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African Swine Fever and Hog Cholera Attacks: Perception and Local Knowledge of Farmers in Manokwari

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ABSTRACT

African Swine Fever (ASF) and Hog Cholera are highly contagious viral diseases in pigs, resulting in losses for pig farmers in Manokwari regency. Farmers cannot avoid panic and resignation. The study aimed to measure pig farmers' attitudes and knowledge about these infectious diseases. Farmers were selected from 12 villages and originated from 8 big ethnics from Papuan and non-Papuan. The findings show that most breeders are still in the early stages of their farming careers and have a long experience. Farmers tend to show concern about African Swine Fever and Hog Cholera. However, their attitudes towards pig diseases are considered less than optimal. Most farmers have fairly good knowledge about African Swine Fever and Hog Cholera. The primary source of information for farmers is obtained from other communities, indicating an exchange of information between pig farmers and the community.

Keywords: African swine fever, hog cholera, local knowledge, perception, Manokwari, West Papua

INTRODUCTION

The existence of pig farming in several regions of Indonesia (Lase et al. 2024; Leslie et al. 2015) is part of the culture of the local community and has been passed down from generation to generation (Iyai et al. 2021). The rearing system varies according to regional conditions, cultural customs of the local community and the purpose of raising the livestock itself. The characteristics of traditionally managed pig farming businesses are visible in several regions in Indonesia, including Papua. (Sorokowski et al. 2013). Pigs are generally raised to contribute to meeting family needs; the role of pigs in the lives of local communities in the social, cultural and economic problems the community faces. (Sayori et al. 2022; Iyai 2011; Sorokowski et al. 2013). Pork is a livestock product in Indonesia that is in high consumer demand.

Livestock cultivation businesses such as pig rearing businesses currently carried out by most rural communities are still part-time. The average rearing business scale is ten animals/livestock, and their orientation to produce commodities according to market demand is also still low. (Widayati et al. 2018; Widayati et al. 2019; Iyai et al. 2011). However, in general, the livestock rearing business is still relied upon as a source of income, as a meat producer, as a source of employment, as a user of agricultural or household waste, and as a savings source for the community. Aims in pig production can be categorized as breeding and fattening businesses with limited ownership.

Increasing the livestock population measures good management and quality (Widayati et al. 2019; Mahlobo 2016). Indonesian people traditionally raise pigs (Losada et al. 1995; Deb 2019; Domínguez and Ly 1997). The community lacks knowledge of how to raise pigs in terms of management, health, feed, and housing. This causes many people to experience failure in raising pigs. One thing that influences the success of raising pigs in the management aspect is health factors and disease control. Pigs are susceptible to diseases, including African Swine Fever (ASF) and Hog Cholera (Angi and Tulle, 2022; Sendow et al. 2020, 2020).

African Swine Fever (ASF) is a highly contagious viral disease in pigs, causing various bleeding in internal organs and accompanied by a very high mortality rate. ASF was first identified in 1921 in Kenya, East Africa. Then, in 1957, it spread to various European and Asian countries, and at the end of 2019, African fever entered Indonesia. ASF disease is not contagious to humans; if it occurs, it will cause large economic

losses because this disease is deadly in pigs. Pigs infected with ASF will show signs such as Fever, loss of appetite, vomiting, diarrhoea, bleeding on the skin and internal organs, change in skin colour to purple, abortion or deficiency in pregnant pigs. This virus is susceptible to infecting all species of pigs from the family *swine.* In all age ranges, the ASF virus is a virus that is very resistant to environmental conditions and can maintain its infectious properties even at low temperatures. For this reason, the ASF virus can survive for a long time on frozen material. (Sorokowski et al. 2013).

Hog Cholera is a contagious animal disease based on the Director General's Decree No. 59/Kpts/PD.610/05/2007, a priority in prevention, control and eradication efforts. This is because Hog Cholera is a disease that causes quite a large economic impact. Hog Cholera (HC), or Classical Swine Fever, is a virulent pig disease. (Lase et al. 2024; Gelolodo et al. 2023; Sendow et al. 2020). According to the OIE (Office International Epizooties) classification, Hog Cholera is categorized as a disease on list A of animal diseases, while in Indonesia Hog Cholera is a disease that is included in 12 types of infectious animal diseases.

The existence of pig farming businesses in Manokwari, as is the case in several regions in Indonesia such as North Sumatra, Bali and Kalimantan, is generally part of the culture of the local community and has been carried out from generation to generation (Karimuna et al. 2020; Iyai et al. 2013) . On the other hand, the efforts made by breeders are economically profitable because feed costs are relatively low compared to commercial feed (Iyai 2011; Iyai, et al. 2015; Warastuti 2001)).

The pig farming business is a business that the people of Papua have carried out for generations over a very long period of time. This can be seen in the maintenance system which is still traditional, namely in extensive and semi-intensive forms. (Junquera et al. 2022; Toro-Mujica et al. 2012; Ripoll-Bosch et al. 2014). Internal factors of breeders more cause the hampered development of livestock businesses in local communities in Papua. These namely socio-cultural factors influence behaviour such as attitudes, knowledge and skills of breeders. Meanwhile, external factors include the lack of counselling and training activities and the lack of information they receive about livestock development. Especially the problem of pig disease which makes pig farmers panic and surrender to face it.

This can be seen in the last three years (2019-2022), when there has been an outbreak of African Swine Fever (ASF) and Hog Cholera in Indonesia, including in Manokwari Regency in 2020. ASF occurred with a death rate of 1,550 pigs owned by the community due to a virus attack. ASF and HC disease occurred in 2018 and attacked livestock, including pigs, resulting in losses for pig farmers in Manokwari Regency. Panic and resignation can be avoided if farmers receive information, knowledge, and skills about infectious diseases to carry out prevention and treatment (Primatika et al. 2021; Sendow et al. 2020). To find out the extent of pig breeders' behaviour in responding to the outbreak of African Swine Fever (ASF) and Hog Cholera (HC) in Manokwari Regency, it is necessary to conduct research. The study aimed to determine the attitudes and knowledge of pig farmers towards African Swine Fever (ASF) and hog Cholera (HC) in Manokwari Regency.

METHODS

Place and time of research

This research was carried out in Prafi and Masni districts, Manokwari Regency. These two districts are centres for beef livestock production, including pig farming. These two districts are also the areas with the most dominant pig deaths among the nine other districts in the Manokwari district, West Papua. This research was carried out for 1 month. The subjects in this research were people who run pig farms in two sample districts in Manokwari Regency. The tools used in this research are questionnaires, cameras, *cell phones*, writing tools, and data processing and word processing tools.

Research Methods and Techniques

The research method used in this research is descriptive, with survey research techniques using observation and interviews with pig owners or breeders using questionnaires (list of questions) for respondents. The questionnaire will ask several questions related to the attitudes and knowledge of breeders in dealing with African Swine Fever (ASF) and Hog Cholera (HC).

Sampling Method

District sampling was carried out purposively, namely first, selecting two districts in Manokwari Regency which raise a lot of pigs

and there have been cases or incidents of outbreaks of African Swine Fever (ASF), and Hog Cholera (HC), namely in Prafi and Masni Districts. After determining the location, continue by searching for infected samples (Snowball Method) (McCarron et al. 2015), namely determining samples in a chain from the first sample progressing to the next sample so that the number of samples is maximum.

Method of collecting data

Data collection was carried out in 2 (two) ways, namely primary data collection and secondary data collection. Primary data collection is carried out by asking respondents directly about responses or opinions about how to handle livestock in the face of ASF and HC outbreaks/viruses and also by giving questionnaires directly to respondents, while secondary data collection will be carried out by obtaining it from government agencies. related agencies.

Observation Variables

The observation variables in this research are; Farmer characteristics, breeder attitudes, and breeder knowledge. Farmer characteristics include breeder age, education level, breeding goals, length of farming, and number of livestock kept. Farmers' attitudes are the things they feel when an outbreak of African Swine Fever (ASF) or hog Cholera (HC) breaks out or is infected in their area or livestock. Farmers' feelings regarding information, impacts and ways to deal with disease outbreaks. The Attitude Sub Variables that will be measured are (1) Feelings of anxiety about facing African Swine Fever (ASF) and hog Cholera (HC). (2) Ego/don't care about African Swine Fever (ASF), and Hog Cholera (HC). (3) Curiosity African Swine Fever (ASF), and Hog Cholera (HC). (4) Discipline to maintain the health of pigs, and (5) Courage to take risks in the face of pig disease outbreaks. The knowledge of breeders in this research is the extent to which breeders know about African Swine Fever (ASF) and Hog Cholera (HC) including knowledge of outbreaks, the consequences of the disease and how to deal with the disease. The knowledge sub-variables that will be measured are (1) Information about African Swine Fever (ASF) and Hog Cholera (HC). (2) Knowledge of African Swine Fever (ASF) and Hog Cholera (HC). (3) Origin/source of information about African Swine Fever (ASF), and Hog Cholera (HC). (4) Participation in counselling and training, and (5) Creativity and innovation in developing local or traditional methods of treatment.

Data analysis

Behavioural data was obtained by measuring using a Likert Scale with scoring, namely ranking the highest to lowest scores regarding Attitude, namely very good (4), good (3), not good (2), and not good (1). Likewise, knowledge ranking scores were obtained, namely very knowledgeable/competent (4), knowledgeable/competent (3), not knowledgeable/less competent (2), and don't know/incompetent (1). Data were analysed using descriptive statistics and inferential statistics in the form of a paired T-test.

RESULTS AND DISCUSSIONS

Sociometric Characteristics of Farmers

The pig farmers as respondents in this research were selected from 30 representative farmers and lived in the Prafi and Masni Districts, Manokwari Regency, West Papua Province (Fig.1). Farmer characteristics include breeder education level (Fig. 2), ethnic (Fig. 3), and aims in keeping pigs (Fig.4) explained as follows.

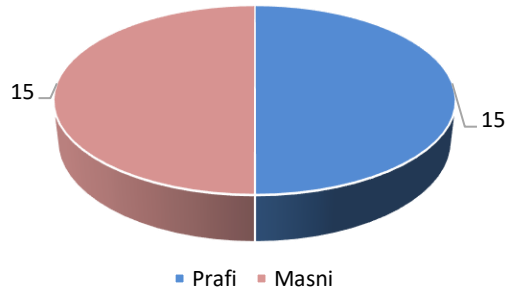

Fig. 1. Composition of farmers selected from two districts

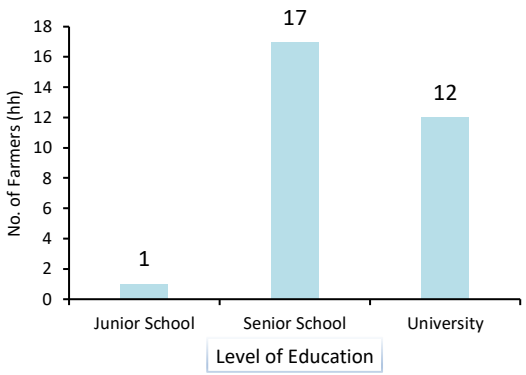

Fig. 2. Schools and education status of the farmers

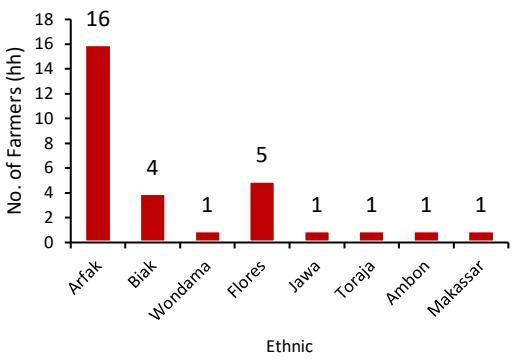

Fig. 3. Ethnicity of origin from Indonesia tribes

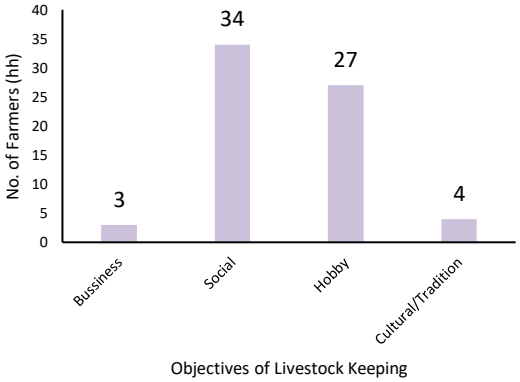

Fig. 4. Aims in keeping pigs.

The breeder's age is one of the determinants of the productive period someone has in carrying out work. The age factor will determine the success of a business because age can determine the value of performance for breeders (Ngaiwi et al. 2023; Belay et al. 2022; Mwaura et al. 2021). The average age of breeders is where part. Most breeders are aged 20-29 years, as many as 12 people/breeder with a percentage of 40%, 30-39 years, as many as 10 people/breeder with a percentage of 34%, 40-49 years, as many as 3 people/breeder with a percentage of 10%, 50- 59 years, as many as 3 people/breeder with a percentage of 10%, 60-69 years, as many as 1 person/breeder with a percentage of 3%, and 70-76 years, as many as 1 person/breeder with a percentage of 3%. With a total of 30 respondents and a percentage of 100%. This means that the majority of pig farmers in the Prafi and Masni districts, Manokwari regency, are in the productive age group. The non-productive age group is 0-14 years old, while the productive age group is 15-56 years old. Those over 57 years old are above less productive. The older a person is, the more likely they are to think more maturely and act more wisely (Toumbourou and Dressler 2024; Pakage et al. 2021; Bolowe et al. 2022; Liu et al. 2020; Reyes-García et al. 2014). Physically it will affect productivity in the livestock business, where the higher the age of the farmer, the relatively lower his workability (Ouma et al. 2013; Sayori et al. 2022).

Education Level

Education is one factor that influences how farmers think and act when developing their businesses. The level of education in this study is the level of formal education, including elementary school, middle school, high school/vocational school, and college. It is known that the average education of breeders is junior high school graduates, namely 1 breeder with a percentage of 3%, senior high school, namely 17 with a rate of 57% and followed by college graduates (S1), namely 12 breeders with a rate of 40%, with a total of 30 respondents. and percentage 100%. This shows that the education level of breeders is quite high. The higher the level of education of breeders, the more optimal their abilities related to the development of livestock activities will be (Iyai et al. 2013; Leslie et al. 2015; Dewantari et al. 2017).

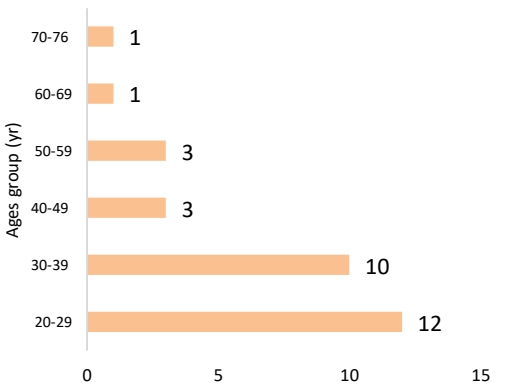

Fig. 5. Ages of farmers group in keeping pigs

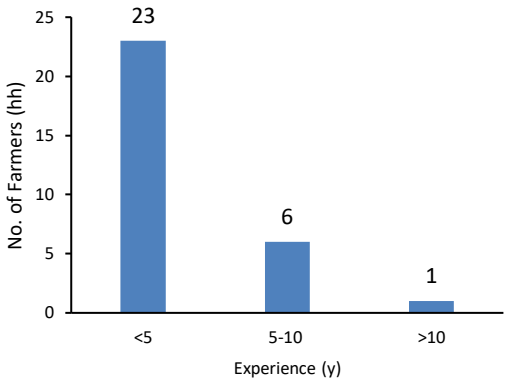

Fig. 6. Experience in keeping pigs

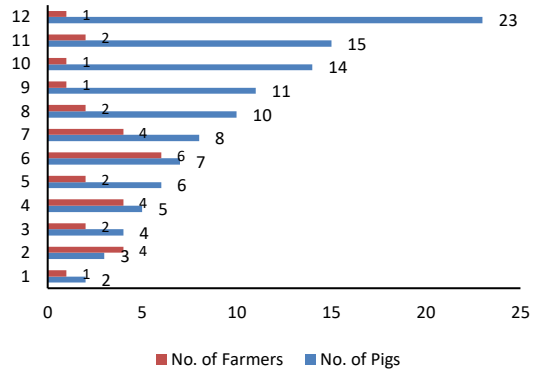

Fig. 7. Pig asset keeping by farmers

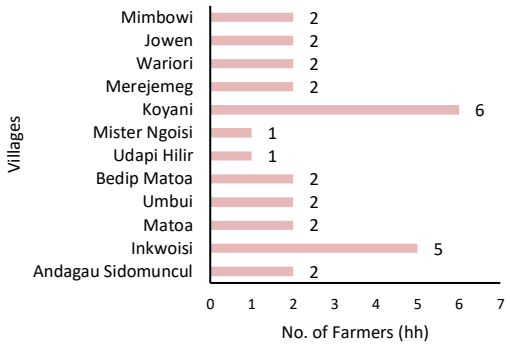

Fig. 8. Distribution of farmers living in villages

Pig keeping Aims

The aim of raising pigs is one of the factors in the farming business in the field of animal husbandry, which carries out renovations and developments. The main aim is to increase production to improve the standard of living of Indonesian farmers. The rest is to be able to meet the needs of food resulting from livestock for all Indonesian people as a whole. fair, even, and sufficient. The aim of raising pigs is directed to social needs counted for 17 farmers (57%), followed by pleasure or hobby for 9 farmers (30%), and the traditional/cultural needs for one farmer (3%). The rest is for business for three farmers (10%). Of the 30 farmers, the majority of breeders prefer social needs as the goal in keeping pigs (Karabozhilova et al. 2012; Sorokowski et al. 2013; Boogaard et al. 2011).

Experiences in Pig-Keeping

The length of time in farming is the length of time a farmer has been involved in a livestock business. Length of breeding is an important factor that farmers must have in improving productivity and ability to work in the livestock business (Nabikyu and Kugonza 2016; Schivera 1955; Berihu and Tamir 2015). The longer you farm, the more skilled you are at managing a livestock business. The number of breeders in the study with the highest length of farming was around less than 5 years, namely 23 people/breeder with a percentage of 20%, while from 5 - 10 years, namely 6 people/breeder with a rate of 20% and more than 10 years, namely 1 person/breeder with a percentage 3%, from a total of 30 respondents with a total percentage of 100%.

Asset of pigs

The number of pig ownership assets shows the number of pigs owned by farmers. The amount of livestock ownership for each respondent varies depending on business conditions. (Nabikyu and Kugonza 2016; Chauhan et al. 2016; Plaza-Bonilla et al. 2017; Sorokowski et al. 2013; Phiri 2012; Correia-Gomes et al. 2017). The amount of ownership of the respondents' livestock in Manokwari Regency is smallholder farmers. This can be seen from the highest number of livestock owners, namely one person/breeder out of 30 respondents with livestock of 23 pigs with a percentage of 3%, while the number of livestock owners is small, namely one person/breeder out of 30 respondents with total livestock of 2 pigs with a percentage of 3%.

Breeder's Attitude

The attitudes of pig farmers in the Masni and Prafi Districts vary. Attitudes have significant and insignificant values. The results of the data on the attitudes of pig farmers in the Masni and Prafi Districts are provided in Table 1.

The farmer's attitude towards the sub-variable of feeling anxious about African Swine Fever (ASF) and Hog Cholera (HC), feeling worried about African Swine Fever (ASF) has an average value of 3.8 and Hog Cholera (HC) has an average value 3.3. By the value of the T-test, there was a significant difference. Farmers believed African Swine Fever (ASF) and Hog Cholera (HC) are dangerous. Properties of ego (not care) about African Swine Fever (ASF), and Hog Cholera (HC), the action of this disease has an average ASF value of 2.0 and HC 2.13 with a T-test value, i.e. no significant difference ($p>0.05$). This means that people ask more questions about neighbours if the disease occurs. In the variable of curiosity of the ASF and HC, the desire to know more deeply has an ASF mean value of 3.2 and HC has a mean value of 3.2.

Table 1. Average Farmer Attitudes

No	Variable	n	Mean/Stdv		T-test	p
			ASF	HC		
A	Attitude					
1	Perceive of anxiety					
1.1	Feelings	30	3.8±0.46	3.3±0.80	0.001	**
1.2	Worrying	30	3.8±0.46	3.3±0.60	0.001	**
2	Ego/Not Caring					
2.1	Preventive action	30	2.0±0.80	2.13±0.86	0.522	NS
3	Curiosity					
3.1	Want to know	30	3.2±0.82	3.2±0.78	1.000	NS
3.2	Want to know about	30	2.7±0.78	2.8±0.46	0.501	NS
4	Discipline					
4.1	Maintaining health discipline	30	3.5±0.68	3.4±0.68	0.083	NS
4.2	Report relevant department	30	2.6±1.06	2.5±1.00	0.662	NS
5	Brave in taking a risk					
5.1	Brave in abolishing pigs	30	2.2±0.52	2.1±0.53	0.184	NS
5.2	Brave in allocating cash	30	2.1±0.59	2.1±0.59	1.000	NS

Explanation: NS; Not significant (P>0.05), **= Significant difference (P>0.01).

However, a T-test value showed no significant difference (p>0.05). When farmers heard about this disease outbreak, people chose media care to find out more about this outbreak. Curiosity about ASF had an average value of 2.7, and HC had an average value of 2.8, with the T-test value having no significant difference (p>0.05). The majority of people prefer ways to prevent and treat this disease. Discipline in maintaining health against African Swine Fever (ASF) has an average value of 3.5, and Hog Cholera (HC) has an average value of 3.4, with the T-test value there being a significant difference (p<0.05). This is because the community frequently keeps pigs and pens clean. The farmer's orderly report to the relevant department for ASF disease has an average value of 2.6, and HC has an average value of 2.5, with the T-test value having no significant difference (p>0.05). The community rarely reports it to the Animal Health Service. The courage to take risks in facing an epidemic and the courage to destroy livestock has an average value of 2.2, and HC has an average value of 2.1, with the T-test value having no significant difference (P>0.05). The reason is done by considering farmers lack the courage to destroy livestock. The courageous farmers will spend their cash to take action to prevent ASF disease. Therefore, the average value of ASF is 2.1 and HC 2.1 (P>0.05). This means that farmers prefer to be less brave enough to spend money to carry out action disease prevention. (Primatika et al. 2021; Sendow et al. 2020; Primatika et al. 2022; Sendow et al. 2020).

Farmer Knowledge

The knowledge of pig farmers in Masni and Prafi Districts varies; knowledge has significant and insignificant values; the results of the attitude data of pig farmers in Masni and Prafi Districts can be seen in Table 2.

The farmers' knowledge of the sub-variable information on African Swine Fever (ASF) and Hog Cholera (HC), when getting ASF information, has an average value of 3.4 and HC has an average value of 3.3 with the T-test value having no difference (P>0 .05). This figure by the reason that the majority of the farmers reluctant to know about ASF and HC diseases. So far, the information about ASF has an average value of 2.8, and HC has an average value of 2.6, with the T-test value having no difference (P> 0.05). This means that most of The public still does not know enough about ASF and HC information. Knowledge about African Swine Fever (ASF) and Hog Cholera (HC), knowing ASF disease has an average value of 2.7 and Hog Cholera (HC) has an average value of 2.5 with the T-test value having no difference (P>0.05) because the community prefer to know in recognizing ASF and HC diseases, recognizing the impact of ASF has an average value of 2.5 and HC has an average value of 2.5 with mark There is no real difference in the T-test because people prefer to know the impact of African Swine Fever (ASF) and Hog Cholera (HC), knowing the signs of the disease ASF has an average value of 2.2 and HC has mark.

Table 2. Average Value of Farmer Knowledge

No	Variable	n	Average/Stdv		T-test	p
			ASF	HCL		
A	Local knowledge					
1	Information on diseases					
1.1	Obtaining information	30	3.4±0.56	3.3±0.59	0.264	NS
1.2	Existing information	30	2.8±0.69	2.6±0.61	0.056	NS
2	Diseases knowledge					
2.1	Recognised diseases	30	2.7±0.58	2.6±0.56	0.211	NS
2.2	Recognised impact	30	2.5±0.73	2.5±0.68	0.813	NS
2.3	Recognised marks	30	2.2±0.84	2.1±0.81	0.702	NS
3	Origin of information					
3.1	Source of information	30	2.6±1.4	2.3±1.4	0.083	NS
3.2	Usage of Cell phone	30	2.6±0.85	2.5±0.72	0.489	NS
4	Involvement of Extension					
4.1	Participation on Extension	30	2.0±0.90	2.2±0.80	0.161	NS
4.2	Material of Extension	30	2.0±0.96	2.4±0.70	0.183	NS
5	Ways of offering medicines					
5.1	Offering medicines	30	2.1±0.71	1.9±0.58	0.134	NS
5.2	Confident medicine	30	2.4±0.67	2.3±0.70	0.184	NS

Explanation: NS; Not significant (P>0.05).

The mean is 2.1 with no significant difference in the T-test value (P>0.05), namely that people prefer to just know rather than really know about the signs of African Swine Fever (ASF) and Hog Cholera (HC).

From the ASF and HC information sources, the African Swine Fever (ASF) information source has an average value of 2.6 and Hog Cholera (HC) has an average value of 2.3 with the T-test value having no significant difference (P>0.05). This is because people prefer to hear from people about information about African Swine Fever (ASF) and Hog Cholera (HC) (Correia-Gomes et al. 2017; Cishesa et al. 2022). Benefit Cell phone/HP to obtain information ASF has an average value of 2.6, and HC has an average value of 2.5, with the T-test value having no significant difference (P>0.05). This is because people choose to use Cell phones/HP. After all, it is useful for people to get information. Participating in counselling about the treatment of African Swine Fever and Hog Cholera, following ASF counselling had a mean value of 2.0 and following HC counselling had a mean value of 2.2 with the T-test value having no significant difference (P>0.05) because many public who prefer to rarely attend counselling and training on handling African Swine Fever and Hog Cholera.

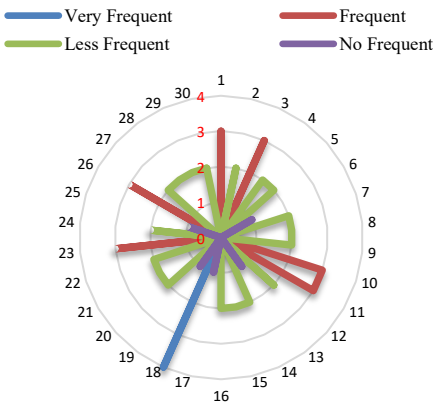

Fig. 9. Ways of offering medicine to pigs during ASF diseases

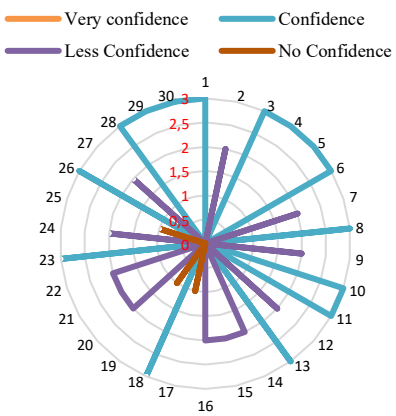

Fig. 10. Confidence in offering medicines during ASF disease

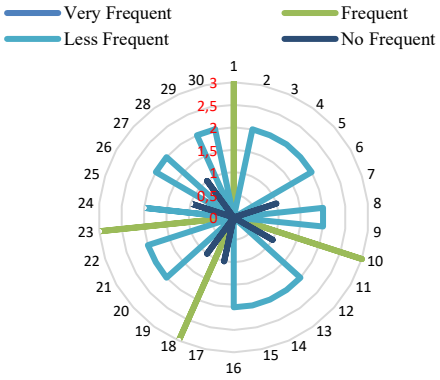

Fig. 11. Ways of offering medicine to pigs during HC diseases

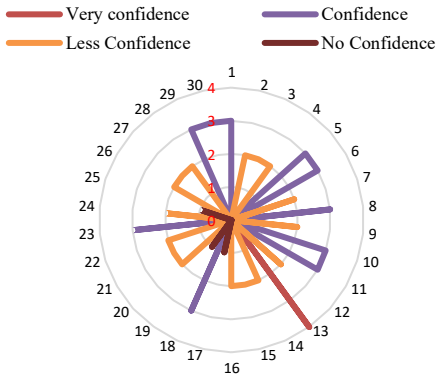

Fig. 12. Confidence in offering medicines during HC disease

The need for ASF counselling materials has an average value of 2.0, and HC has an average value of 2.4, with the T-test value having no significant difference (P>0.05), with the community preferring the necessary material regarding disease prevention. Local or traditional methods for ASF and HC, giving traditional medicine for ASF disease has a mean value of 2.1 (Fig. 9) and giving traditional medicine for HC disease has a mean value of 1.9 (Fig. 11) with the T-test value not significantly different (P >0.05) this is because people choose to rarely treat ASF and HC. Confidence in traditional medicine for treating ASF disease has an average value of 2.4 (Fig. 10) and for treating HC has an average value of 2.3 (Fig. 12) with the T-test value not being significantly different (P>0.05), namely that people choose to be less confident in giving traditional medicine to the pigs infected with African Swine disease: fever and Hog Cholera. (Isty 2023; Putut et al. 2021; Arias et al. 2017).

CONCLUSIONS

Most pig farmers are in the young productive age range between 20-29 years old. The majority of farmers have high school/vocational and tertiary education, indicating a fairly good level of education among pig farmers. Most breeders have been breeding for less than 5 years, and ownership of the livestock varies. This indicates that most breeders are still in the early stages of their farming careers and have a long experience. Farmers tend to show concern about ASF and HC. However, their attitudes towards pig diseases are considered less than optimal. The majority of farmers have fairly good knowledge about African Swine Fever and Hog Cholera. The main source of information for breeders is from other people, indicating that there is an exchange of information between the breeder community.

Research recommendations make it possible to carry out further research on the interaction behaviour of pig breeders with hunting activities where wild boar animals are suspected to be carriers of ASF and HC disease germs. Restrictions and termination of import and export trade in livestock and products between regions in Indonesia, especially in West Papua, which are suspected of being infected with ASF and HC diseases. There is a need for outreach and training activities to prevent and treat infectious diseases such as ASF and HC. It is necessary to observe ASF and HC diseases in pigs based on seasons to determine the possible effects of differences in the extreme rainy and dry seasons on the phenomenon of the spread of ASF and HC diseases, to prevent the spread of ASF disease and HC in pigs.

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Conflict of interest

The authors declare that they have no competing interests.

Authors' contribution

MD, DAI, and AL wrote and designed the research project proposal. AL, DAI, and YS collected data from farmers. DAI, MD, TWW, and NLM run an analysis of the field data. MJW

and DW provided materials and transportation during field research. YS, and YSl, consulted Statisticians. MD, DAI and TWW wrote the draft and finalized the manuscript.

REFERENCES

Angi, Andrijanto Hauferson, and Defrys R. Tulle. 2022. "Identifikasi Faktor Resiko Yang Berperan Sebagai Sumber Penularan Penyakit African Swine Fever Di Kota Dan Kabupaten Kupang." Partner 27 (2): 1939. https://doi.org/10.35726/jp.v27i2.1072.

Arias, Marisa, Ana de la Torre, Linda Dixon, Carmina Gallardo, Ferran Jori, Alberto Laddomada, Carlos Martins, et al. 2017. "Approaches and Perspectives for Development of African Swine Fever Virus Vaccines." Vaccines 5 (4): 1–20. https://doi.org/10.3390/vaccines5040035.

Azizah Primatika, Roza, Etih Sudarnika, Bambang Sumiarto, Chaerul Basri, Program Studi Kesehatan Masyarakat Veteriner, Fakultas Kedokteran Hewan, Institut Pertanian Bogor, Jawa Barat, Departemen Kesehatan Masyarakat Veteriner, and Universitas Gadjah Mada. 2021. "Tantangan Dan Kendala Pengendalian African Swine Fever (ASF) Challenges and Barriers to African Swine Fever (ASF) Control." Jurnal Sain Veteriner 39 (1): 62–72. https://jurnal.ugm.ac.id/jsv.

Belay, Abrham, Christopher Oludhe, Alisher Mirzabaev, John W. Recha, Zerihun Berhane, Philip M. Osano, Teferi Demissie, Lydia A. Olaka, and Dawit Solomon. 2022. "Knowledge of Climate Change and Adaptation by Smallholder Farmers: Evidence from Southern Ethiopia." Heliyon 8 (12): e12089. https://doi.org/10.1016/j.heliyon.2022.e12089.

Berihu, Mulugeta, and Berhan Tamir. 2015. "Characterization of Feed Resources and Body Condition Scores of Pigs under Small Scale Intensive Production in East Shewa, Ethiopia Department of Animal Science, College of Veterinary Medicine and Agriculture," 4 (3): 106–12. https://doi.org/10.5829/idosi.ajn.2015.4.3.101135.

Bolowe, Monosi Andries, Ketshephaone Thutwa, Patrick Monametsi Kgwatalala, Phetogo Ineeleng Monau, and Cosmas Malejane. 2022. "Production Characteristics and Management Practices of Indigenous Tswana Sheep in Southern Districts of Botswana." Animals 12 (7). https://doi.org/10.3390/ani12070830.

Boogaard, B. K., S. J. Oosting, B. B. Bock, and J. S.C. Wiskerke. 2011. "The Sociocultural Sustainability of Livestock Farming: An Inquiry into Social Perceptions of Dairy Farming." Animal 5 (9): 1458–66. https://doi.org/10.1017/S1751731111000371.

Chauhan, Anuj, B H M Patel, Rajveer Maurya, Sushil Kumar, Sanjeev Shukla, and Subodh Kumar. 2016. "Pig Production System As a Source of Livelihood in Indian Scenario: An Overview." International Journal of Science Technology 5 (4): 2278–3687.

Cishesa, Thierry Heri, Anicet Bahati Kavange, Justin Zigashane Kulimushi, Dieudonné Cigajir'Omwirhwe Rugendabanga, Crispin Ndagano Kamole K'Eka, Rosine Lufungulo Rosine, Charles Bahavu Hangi, Nshokano Baharanyi Josué, and Patient M. Zamukulu. 2022. "Traditional Livestock System and Pathologies Risk in the Small-Scale Pig Farming in Kamituga Sub County, Eastern Democratic Republic of the Congo." OALib 09 (04): 1–13. https://doi.org/10.4236/oalib.1108637.

Correia-Gomes, Carla, Madeleine K. Henry, Harriet K. Auty, and George J. Gunn. 2017. "Exploring the Role of Small-Scale Livestock Keepers for National Biosecurity—The Pig Case." Preventive Veterinary Medicine 145: 7–15. https://doi.org/10.1016/j.prevetmed.2017.06.005.

Deb, S M. 2019. "Traditional Livestock Production and Growth Opportunities in India." https://uknowledge.uky.edu/igc/23/keynote/9/.

Dewantari, M, I K W Parimartha, and D A N I W Sukanata. 2017. "Profile Usaha Peternakan Babi Skala Kecil Di Desa Puhu Kecamatan Payangan Kabupaten Gianyar the Profile of Small Pig Farms At Puhu Village

District." Majalah Ilmiah Pertenakan 20 (2): 79–83.

Dewantari, M, I KW Parimartha, and DANIW Sukanata. n.d. "Profil Usaha Peternakan Babi Skala Kecil Di Desa Puhu Kecamatan Payangan Kabupaten Gianyar," 79–83.

Domínguez, P. L., and J. Ly. 1997. "An Approach to the Nutritional Value for Pigs of Sweet Potato Vines (Ipomoea Batatas (l.) Lam)." Livestock Research for Rural Development 9 (2): 1–10.

Gelolodo, Maria Aega, Yohanes T R M R Simarmata, Tri Utami, Tarsisius Considus Tophianong, Frans Umbu Datta, Yeremia Y Sitompul, Cynthia Dewi Gaina, et al. 2023. "Diagnosa Penyakit Hewan Dengan Teknik Polymerase Chain Reaction Di Lingkungan Universitas Nusa Cendana." International Journal of Community Service Learning 7 (2): 160–67. https://doi.org/10.23887/ijcsl.v7i2.55140.

Hombahomba, EYD, P Purwanta, and GMN Isty. 2023. "Peningkatan Pengetahuan Dan Sikap Peternak Babi Terhadap Penyakit African Swine Fever (ASF) Di Kampung Meyes Distrik Manokwari Utara." Prosiding Seminar Nasional Pembangunan Dan Pendidikan Vokasi Pertanian 4 (1): 92–104. https://doi.org/10.47687/snppvp.v4i1.634.

Iyai, D. A., O. Marani, T. Marjen, and L. Usior. 2013. "Pig Farming Performances of Three Papuan Tribes: Case Study of Byak, Onate and Arfak Tribes in Papua Barat." Journal of the Indonesian Tropical Animal Agriculture 38 (1): 55–64. https://doi.org/10.14710/jitaa.38.1.55-64.

Iyai, D. A., B. W.I. Rahayu, I. Sumpe, and D. Saragih. 2011. "Analysis of Pig Profiles on Small-Scale Pig Farmers in Manokwari-West Papua." Journal of the Indonesian Tropical Animal Agriculture 36 (3): 190–97. https://doi.org/10.14710/jitaa.36.3.190-197.

Iyai, D A, D Saragih, and M Kayadoe. 2013. "Quantifying Feeding Regimes on Weaned Sows under Tropical Papua Pig Keeping Systems." Animal Production 15 (2): 106–18.

Iyai, DA. 2011. "Comparing Characteristics of Various Agro-Ecological Zones of Pig Farming Systems ; Case Study of Islands, Coastal and Lowland Pig Farming Systems in Papua and West Papua." Sains Peternakan 9 (September): 88–99.

Iyai, DA, B Gobay, and A Yaku. 2015. "Understanding the Objectives of Pigs Farming Development in Arfak Tribe Farmers, West Papua." International Journal of Agriculture … 3 (2): 179–91. http://pasca.unhas.ac.id/ojs/index.php/ijas/article/view/106.

Iyai, DA, D Nurhayati, M Arim, D Saragih, M Orisu, M Djunaedi, SY Randa, et al. 2021. "Analyses of Interlinked Actors in Determining the Potential Business Beneficiaries of Small-Scale Pig Farming Systems in West Papua, Indonesia." Heliyon 7 (2). https://doi.org/10.1016/j.heliyon.2021.e05911.

Junquera, Victoria, Daniel I. Rubenstein, Adrienne Grêt-Regamey, and Florian Knaus. 2022. "Structural Change in Agriculture and Farmers' Social Contacts: Insights from a Swiss Mountain Region." Agricultural Systems 200 (May). https://doi.org/10.1016/j.agsy.2022.10343.

Karabozhilova, I., B. Wieland, S. Alonso, L. Salonen, and B. Häsler. 2012. "Backyard Chicken Keeping in the Greater London Urban Area: Welfare Status, Biosecurity and Disease Control Issues." British Poultry Science 53 (4): 421–30. https://doi.org/10.1080/00071668.2012.707309.

Karimuna, Siti Rahmah, Sri Bananiek, Syafiuddin Syafiuddin, and Waode Al Jumiati. 2020. "Potensi Pengembangan Komoditas Peternakan Di Sulawesi Tenggara." Jurnal Ilmu Dan Teknologi Peternakan Tropis. Universitas Halu Oleo. https://doi.org/10.33772/jitro.v7i2.12215.

Lase, J. A., Surya, and M. A. Da Costa. 2024. "Germplasm of Indonesia Local Pig: Potential, Threat of Extinction, and Conservation Strategy." IOP Conference Series: Earth and Environmental Science 1292 (1). https://doi.org/10.1088/1755-1315/1292/1/012004.

Leslie, Edwina E.C., Maria Geong, Muktasam Abdurrahman, Michael P. Ward, and Jenny

Ann L.M.L. Toribio. 2015. “A Description of Smallholder Pig Production Systems in Eastern Indonesia.” Preventive Veterinary Medicine 118 (4): 319–27. https://doi.org/10.1016/j.prevetmed.2014.12.006.

Liu, Yujing, Renchuan Hu, Songsong Shen, Zheng Zhang, Jing Zhang, Xiaoling Song, and Sheng Qiang. 2020. “Plant Diversity in Herbal Tea and Its Traditional Knowledge in Qingtian County, Zhejiang Province, China.” Plant Diversity 42 (6): 464–72. https://doi.org/10.1016/j.pld.2020.12.002.

Losada, H, M Neale, J Vieyra, R Soriano, J Rivera, J Cortes, and D Grande. 1995. “The Potential of Traditional Systems of Pig Production in the Temperate Region of Xochimilco.” Livestock Research for Rural Development 7 (1): Article 7.

Mahlobo, Busie Truetia. 2016. “Multi – Criteria Livestock Assessment for Sustainability of Smallholder Farms in Kwa-Zulu Natal,” no. March.

McCarron, Margaret, Peninah Munyua, Po-Yung Cheng, Thomas Manga, Cathryn Wanjohi, Ann Moen, Anthony Mounts, and Mark A. Katz. 2015. “Understanding the Poultry Trade Network in Kenya: Implications for Regional Disease Prevention and Control.” Preventive Veterinary Medicine 120 (3–4): 321–27. https://doi.org/10.1016/j.prevetmed.2015.03.021.

Mwaura, G. G., M. N. Kiboi, J. N. Mugwe, G. Nicolay, E. K. Bett, A. Muriuki, C. M. Musafiri, and F. K. Ngetich. 2021. “Economic Evaluation and Socioeconomic Drivers Influencing Farmers’ Perceptions on Benefits of Using Organic Inputs Technologies in Upper Eastern Kenya.” Environmental Challenges 5 (August). https://doi.org/10.1016/j.envc.2021.10028.

Nabikyu, J., and D. R. Kugonza. 2016. “Profitability Analysis of Selected Piggery Businesses in Peri-Urban Communities of Kampala Uganda.” Livestock Research for Rural Development 28 (5): 2016.

Ngaiwi, Mary E., Ernest L. Molua, Denis J. Sonwa, Majory O. Meliko, Eric J. Bomdzele, Justine E. Ayuk, Augusto Castro-Nunez, and Mathunin M. Latala. 2023. “Do Farmers’ Socioeconomic Status Determine the Adoption of Conservation Agriculture? An Empirical Evidence from Eastern and Southern Regions of Cameroon.” Scientific African 19. https://doi.org/10.1016/j.sciaf.2022.e01498.

Ouma, E.A., M.M. Dione, Peter Lule, Kristina Roesel, L. Mayega, D. Kiryabwire, G. Nadiope, and Danilo Pezo. 2013. “Characterization of Smallholder Pig Production Systems in Uganda.” Livestock Research for Rural Development 26 (3): 2014. http://hdl.handle.net/10568/29094.

Pakage, Stepanus, Fredrik Mathius Giay, Elfira Kariane Suawa, and Deny Anjelus Iyai. 2021. “Stochastic Frontier Approach Applied in Measuring Economic Efficiency and Determining Factors on Local Broiler Breeder in Manokwari Regency, West Papua .” 20 (3). http://www.ashwinanokha.com/ijeb-v20-3-2021.php.

Phiri, R. E. 2012. “Determination of Piggery Business Profitability in Balaka District in Malawi.” Livestock Research for Rural Development 24 (8): 202006.

Plaza-Bonilla, Daniel, Carlos Cantero-Martínez, Javier Bareche, Jose Luis Arrúe, Jorge Lampurlanés, and Jorge Álvaro-Fuentes. 2017. “Do No-till and Pig Slurry Application Improve Barley Yield and Water and Nitrogen Use Efficiencies in Rainfed Mediterranean Conditions?” Field Crops Research 203: 74–85. https://doi.org/10.1016/j.fcr.2016.12.008.

Primatika, Roza Azizah, Etih Sudarnika, Bambang Sumiarto, and Chaerul Basri. 2022. “Estimation of the Probability Risks of African Swine Fever Outbreaks Using the Maximum Entropy Method in North Sumatra Province, Indonesia.” Veterinary World 15 (7): 1814–20. https://doi.org/10.14202/vetworld.2022.1814-1820.

Putut, Putut Isworo Arimurti, Chaerul Basri, and Denny Widaya Lukman. 2021. “Deteksi Virus African Swine Fever Dari Sampah Makanan Kapal Laut Internasional Di Pelabuhan Tanjung Priok.” Acta VETERINARIA Indonesiana 9 (2): 112–19. https://doi.org/10.29244/avi.9.2.112-119.

Reyes-García, Victoria, Laura Aceituno-Mata, Laura Calvet-Mir, Teresa Garnatje, Erik Gómez-Baggethun, Juan J. Lastra, Ricardo Ontillera, et al. 2014. "Resilience of Traditional Knowledge Systems: The Case of Agricultural Knowledge in Home Gardens of the Iberian Peninsula." Global Environmental Change 24 (1): 223–31. https://doi.org/10.1016/j.gloenvcha.2013.11.022.

Ripoll-Bosch, R., M. Joy, and A. Bernués. 2014. "Role of Self-Sufficiency, Productivity and Diversification on the Economic Sustainability of Farming Systems with Autochthonous Sheep Breeds in Less Favoured Areas in Southern Europe." Animal 8 (8): 1229–37. https://doi.org/10.1017/S1751731113000529.

Sayori, A, TW Widayati, A Supriyantono, SY Randa, and DA Iyai. 2022. "Pig Farming System in West Papua : A Case Study of Three Districts." Annals of Agriculture Science and Research 1 (1): 1–10.

Schivera, Diane. 1955. "Raising Organic Pigs," 16–18.

Sendow, Indrawati, Atik Ratnawati, NLP I Dharmayanti, and Muharam Saepulloh. 2020. "African Swine Fever: Penyakit Emerging Yang Mengancam Peternakan Babi Di Dunia." Indonesian Bulletin of Animal and Veterinary Sciences 30 (1): 15. https://doi.org/10.14334/wartazoa.v30i1.2479.

Sorokowski, Piotr, Agnieszka Sorokowska, and Dariusz P. Danel. 2013. "Why Pigs Are Important in Papua? Wealth, Height and Reproductive Success among the Yali Tribe of West Papua." Economics and Human Biology 11 (3): 382–90. https://doi.org/10.1016/j.ehb.2012.02.008.

Toansiba, Merry, Els Tieneke Rieke Katmo, Krisnawati Krisnawati, and Yustina Linda Dina Wambrauw. 2021. "Pengelolaan Tanah Dalam Pengetahuan Lokal Dan Praktik Pertanian Berkelanjutan Pada Masyarakat Arfak, Papua Barat." Jurnal Ilmu Pertanian Indonesia 26 (3): 370–78. https://doi.org/10.18343/jipi.26.3.370.

Tolera, Adugna, and Aster Abebe. 2007. "Livestock Production in Pastoral and Agro-Pastoral Production Systems of Southern Ethiopia." Livestock Research for Rural Development 19 (12): 2007.

Toro-Mujica, P., A. García, A. Gómez-Castro, J. Perea, V. Rodríguez-Estévez, E. Angón, and C. Barba. 2012. "Organic Dairy Sheep Farms in South-Central Spain: Typologies According to Livestock Management and Economic Variables." Small Ruminant Research 104 (1–3): 28–36. https://doi.org/10.1016/j.smallrumres.2011.11.005.

Toumbourou, Tessa D., and Wolfram H. Dressler. 2024. "The Politics of Misalignment: NGO Livelihood Interventions and Exclusionary Land Claims in an Indonesian Oil Palm Enclave." Critical Asian Studies 56 (1): 89–114. https://doi.org/10.1080/14672715.2023.2272736.

Trisiwi Wahyu Widayati, Bernadeta Wahyuni Irianti Rahayu, Dwi Djoko Rahardjo, and Marlyn Nelce Lekitoo. 2019. "Feeding Effect of Different Levels of Agricultural and Food Waste on Growth Performance and Economics in Pig Production." Journal of Agricultural Science and Technology A 9 (4): 240–47. https://doi.org/10.17265/2161-6256/2019. 04.004.

Warastuti, DF. 2001. "Sistim Pemeliharaan Ternak Babi Di Pesisir Teluk Doreri Kabupaten Manokwari." Universitas Papua.

Widayati, TW, BW Rahayu, DD Rahardjo, and B Santoso. 2018. "The Utilization of Agricultural and Food Industry Wastes as Feed of Grower Pigs in Manokwari Regency West Papua." Animal Production 20 (3): 165. https://doi.org/10.20884/1.jap.2018.20.3.723.