4.93	3.08	7.44
	No Formal Education	122	28.64	24.39	33.19
	Not completed High School	93	21.83	18.00	26.02
Employment	Employed	50	11.74	8.84	15.18
	Other	5	1.17	43.06	52.75
	Pensioner/retired	167	39.20	34.31	43.78
	Unemployment	204	47.89	0.52	3.04
Income (Rands)	0-3500	366	85.92	82.25	89.08
	3600-6000	26	6.10	4.03	8.82
	6000-10000	21	4.93	3.08	7.44
	>11000	13	3.05	1.63	5.16
Experience (Years)	2-5	172	40.38	35.68	45.21
	Less than 1	75	17.61	14.11	21.56
	>5	179	42.02	37.28	46.87
Reason rearing pigs?	As a source of income & meat for family	52	12.21	9.25	15.70
	Source of meat for family	374	87.79	84.30	90.75

Profile of famers based on their knowledge of ASF

When respondents were asked to describe ASF, most (31.46%, n=134) described it as being a flu like, contagious and viral disease. This was followed 26.06% (n=111) who describe ASF as a viral disease and 22.54% (n=96) who only described it as being a flue like disease. Respondents who only described AFS as being a contagious disease were the minority (19.95%; n=85).

Regarding the animal species that can spread ASF, 44.84% (n=191) of the respondents mentioned pigs, while 39.67% (n=169) indicated that all of the above (i.e., wild pigs, pigs and warthogs can spread ASF). While 9.62% (n=41) and 5.87% (n=25) of the respondents thought that only wild pigs and warthogs respectively can spread ASF.

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With regard to how ASF is spread, 39.91% (n=170) of the respondent mentioned the illegal movement of pigs as the route through which ASF is spread. This was followed by 32.63% (n=139) who indicated that all of the above (i.e., lack of a foot bath, feeding swill and illegal movement of pigs) can spread the disease. While a mere 19.25% (n=82) and 8.22% (n=35) only indicated lack of the foot bath or biosecurity and feeding of swill respectively as factors that promote the spread of ASF. In response to the question whether ASF can be transmitted from one pig to another, majority (97.18%; n=414) of the respondents responded in the affirmative. Only 2.82% (n=12) were not aware that ASF can spread from one pig to another.

Majority of the respondents (53.76%; n=229) stated that the source of ASFV was all of the above (i.e., *Ornithodorus* tick and wild boars). Those who indicated that only *Ornithodorus* tick were the source of ASF, made up only 22.30% (n=95) of the respondents, while those who indicated that only wild boars serve as a source of the ASFV made up 21.13% (n=90) of the respondents.

Responding to the question "Which of the following clinical signs can be seen in a case of ASF, 59.62% (n=254) of the respondents chose all the above (i.e., high fever, mortality in 15-45 days, ocular discharge) as clinical signs of ASF. A small number identified a high fever (12.44%; n=54) and death occurring 15-45 days (12.44%; n=53) as clinical signs likely to be seen in a case of ASF. Only 9.62% (n=41) mentioned ocular discharge as the clinical sign in ASF. Participants who were not aware of any of the clinical signs of ASF constituted 2.35% (n=10) of the study population. Base on the responses to the question on whether ASF can be spread by pigs and in pork products, the overwhelming majority of respondent (95.77%; n=408) answered in the affirmative. A very small percentage (0.70%, n=3) of farmers were not aware that the ASFV can be carried by pigs and in pork products.

When asked if ASF is a curable disease**,** 96.48% (n=411) were aware that ASF is not a curable disease, while a very small number (0.70%; n=3) did not know whether ASF was curable or not. In response to the question whether feeding swill (waste feed from the kitchen) to the pigs can reduce the transmission of ASF, 73.00% (n=311) rightly indicated that feeding swill cannot reduce ASF. This was followed by those who indicated that they did not know if feeding swill can reduce ASF (23.21%; n=99) and those who indicated that feeding swill reduces the risk of outbreak of ASF in the community (0.94%; n=4).

Participants were asked if ASF is a notifiable disease, and the majority (89.44%; n=381) responded in the affirmative. However, 7.75% (n=33) of the respondents were not aware that ASF was a notifiable disease (*Table 2***)**.

Distribution of farmers based on attitude and practices towards ASF

All the respondents (100%, n= 426) indicated if they suspected that a pig had ASF, they would call the nearest State Veterinary office (SV) immediately. However, close to 60% (57.28%; n=244) of the farmers confirmed that they fed their pigs on swill, while 42.72% (n=182) did not feed their pigs with swill.

Almost all the participants (87.09%, n=371) never discussed or talked about ASF with family members or neighbours. A very small percentage of respondents (12.91%; n=55) mentioned that-they had talked about ASF. Almost all the respondents (92.72; n=395) were of the view that an outbreak of ASF would ruin their enterprises, while 7.28% (n=31) had a contrary view with the regard to the impact of ASF on their pig farming enterprise (*Table 3*).

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Table 2. *Results of the assessment of the knowledge of the participants towards ASF*

Variable	Level	n	%	95% CI	
				Lower	Upper
What is ASF	A flue like disease	96	22.54	18.65	26.80
	Contagious disease	85	19.95	16.26	24.07
	Viral disease	111	26.06	21.95	30.50
	All of the above	134	31.46	27.07	36.10
According to you which one of the following animals might spread ASF?	Pigs	191	44.84	40.05	49.70
	Warthogs	25	5.87	3.83	8.54
	Wild pigs	41	9.62	7.00	12.83
	All of the above	169	39.67	34.99	44.49
	Feeding of swill	35	8.22	5.79	11.24
	No footbath/biosecurity	82	19.25	15.61	23.32
	Illegal movement of pigs	170	39.91	35.22	44.73
	All of the above	139	32.63	28.19	37.31
Can ASF be transmitted from one pig to another?	Yes	414	97.18	95.13	98.54
	Don’t know	12	2.82	1.46	4.87
Which of these can be a source of ASF virus?	Wild boars	90	21.13	17.35	25.31
	Ornithodorus tick	95	22.30	18.43	26.56
	Both of the above	229	53.76	48.89	58.57
	N/A	12	2.82	1.46	4.87
Which of the following clinical signs can be seen in an ASF case?	High Fever	56	13.15	10.08	16.73
	Ocular discharge	41	9.62	7.00	12.83
	Death occur 15-45days	53	12.44	9.46	15.96
	All of the above	254	59.62	54.79	64.32
	Don’t know	10	2.35		
	N/A	12	2.82	1.46	4.87
Can ASF be carried in pigs and pork products?	Yes	408	95.77	93.40	97.48
	No	3	0.70	0.15	2.04
	Don’t know	3	0.70	0.15	2.04
	N/A	12	2.82	1.46	4.87
Do you think that ASF is a curable disease?	N/A	12	2.82	1.46	4.87
	No	411	96.48	94.26	98.02
	Don’t know	3	0.70	0.15	2.04
In your opinion, do you think the feeding of swills to pigs can reduce the transmission of ASF in the community?	Yes	4	0.94	0.26	2.39
	No	311	73.00	68.52	77.17
	Don’t know	99	23,24	19,31	27,55
	N/A	12	2,82	1,46	4,39
Do you know if ASF is a notifiable disease or not?	Yes	381	89.44	86.12	92.19
	No	33	7.75	5.39	10.71
	N/A	12	2.82	1.46	4.87

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When respondents were asked if they had heard about the ASF in the previous years, 33.10% (n=141) said they had not heard about ASF in the previous year. However, the majority (66.90%, n=285) indicated that they had heard about the disease in the past year.

According to the majority of the respondents, the best way to receive information about ASF was from the veterinary services officials (93.66%; n=399). Other modes of disseminating information such as broadcasting message by radio (2.82%; n=12), TV (2.58%; n=11), billboards (0.47%; n=2) and posters (0.47%; n=2) were not popular among the respondents. Most respondents (58.69%; n=250) mentioned that they had not heard from the Department of Agriculture in the last 6 months. Just slightly over 40% (41.31%; n=176) said that they had heard from the department of Agriculture.

Table 3. *Attitudes and practices towards ASF of the respondents*

Variable	Level	N	%	95% CI	
				Lower	Upper
In your opinion, if you suspect that your pigs have ASF. What will you do.	Immediately call your nearest State Vet office	426	100	99.14	1.000
Do you feed your pigs with swills (waste feed from your kitchen)?	No	182	42.72	37.97	47.57
	Yes	244	57.28	52.43	62.03
Do you usually talk or discuss with your family or neighbours about the ASF?	Yes	55	12.91	83.53	90.12
	No	371	87.09	9.88	16.47
An outbreak of ASF would be disastrous for pig farmers in this area?	Yes	395	92.72	89.83	95.00
	No	31	7.28	0.55	10.17

In response to the question whether the farmer ever hunt for wild/bush pigs, 61.50% (n=262) did not hunt for wild/bush pigs. Only 38.50% (n=164) of the farmers indicated that they hunted wild/bush pigs. Further investigation revealed that 38.26% (n=163) of the respondents who hunted wild/bush pigs brought the whole carcass with its skin to the homestead. Few (0.47%; n=2) respondents mentioned that the meat is first cooked in the bush before it is brought home.

With respect to how pigs are reared, slightly over half (52.11%, n=222) of the respondents indicated that they always kept their pigs in a sty/house. This was followed by 16.67% (n=71) who kept their pigs in a house but at times let them to roam, 10.80% (n=46) who let the pigs roam around but at a times tied them with the rope, and 10.33% (n=44%) who always let their pigs to roam around and scavenge for food. A very small number of farmers always kept the pigs tied by a rope near the homestead (5.87%, n=25) or in a house but at a times tie them with the rope (4.23%; n=18).

With respect to the biosecurity measures farmers adopt on their farms, few farmers (12.44%, n=53%) did not feed swill or scrap to their pigs. Meanwhile, 31.46% (n=134) of the respondents indicated that they did not allow bush pig meat onto their farms. Slightly over half (53.05%; n=226) of the farmers mentioned that they did not allow their pigs to roam around in the area looking for the food, while all the farmers (100%, n=426) said that they had a closed herd (*Table 4*).

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Table 4. *The proportion of respondents who adopted the different intervention measures with potential to minimize outbreaks of ASF in the study area*

Variable	Level	Frequency n	Percentage %	95% CI	
				Lower	Upper
During the previous years, have you heard about the AFS outbreak on the radio, television,	Yes	285	66.90	62.21	71.36
	No	141	33.10	28.64	37.79
In your opinion, what are the best ways to receive information about AFS for you and your family?	Broadcast messages	12	2.82	1.46	4.87
	Billboards	2	0.47	0.06	1.69
	TV	11	2.58	1.30	4.57
	Posters	2	0.47	0.06	1.69
	Veterinary Services officials	399	93.66	90.91	95.78
	Others				
In the last 6 months has anybody from the department of Agricultural and rural development spoken to you	No	250	58.69	53.85	63.40
	Yes	176	41.31	36.60	46.15
Do you ever go hunting for wild/bush pigs?	No	262	61.50	56.70	66.15
	Yes	164	38.50	33.85	43.30
How is the meat from bush pigs handled?	Meat is first cooked in the bush before it is brought home	2	0.47	0.06	1.69
	Whole carcass with its skin is brought home	163	38.26	33.63	43.06
	Did not answer	261	61.27	56.46	65.92
Which of the following best describes the way your rare your pigs?	I always keep my pigs tied by a rope near homestead	25	5.87	3.83	8.54
	I always let my pigs to roam and look for food	44	10.33	7.61	13.62
	I keep pigs in a house but at times let them to roam	71	16.67	13.23	20.55
	I keep pigs in a house but at times tie them on a rope	18	4.23	2.52	6.60
	I let them roam but at times tie them with a rope	46	10.80	8.01	14.14
	My pigs are always kept in a pig sty/house	222	52.11	47.25	56.94
What biosecurity measures have you implemented on the farm to keep out ASF (tick all the applies to you)?	I have a closed herd	426	100		
	I have a foot bath at entry to my farm or pig house	0	0		
	I do not feed swill or scrap meat from outside	53	12.44		
	I do not allow bush pig meat onto my farm	134	31.46		
	I do not allow my pigs to roam in the area	226	53.05		

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Multivariate analysis results

Based on the results of the univariate analysis (Supplementary material B), the following variables were significantly associated with a high knowledge score for ASF at a generous p-value of ≤ 0.2: Residence, Age, sex, education, experience, and reason for farming with pigs. Only these variables were used in the multivariate analysis to determine the predictors of high knowledge score (>60%) or being knowledgeable.

Results of the multivariate analysis are presented in *Table 5*. Considering Inkosi Langalibalele as the reference level, the coefficient estimates of Alfred Duma and Okhahlamba locations have negative values with an odds ratio of less than 1 (p= 0.524 & P= 0.383). Therefore, farmers from Alfred Duma and Okhahlamba locations were significantly (p= 0.0018) less likely to be more knowledgeable about ASF or obtain a higher knowledge score on ASF as compared to respondents from Inkosi Langalibalele.

Table 5. *Multivariate analysis for factors significantly associated with high knowledge score (.60%) for African swine fever*

Variable / Category	Coefficient	SE	OR	95% CI		P-value
Residence				**Lower**	**Upper**	
Inkosi Langalibalele	Ref					
Alfred Duma	-0.6457	0.2876	0.524	0.296	0.916	0.0247
Okhahlamba	-0.9604	0.2952	0.383	0.212	0.678	0.0011
Sex of respondent						
Female	Ref					
Male	0.5577	0.2187	1.747	1.140	2.689	0.0108
Age						
Over 71	Ref					
18-35	1.2313	0.4630	3.426	1.434	8.964	0.0078
36-53	1.1513	0.4412	3.162	1.386	7.965	0.0091
54-71	1.4205	0.4456	4.139	1.797	10.501	0.0014
Reason for rearing pigs						
Source of meat for family	Ref					
Both income and meat source for the family	1.4015	0.3577	4.061	2.073	8.513	0.0001

With regards to sex, the coefficient estimates for male was 0.5577 with an odds ratio of 1.747. Therefore, the male respondents were significantly (P= 0.0024) more likely to be more knowledgeable about ASF as compared to their female counter parts (reference point). For the variable age, with the category aged over 71 years as the reference category, all other age categories had a positive coefficient estimate, with odds ratios greater than 1, indicating that younger age groups were significantly (P <0.05) more likely to be more knowledgeable about ASF as compared to older respondents (over 71 years).

Lastly, the coefficient of ‘the variable “reason for rearing pigs”, rearing pigs for both income and as a source of meat for the family had a positive coefficient with an odds ratio of 4.061. Which means that farmers who reared pigs as a source of both income and source of meat for the family were significantly (P=0.0001) more likely to be knowledgeable compared to those who only reared pigs as a source of meat for the family.

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Discussion

The results of this study show that the majority of the participant in the study were between the age of 36-71 years of age. It has been observed that in Africa and South Africa specifically, that older people, tend to relocate to the rural areas and start practising the farming (Rakgwale, 2020).

According to cultural beliefs among rural African communities or societies, men are considered to be the owners of the livestock since they are the heads of the family. This could explain results reported in this study that showed that most of the participants were males (60.80%). However, findings of this study, contrast with findings of an earlier study carried out in the same uThukela District, in which it was observed that more female farmers (60%) compared to males were involvement in pig farming (Sibongiseni, 2013). The change in the demographics of emerging pig farmers in the study area as demonstrated by the difference between results of the present study and the one conducted by Sibongiseni (2013) was not expected and the authors are not able to explain the cause of this change.

The majority of participants in this study did not possess formal education and only few of them had completed matric and tertiary education. This was expected given that the study was conducted in a rural area.

The majority of participant is this study were unemployed and or were pensioners. This is consistent with the results that were reported by Sibongiseni (2013). Findings of the present study therefore confirm that uThukela District has a high level of poverty and unemployment, and out of the three municipalities of uThukela District, Langalibalele Municipality had the highest unemployment rate and hence experiences the highest levels of poverty.

With regards to income, the majority of participants earned between 0 – R3500 per month. These results did not come as a shock given that the area is predominantly rural moreover with a high unemployment rate.

The majority of farmers who participated in the study had five years of experience of keeping pigs. Five years is a short time for one to pick up experience. Therefore, overall emerging pig farmers in the study area lacked experience of farming with pigs. This could explain the low level of knowledge about ASF observed among the participants.

Most farmers (87.79%) in the present study reared pigs mainly to serve as a source of meat for their families. This could be attributed to farmers not being able to meet conditions requiring farmers to declare the disease status of their herds before they can sell their pigs through the formal market channels.

Knowledge of the disease

Generally, participants in this study scored low on knowledge about ASF. For example, most failed to identify the correct answers to certain questions about ASF. This has also been observed in other studies that reported insufficient knowledge about ASF among farmers (Chilundo et al., 2020). However, results of the present study contrast with findings of the study from Central–South Cameroon where 90% of pig farmers displayed good knowledge about ASF (Ngwa et al., 2020). This is also the case with studies conducted in Uganda, Ukraine, Madagascar and the United Kingdom, in which it was observed that the majority of farmers were knowledgeable about the disease (Muhangi et al., 2014; Randrianantoandro et al., 2018; Muñoz-Gómez et al., 2021). The low proportion of farmers who scored high on knowledge of ASF in the present study,

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shows a lack of awareness of the disease in the area, which could be attributed to the fact that the participants in the present study were predominantly older.

A study in Europe by Guinat et al. (2016) observed that the transmission of ASF was mainly through the wild pigs and warthogs. Wild pigs and warthogs are known to be a source of ASF infection for domestic pigs (Magadla, 2015). With regard to transmission of ASF, while the majority of participants in the present study identified domestic pigs, 44.84% only mentioned wild pigs and 25% only mentioned warthogs as potential transmitters of ASF. The low numbers of participants in this study that identified wild pigs and warthogs as potential transmitters of ASF, is a source of concern because it suggests a low level of awareness of the disease in the study area.

Farmers in the study area do feed swill, which is known to spread ASF, to their pigs. This is consistent with finding of a study in Europe that observed that up to 57.28% famers interviewed fed swill to their pigs (Khomenko et al., 2013). Generally, the primary source of ASF infection in outbreaks is through the contaminated swills. That is why it is recommended that swill be boiled at least for 60 minutes before feeding it to the pigs in order to minimize the risk associated with feeding of swill (Geering et al., 2011; Sibongiseni, 2013). However, it is not uncommon for farmers not to boil swill before feeding it to their pigs. For example, the majority of the household (95.2%) in a study conducted in Kenya by Nantima et al. (2016), were not aware that swill should be boiled before it is fed to pigs.

The findings of the present study suggest a low level of understanding of the factors that promote the spread of ASF. These findings contrast with other studies (Chenais et al., 2017) conducted in Uganda that observed that farmers were aware of the factors that promote the spread of ASF. Similarly, in a study conducted in Mozambiue by Chilundo et al. (2020) it was observed that the majority of the smallholder farmers were knowledgeable about the risk factors for the spread of ASF. The differences observed between the studies in terms of the level of understanding of the factors that promote the spread of ASF could be explained by the differences in the effectiveness of the extension services rendered to the farmers.

Findings reported in this study, showed that many farmers were able to identify all the clinical sign of ASF such as a high fever, ocular discharge, and death in15-45 days. Similarly in Uganda, it was observed that farmers could describe the clinical signs of ASF and were aware of how ASF spreads (Chenais et al., 2017; Rousset et al., 2018).

The attitudes and practices towards ASF

It was evident that mass media (i.e., radio and television) was the main source of the information on ASF for the respondents. A study by Tejler and Teijler (2012) conducted in Uganda also mentioned that the main source of information in different villages was radio. In view of this, and as recommended by other authors, awareness campaigns should be carried out using all possible sources of information including mass media, posters, leaflets, radio and TV shows (Arias and Sánchez-Vizcaíno, 2008; Kerba Suzanne, 2019).

In event of a suspected case of ASF, most farmers would immediately contact the nearest SVO. In contrast, a study that was conducted in England by Guinat et al. (2016) observed that the majority of farmers would not seek the opinion of a veterinary surgeon immediately if they suspect ASF. They would rather wait for a couple of days with a hope that the pigs would recover. However, in countries like Germany and the Western part of the Russian Federation, it was observed that if farmers suspected ASF, they would immediately report to the veterinarian (Vergne et al., 2016). The observed differences

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between the different study populations could also be attributed to differences in the effectiveness of the extension services of the respective countries.

The practice of hunting wild / bush pigs though not widespread, was nonetheless practiced by some farmers. Moreover, majority of the participants who admitted to hunting wild pigs, brought home whole carcasses. This practice increases the risk of the spread of ASF. A study from Europe by Khomenko and Kerba (2018) showed that discovery of carcasses by hunters visiting the wild boar habitats, is the most likely way to introduce the disease in the free zone.

Adoption of biosecurity in this study population was very poor. This is a problem that has also been observed in other African countries. For example, a similar study conducted in Nigeria showed that the respondents had very poor sanitary and biosecurity measures to help contain and prevent ASF disease (Asambe et al., 2019). In another study from Uganda, it was also observed that biosecurity measures were either poorly or not implemented at all by farmers (Dione et al., 2017).

Predictors of high knowledge score for ASF

Residents of Alfred Duma (Adjusted odds ratio (AOR)=0.524) and Okhahlamba (AOR=0.383) Municipality were less likely to obtain a high knowledge score compared to the farmers in Inkosi Langalibalele. It is not unusual to observe differences in knowledge level between areas. For example, in a study done in Abdela, Ethiopia, showed that residents in Urban areas were less likely to obtain a higher score compared to those who resided in rural areas (Nejash et al., 2017). This could be attributed to the difference between the extension effort directed at the different areas by officials of the department responsible for extension services in the area. It could also be due to differences between educational levels in the different areas.

The male respondents were twice (AOR=1.747) as likely to obtain a higher knowledge score compared to their female counter parts. This is consistent with findings of an Indian study by Biswas et al. (2015) that revealed that males were significantly (P=0.05) more likely to obtain a higher knowledge score than the female farmers. Similar findings where male respondents tended to have higher knowledge than the females (AOR=2.32) have also been reported by other authors (Alhaji et al., 2018).

Farmers who kept pigs as a source of both income and meat for the family had higher odds (AOR=4.061) of being classified as knowledgeable as compared to their counterparts who kept pigs for only home consumption. This could be due to the fact that farmers who keep pigs for purposes of selling, make effort to attend the farmer's day and gain more knowledge about requirements for raising pigs sold on the commercial market. This is likely not to be the case with farmers who keep only pigs as a source of meat for their families.

Younger respondents had higher odds of being more knowledgeable as compared to the respondents aged >71 years. This is an agreement with the study done by Kothalawala et al. (2018). Generally older farmers tend to have difficulties in acquiring knowledge of animal diseases.

Conclusion and Recommendations

Although majority of the farmers displayed a good attitude towards ASF in that they would report the disease immediately to the responsible authorities, majority displayed poor knowledge with respect to ASF. Practices such feeding swill and hunting wild pigs,

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coupled with bringing whole carcasses of a wild pig to the homestead heightens the risk of an outbreak of ASF in uThukela. The study was able to identify the demographic characteristics that predict a high knowledge score for ASF. Findings of this study could be used to design educational campaigns aimed at improving the knowledge of the respondents and enforce a positive attitude and good practices towards ASF.

Conflict of interests. The authors have not declared any conflict of interests.

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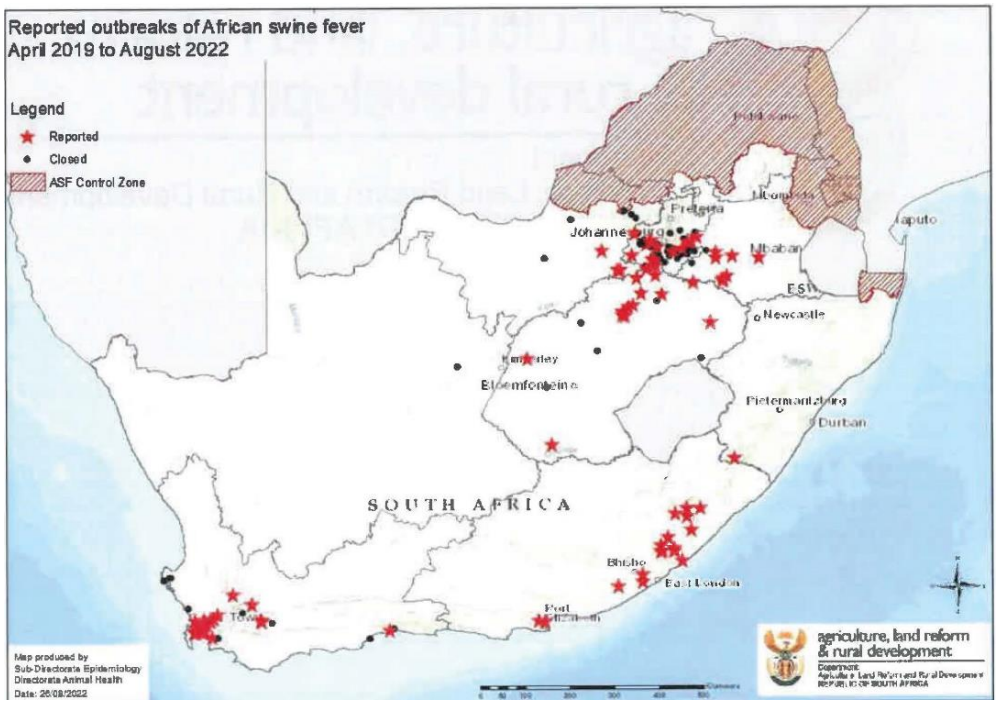
APPENDIX



Supplementary Material A. *Map of South Africa showing the control zone, and the recent outbreaks of African Swine Fever, April 2019 -August 2022*

Supplementary material B. *Univariate analysis showing simple association between the different predictors (socio-economic and demographic) variables and being knowledge as the outcome variable*

Variable	Level	Not knowledgeable (%)	Knowledgeable %	P-value
Residence	Okhahlamba	56.52	43.48	0.0018
	Alfred Duma	51.11	48.89	
	Inkosi Langalibalele	32.94	67.06	
Age	18-35	52.87	47.13	0.0002
	36-53	49.34	50.66	
	54-71	39.86	60.14	
	Over 71	79.49	20.51	
Gender	Male	43.63	56.370	0.0024
	Female	58.68	41.32	
Education Level	No formal education	41.80	58.20	0.0794
	Completed primary school	58.51	41.49	
	Not completed high school	55.91	44.09	
	Completed matric	58.51	41.49	
	Completed tertiary	47.62	52.38	
Employment status	Employed	48.00	52.00	0.6429
	Unemployed	47.06	52.94	
	Pensioner/retired	53.29	46.71	
	Other	40.00	60.00	

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Income	0-3500	49.18	50.82	0.2850
	R3600-6000	65.38	34.62	
	R6000-10000	38.10	61.90	
	≥11000	46.15	53.85	
Experience	< 1 year	62.67	37.33	0.0209
	2-5 years	50.00	50.00	
	>5 years	43.58	56.42	
Reason for farming	Source of income	0.00	0.00	0.0001
	Source of meat for the family	53.21	46.79	
	Both as a source of income and meat for family	23.08	76.92	
	Other	0.00		

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