



REPÚBLICA DEMOCRÁTICA DE TIMOR-LESTE
INSTITUTO NACIONAL DE CIÊNCIAS E TECNOLOGIA (INCT)



Relatório de Pesquisa Científica INCT 2021

Instituto Nacional
de Ciências e Tecnologia de
Timor-Leste



Prevalence of parasites
on various smallholder pig production systems
in Timor-Leste

Alipio de Almeida

Desembro de 2021

Relatório de Pesquisa Científica INCT 2021

Instituto Nacional de Ciências e Tecnologia
Timor-Leste



Prevalence of parasites
on various smallholder pig production systems
in Timor-Leste

Area de Conhecemento: Agricultura- Medicina Veterinaria
Trabalho Elaborado Por: Alipio de Almeida
Mentor: Doutor Domingos B. Caeresi

Declaração

Nome: Alipio de Almeida

Endereço Eletrónico: alipio.dealmeida@yahoo.com.au

Telefone/Telemóvel: +67078351616

Número de Bilhete de Identidade: 06020227077596960

Título da Pesquisa Científica INCT 2021: Prevalence of parasites on various smallholder pig production systems in Timor-Leste

Área de Conhecimento: Agricultura – Medicina Veterinária

Mentor: Doutor Domingos B Caeresi

Monitor(a): _____

Ano de Conclusão: 2021

Declaro, por minha honra, que os dados aqui apresentados são verdadeiros e que neste estudo apresentado não foi cometido plágio nem nenhuma ilegalidade em termos de direitos de autor. Autorizo a reprodução integral deste relatório apenas para efeitos de investigação.

Instituto Nacional de Ciências e Tecnologia, a _____ de _____ de _____.



Assinatura do Investigador:

Tomei conhecimento da informação desta declaração e também declaro que todos estes dados são verdadeiros. Assinatura do Mentor: _____.

ACKNOWLEDGEMENTS

This research was funded by the Instituto Nacional de Ciências e Tecnologia (INCT) de Timor-Leste in 2021. The author would like to acknowledge the essential assistance of staff at the Universidade Nacional Timor Lorosa'e (UNTL) provided by Dr. Adelaide Jose Pereira Cristovao (Adel), and Abilio Guterres, and the alumni of Animal Health Department of UNTL: Silvestre Amaral (Sibe), Carolina Calado (Carol), and Jaime Tilman (Aime), Odalia Belo, and Linda. Thank you also to final year students: Cesario, Abe, Amoy, Zita, Sebas, Merlina, Merlinda, Milena, Cham, Agio, Azito, Joanica, Betanoy, Apoli, Reway, Tonia, Romana, Deolavio, Julio, Gio, Apin, Ester, Sico Dagima, Palomino, Jeliana, and Apeu Welde. The research relied on the assistance of staff from the Ministry of Agriculture and Fisheries (MAF) provided by Casimiro Mau, BSAnim, Adelino Soares, BSAnim, Mestri Januario Correia, Betty, maun Aris Tavares. The authors would like to thank the President Authority of Bobonaro and Baucau municipality, the Head of selected Sucos, village livestock workers and pig owners for their assistance and cooperation. Finally, the Author thanks to Dean of Fagri and Academic Director of Animal Health Department, UNTL.

Abstract

A survey with objectives to define the prevalence of internal and external parasites of pigs in Timor-Leste. As many as 180 pig owners have been selected from six sucos in Timor-Leste to be respondents of the survey. And, a total of 360 pigs have been enrolled in the survey for faecal collection and skin scraping sample collection. The respondents and the pigs were randomly selected from six selected sucos to represent eastern and western regions. As many as 30 respondents with 60 pigs in each suco have been selected to be sampled during the research period. An interview to selected pig owners and direct observation of pigs owned by the farmers have been recorded in pig record form. The result showed the prevalence of gastrointestinal parasites of pigs in Timor-Leste was 41.94%. At the suco level, the findings showed the prevalence of internal parasites in the suco Ritabou, Manaka, Aidabaleten, Baha-Mori, Libagua, and Triloca: 71.67%, 56.67%, 18.33%, 35.00%, 12.07%, and 56.45%, respectively. In addition, the survey identified the prevalence of seven gastrointestinal parasites affecting pigs in Timor-Leste, including *Ascaris suum* (21.67%), *Globocephalus urosubulatos* (14.72%), *Hyostromylus rubidos* (11.11%), *Stongyloides ransonii* (5.00%), *Oesophagostomum dentatum* (3.61%), *Trichuris suis* (2.22%), and *Metastrongylus* sp (1.11%). Finally, the survey have identified two external parasites of pigs in Timor-Leste were demodex and sarcoptes. It is suggested to continue conduct similar research in other places to mapping up the prevalence and its distribution in Timor-Leste. The study recommended to do eradication program by the Ministry of Agriculture, particularly the department of veterinary services.

Key words: pigs, Timor-Leste, parasite prevalence, demodex, sarcoptes, *A.suum*, *T. suis*

Contents

Relatório de Pesquisa Científica INCT 2021	2
Declaração	3
ACKNOWLEDGEMENTS.....	4
Abstract.....	5
Índice.....	6
Índice de Tabelas	7
Index of Graph.....	7
1. INTRODUCTION.....	8
1.1. Contextualisation	8
1.2. Research Problem	9
1.3. Objectives	10
1.3.1. General Objective	10
1.3.2. Specific objective	10
1.4. Importance of research	10
1.5. Justification	10
1.6. Work Organisation	11
2. GEOGRAPHICAL LOCATION.....	11
2.1. Sampling strategy	11
2.1.1 Municipality	11
2.1.2. Administrative post and suco selection.....	12
2.1.3. Household (respondents) selection.....	13
3. THEORETICAL FRAMEWORK	14
4. RESEARCH METHODOLOGY	15
4.1. Research methods.....	15
4.2. Population and sampling	15
4.2.1. Pig selection	15
4.2.2. Sample size estimation	15
4.3. Data collection Technique	16
4.3.1. Questionnaire design.....	16
4.3.2. Data collection	16
4.3.3. Data Analyses.....	18
5. RESULT ANALYSES.....	19
5.1. The prevalence of internal parasites of pigs in Timor-Leste	19
5.2. The prevalence of each parasite of pigs in Timor-Leste.....	19
5.2.1. Internal parasites.....	19

5.2.2. The prevalence of External parasites	20
6. DISCUSSION OF RESULTS	21
6.1. Internal parasite of pigs in Timor-Leste.....	21
6.2. External parasite of pigs in Timor-Leste	22
7. CONCLUSSION AND RECOMMENDATIONS.....	23
7.1. Conclusion	23
7.2. Recommendations	23
8. BIBLIOGRAPHY	24
Anexos.....	25
1. Pig record form	25
2. Pictures of survey activities	26

List of Table

Table 1. Sample size required in each selected sucos (20 households/suco)

List of Graph

Graph 1. The prevalence of internal parasites of pigs in Timor-Leste

Graph 2. The prevalence of external parasites of pigs in Baucau and Bobonaro municipalities

1. INTRODUCTION

1.1. Contextualisation

Timor-Leste is a small and young country which is geographically mountainous with an area of about 19,000 sq km, consisting of 12 municipalities (formerly known as districts) and one special region, the enclave of Ambeno (Da Costa, Piggins, & Da Cruz, 2003). Up to 87% of Timorese people are farmers who keep livestock (National Census 2015), and 95% owning livestock (TL Agriculture census, 2019). Livestock are very important in the lives of the people of Timor-Leste (Copland, Afonso, Fontes, & Serrao, 2003). Pigs are one of the most important livestock species for the people of Timor-Leste since 82% (National census 2015), and become 92% (TL Agriculture census 2019) of them are raising small livestock such as pigs. The people in other south east Asian countries also find pigs to be important (Huynh, Aarnink, Drucker, & Verstegen, 2007). There are several reasons for Timorese people to keep pigs. The majority of the population are Christian who can raise and eat pork. Pigs are also used as gifts, as a living bank that can be sold at any time when they need money (Bettencourt, Tilman, Narciso, Silva Carvalho, & Henriques, 2014), and can be used for traditional and modern ceremonies (Aube, Cesaretti, Fossi, & Forsen, 2007; Bettencourt et al., 2014). Selling pigs can be used to boost the income of the poorest of the rural community (Copland et al., 2003). Increasing the population and productivity of pigs would help to supply the animal protein needs of the Timorese people. On the other hand, the productivity of pigs in Timor-Leste is limited by several factors, including feed, production systems, and health management.

There are only few publications on the pigs in Timor-Leste, including one about productivity and roles of pigs in Timor-Leste (Noronha, Agbisit Jr, Estrella, & Dizon, 2017). However, further investigations are needed with appropriate methods of data collection in order to achieve accurate findings.

One previous survey about classical swine fever virus in pigs in Timor-Leste was conducted by Timorese and Australian scientists (De Carvalho, Suartha, & Dharmawan, 2016; Sawford et al., 2015) to document the sero-prevalence and the antibody of swine fever virus.

The prevalence of internal parasites, particularly *Ascaris suum* in pigs in Eastern, Central, and Western regions in Timor-Leste was studied by (Amaral & Da Costa Freitas, 2015).

However, further research is needed to confirm previous findings.

Another publication is the socio-cultural study conducted by Cynthia Hunter through ACIAR project: *AH/2012/065 Regional approach to enhance smallholder pig systems in Timor-Leste*. However, these publications do not provide sufficient information on reproduction and management of pigs in Timor-Leste. There is only one publication about the prevalence of *Ascaris suum* in pigs in Timor-Leste, but there is no publication about other parasites that are found in pigs in the country.

Many of parasitic diseases are affecting pigs in Timor-Leste. The impact of parasites can be direct and indirect on the affected pigs. However, no previous researches describe the prevalence of internal and external parasites of pigs in Timor-Leste. This survey aimed to define the prevalence of internal and external parasites of pigs on the smallholder pigs in Timor-Leste.

1.2. Research Problem

There were lots of parasites have been identified in domesticated animals, particularly pigs in Timor-Leste. Lack of references about the infection of parasites on smallholder pigs and its prevalence in Timor-Leste become the principal issue to be solved. Additionally, as it relates to the medicines and vitamins that are needed to supply by the relevant government institutions, such as Ministry of Agriculture and Fisheries.

1.3. Objectives

1.3.1. General Objective

To identify the internal and external parasites of pigs and analyse the effect of the parasites on pigs in Timor-Leste.

1.3.2. Specific objective

To estimate the prevalence of external and internal parasites affecting pigs in Timor-Leste and recommend the potential strategies to eradicate the parasites and improve pig production in the country.

1.4. Importance of research

The survey will identify the parasites which are affecting pigs and will define the prevalence of each identified parasites on smallholder pigs raised in the country. The findings will recommend the potential strategies to be used by the relevant government institutions to do control and eradication programs in Timor-Leste.

1.5. Justification

The study will generally identify all internal and external parasites which is naturally affecting smallholder pigs in Timor-Leste. Moreover, the prevalence of each parasite that are identified in pigs will then be defined. Further, to recommend eradication program to improve pig production in the country after the outbreak of the African swine fever. The findings will also analyse the effect of the internal and external parasites on the selected farmers pigs on the production aspects. Finally, the results will also recommend the potential strategies taken by the government institutions to eradicate the identified parasite of pigs in the country to improve pig industry.

1.6. Work Organisation

The study was funded by the Instituto Nacional Ciencia e Tecnologia (INCT). The survey is leaded by a Timorese veterinarian: Alipio de Almeida, and was supported by veterinarians, lecturers and students of Animal Health Department, Faculty of Agriculture, Universidade Nacional Timor Lorosa'e (UNTL).

2. GEOGRAPHICAL LOCATION

Generally, the study covers whole regions of Timor-Leste. However, due to the limitation of the funds and time, the study conducted in two selected municipalities to represent the country. The selected municipalities are Baucau (Eastern region), and Bobonaro (Western region) of Timor-Leste.

2.1. Sampling strategy

2.1.1 Municipality

Two municipalities have been chosen to represent the Eastern and Western regions of Timor Leste. These are the municipalities of Baucau and Bobonaro to represent Eastern and Western regions, respectively. Administratively, more details about both municipalities as described below.

The municipality of Baucau situated on the north coast, east of Dili and has six administrative posts; Baucau, Laga, Baguia, Quelicai, Vemasse, and Venilale. On the other hand, the municipality of Bobonaro is located in the west of Timor-Leste. This municipality extends approximately 100 km from north (the coast) to south and following the border between Indonesia and Timor-Leste. Bobonaro has six administrative posts; Atabae, Balibo, Bobonaro, Cailaco, Maliana, and Lolotoe (Da Costa et al., 2003). The pig population that is kept by farmers in the municipal of Baucau and Bobonaro can be categorized as smallholder

pig farming because the average pig ownership is around 3 pigs per household (National Census 2015).

2.1.2. Administrative post and suco selection

Based on logistic and time considerations, three Administrative Posts were selected in each municipality and one suco in each Administrative Post.

Prior to selection, these administrative posts will be categorised as urban and non-urban areas. The importance of stratification of urban and non-urban sucos (villages) is related to ease of access and availability of services. Urban sucos have ready access to information and services from the livestock and veterinary divisions of the ministry of agriculture and fisheries (MAP) as well as availability of medicines, vitamins, and vaccination. These urban sucos also have better access to markets and electricity. However, non-urban or rural sucos are situated in the administrative post that outside or far from the town centre. The non-urban sucos do not have access to the information and services available to urban sucos.

Productivity from urban and rural sucos will be measured and compared to determine the impact of the different services and management of these two environments.

Table 1 lists the Administrative Post by urban/non-urban categories. Proportional stratified sampling of Administrative Posts by urban/non-urban categories determines 1 urban and 2 non-urban in each municipality. Random sampling method is used to select the 2 non-urban Administrative Posts per municipality and then the 1 suco per selected Administrative Post. Then, lists of all sucos in each selected Administrative Posts will be documented. A random sampling method will be used to select one suco from each selected Administrative Posts to represent each category (urban or rural).

2.1.3. Household (respondents) selection

During a preliminary visit to each selected suco to explain the objective of the survey, the village leader will be asked to provide a sampling frame for pig owners (list of all households currently raising pigs categorized by management system (confined, semi-confined, free range). Pig owners will be selected using stratified random sampling based on the pig management systems applied in the selected sucros, whether free-range, semi-confined/tied up, and confined.

3. THEORICAL FRAMEWORK

To achieve the objectives of the study, a survey for data and sample collections have been conducted in the selected villages. An interview with selected farmers conducted at farmers house close to pigs. Then, skin scraping and faecal samples collected after the interview. The activities during the survey for data collection covers sample collection directly from selected pigs, direct observation on pigs owned by respondents, and respondents' interview to collect some additional data were needed. The collected samples then fresh and directly examine through the mini and mobile laboratory that was set up by the researcher team. The selected pigs enrolled and involved in the data collection continuously apply symptomatic treatment during the direct observations and sample collections. The samples collected during the day then continuously examined in the research camps in each suco at the afternoon post sample collection.

4. RESERCH METHODOLOGY

4.1. Research methods

Once visit survey uses one questionnaire per household for a structured interview and a data sheet for direct observation on the pigs that is raised by farmers in both municipalities of Baucau and Bobonaro, Timor-Leste. The combination of questionnaire and direct observation of the enrolled pigs will include their housing, and production / management system in each household. This will be recorded on a data sheet to ensure accuracy of the information collected in the study. The pig population that is kept by farmers in the municipal of Baucau and Bobonaro can be categorized as smallholder pig farming because the average pig ownership is around 3 pigs per household (National Census 2015).

Faecal and skin scraping samples collected from selected pigs during the field survey then freshly examined in the suco where data is being collected. Methods used for the examination of the samples were simple and McMaster slide. Skin scraping examination was used fresh and simple technique for the parasite identifications.

4.2. Population and sampling

4.2.1. Pig selection

For internal and external parasite identification, faecal and skin scraping samples will be collected from pigs owned by selected households. In total 360 pigs will be enrolled in the survey, two pigs per household. Simple random sampling is used to select two pigs in each household. Selected households who have more than two pigs, all pigs are listed and randomly selected two of them and collecting samples from the selected ones. In total 180 pig owning households will be enrolled in the survey, 30 per village.

4.2.2. Sample size estimation

Required number of pigs to estimate prevalence of internal parasites

The sample size required in this survey is based on the design prevalence 30%. The 30% design prevalence is based on the finding of the prevalence of *Ascaris suum* in pigs in Timor-Leste

(Amaral & Da Costa Freitas, 2015). Using statulator sample size calculation with the prediction of 30% prevalence of the total national pig population of pigs (TL Agriculture Census 2015) and level of precision 5% and 95% confidence level, the sample size required in this survey is 323 (Dhand & Khatkar, 2014).

Table 1. Sample size required in each selected sucos (20 households/suco)

Municipal	Administrative post	Sucos	Faecal sample	Skin scraping
Baucau	Baucau	Triloca (urban)	60	60
	Laga	Libagua (non-urban)	60	60
	Venilale	Baha-Mori (non-ruban)	60	60
			180	180
Bobonaro	Atabae	Aidabaleten (non-urban)	60	60
	Cailaco	Manapa (non-urban)	60	60
	Maliana	Ritabou (urban)	60	60
			180	180
Total Sample (180 households; faecal sample 360; skin scraping 360) from 360 pigs.			360	360

4.3. Data collection Technique

4.3.1. Questionnaire design

Questions included in the questionnaire was based and or be covered the variables and the objectives of the study. A specific data collection sheet was used to record relevant data, mortality and other relevant information with direct observation to selected pigs and its facilities. Structure questions will be used in the questionnaire for the structured households' interview.

4.3.2. Data collection

Interview

One person from each household that be interviewed. This person may be a male or female who is familiar with and understands the pig management system. The face to face interview between selected pig owner and interviewer will be conducted in the farmers house, or as close as possible to the pigs, so that the direct observation on the pigs may be conducted at the same time, using the data sheet. Data from the questionnaire based structured interview will be recorded by interviewer at the time during the interviewing. Faecal and skin scraping samples will be collected immediately after the interview. These samples will be examined in the field, or back in the place where researcher team used as accommodation.

Collection of samples

The sample used in the study are faecal and skin scraping. Both faecal and skin scraping samples will collect from the same selected pigs in each selected households.

Faeces from the selected pigs will be collected directly from the rectum of pigs. To remove the faeces from pigs, the selected pigs will be captured using pig snare and be restrained correctly. The pigs abdomen will be massaged while the rectum is stimulated. When the faecal sample is expelled, it will be placed into a plastic bag or container and examined as soon as possible (Oka & Dwinata, 2011).

Pigs will be well and carefully restrained, and a gentle skin scraping will be taken from the inner surface of one ear. Then, scraping will be taken by flooding the inner surface of ear with mineral oil and scraping the skin with a blade until reach the capillary layer.

Examination of collected samples

Faecal examination will be conducted using the Simple McMaster technique.

Examination procedures: Mix 4 g faeces with flotation fluid (saturated salt) is placed in a cylinder with a stirring device. Then, the faecal suspension is poured through a tea strainer of cotton gauze into a container immediately after stirring, and the retained debris is discarded.

Using a Pasteur pipette, a subsample is immediately used to fill both sides McMaster

counting chamber. After 3 to 5 minutes the filled McMaster slide is examined under a Microscope using 40-100X magnification to identify parasites seen at the counting chamber, and count number of eggs (Roepstorff & Nansen, 1998) (expressed as eggs per gram faeces).

Skin scraping

After that, the scraping materials will be placed into a petri dish, and continue to examine in microscope 40X magnification to identify the existing parasites (Arends, Stanislaw, & Gerdon, 1990).

4.3.3. Data Analyses

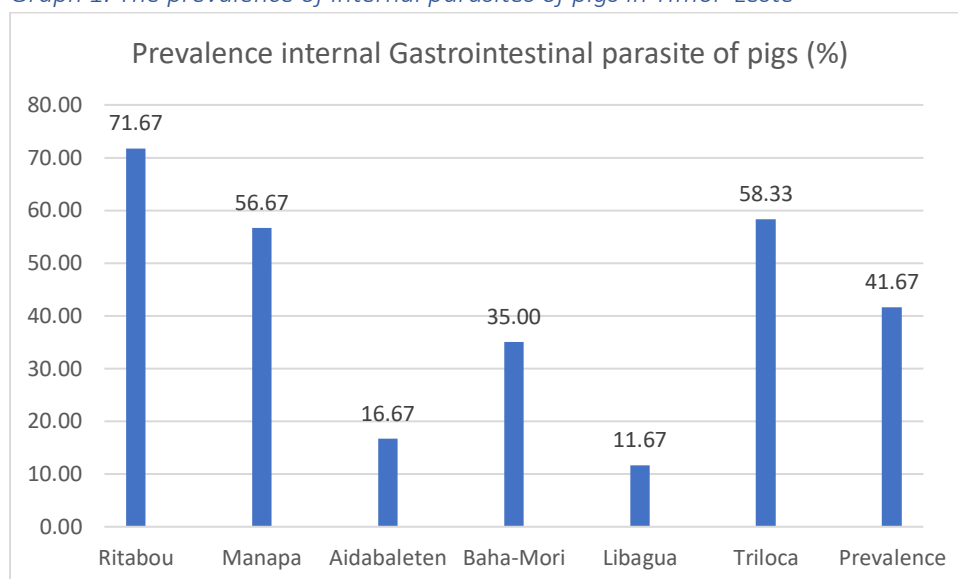
During the data collection, all data recorded during the household interview will be securely kept by the researcher and be stored in the Faculty of Agriculture office, Universidade Nacional Timor Lorosa'e (UNTL). At the end of data collection period, the data then descriptively analyses by using SPSS to describe the results.

5. RESULT ANALYSES

5.1. The prevalence of internal parasites of pigs in Timor-Leste

The sample size required in each selected suco and total in the survey was 60 and 360, respectively. The samples consisted of 360 faecal samples and 360 skin scraping from 360 selected pigs in selected municipalities. The result of the survey on the parasites status can be seen in the graph 1.

Graph 1. The prevalence of internal parasites of pigs in Timor-Leste



Results showed the percentage of positive parasites 43, 34, 10, 21, 7, and 35, and 150 in the suco of Ritabou, Manapa, Aidabaleten, Baha-Mori, Libagua, and Triloca, respectively. The laboratory diagnoses have identified 150 samples positively examined on the internal parasites with the prevalence of the internal parasites was 41.67%.

5.2. The prevalence of each parasite of pigs in Timor-Leste

5.2.1. Internal parasites

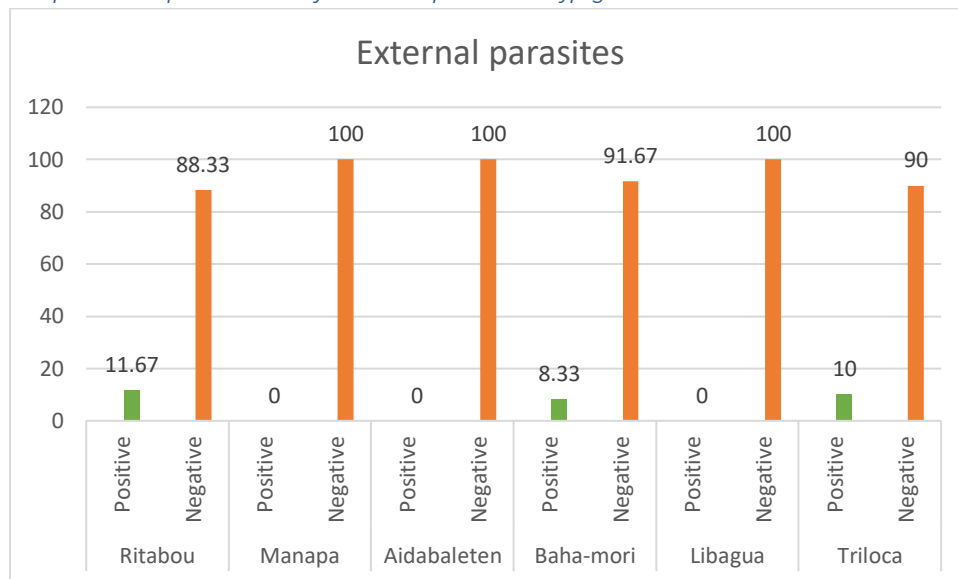
The findings recorded that the internal parasites naturally affecting pigs in Timor-Leste are *Ascaris suum*, *Trichuris suis*, *Strongyloides ransonii*, *Hyostromylus rubidos*, *Globocephalus urosululatos*, *Oesophagostomum dentatum*, and *Metastrongylus sp* with various prevalences with various prevalence, including 55.81% (24), 2.33% (1), 30.23% (13), 23.26% (10),

34.88% (15), and 13.95% (6), respectively. The detail of the prevalences can be seen at the graph 1.

5.2.2. The prevalence of External parasites

There are two external parasites of pigs have been identified in the current survey in Baucau and Bobonaro municipalities in Timor-Leste. The parasites are Sarcoptes and Demodex.

Graph 2. The prevalence of external parasites of pigs in Baucau and Bobonaro municipalities



Ritabou		Manapa		Aidabaleten		Baha-mori		Libagua		Triloca	
Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
7	53	0	60	0	60	5	55	0	60	6	54
11.6666667	88.3333333	0	100	0	100	8.33333333	91.6666667	0	100	10	90

The results showed that the external parasites of pigs in Baucau and Bobonaro municipalities are varied. The graph 2 presented the higher and lower prevalences of external parasites were 11.67%, and zero percents, respectively in the research sites. However, the direct observations on the majority pigs owned by the selected respondents are symptomatically showed skin diseases. The

6. DISCUSSION OF RESULTS

6.1. Internal parasite of pigs in Timor-Leste

Findings from the study have identified there are seven parasites affecting pigs in Timor-Leste. All the parasites are located at the gastrointestinal of pigs. The parasites are *A. suum*, *T. suis*, *Globocephalus urosulatus*, *Hyostromylus rubidos*, *Stongyloides ransonii*, *Oesophagostomum dentatum*, and *Metastrongylus sp.* The prevalence of parasite was about 42% was categorically very high. The infection of the parasite can be single, and can also with more than one parasite or multiple infection. Based on the prevalence rated in the survey, the study suggested to the relevant institutions such as Ministry of Agriculture and Fisheries through the department of veterinary services to control the diseases caused by the gastrointestinal parasites of pigs in the country. As the most of Timor-Leste people are farmers, pig keeping is an important livelihood activity for farmers in the whole country of Timor-Leste. As everyone knows that Timorese farmers traditionally keeping pigs for cultural ceremonies, and income generation. This because pigs grow fast, have high fecundity rates and short generation intervals resulting in quick generation of cash for farmers; women prefer to rear pigs as they do not require as much physical labor in handling, and pig keeping needs less or small space of land. Most of the pigs in Timor-Leste, particularly in the rural areas are produced under traditional smallholder systems, which are often considered wasteful and not as profitable as intensive production systems due to poor feed conversion, high mortality rates, low reproductive rates, and poor final products. However, for resource-poor farmers, the traditional pig production system is attractive because it requires much less space and little to even no housing due to the pig's natural free-range, and utilize kitchen leftovers and agricultural waste for their daily food. On the other hand, when the pigs that applied free-range system affecting diseases, the diseases then transmitted to other pigs, including the semi-intensive and penned one. In addition, the infections with internal parasites

probably reduce production as they potentially cause lower average daily gains and also cause in poorer feed conversion ratios. For that reason, this study aimed, first, to estimate the prevalence of pig infection with common gastrointestinal parasites in Timor-Leste; and second, to recommend the gastrointestinal parasite management in smallholder pig production systems, particularly in Baucau and Bobonaro municipalities and in whole country of Timor-Leste.

6.2. External parasite of pigs in Timor-Leste

The survey have identified two external parasites affecting pigs in Timor-Leste were demodex and sarcoptes. Both parasites causing skin diseases of pigs in Baucau and Bobonaro municipalities. Although the prevalence of each parasite was very low, but the direct observations on selected pigs owned by the selected respondents showed that the majority pigs have skin diseases. Not only for grower pigs, the adults and the starter pigs are also symptomatically showing the skin diseases, including ticks. Based on the clinical signs, a skin scraping technique was applied to collect samples to do external parasite identification on pigs in the selected sites.

The findings of the present survey in Baucau and Bobonaro municipalities have identified that the prevalence of Sarcoptes and Demodex with low prevalence, but all pigs showed clinical signs to the existence of external parasites on pigs in the country. The genus of Sarcoptes were the predominantly mite species identified in pigs raised in the current research sites, Demodex species. This probably due to the warmer temperatures, higher humidity, and more sunshine found in both survey sites of Timor-Leste, which are ideal for mite reproduction and multiplication. Based on the findings, we recommend to the relevant institutions such as the Department of Veterinary services of the Ministry of Agriculture and Fisheries to regular and routine parasite control to eradicate the diseases affecting by the identified parasite of pigs.

7. CONCLUSION AND RECOMMENDATIONS

7.1. Conclusion

The survey have identified the prevalence of the gastrointestinal parasites with various rates in pigs in Bobonaro and Bucau municipalities. These parasites are not only internal, but also external parasite. The internal parasites are *A. suum*, *T. suis*, *Globocephalus urosubulatos*, *Hyostrogylus rubidos*, *Stongyloides ransonii*, *Oesophagostomum dentatum*, and *Metastrongylus sp.* In addition, the external parasites identified are *Sarcoptes* and *Demodex*.

7.2. Recommendations

The parasite control program is urgently needed by the government institutions to control the parasite affecting pigs in the country, for both internal and external parasites to reduce the negative effects caused and improve pig production in Timor-Leste.

8. BIBLIOGRAPHY

Bibliography

- Amaral, & Da Costa Freitas. (2015). Prevalence of round worm (*Ascaris suum*) in pigs in Timor Leste.
- Arends, Stanislaw, & Gerdon. (1990). Effects of sarcoptic mange on lactating swine and growing pigs. *Journal of animal science*, 68(6), 1495-1499.
- Aube, Cesaretti, Fossi, & Forsen. (2007). *FAO/WFP Crop and Food Supply Assessment Mission to Timor-Leste. Food and Agriculture Organization of the United Nations*. Rome: Food and Agriculture Organization of the United Nations.
- Bettencourt, Tilman, Narciso, Silva Carvalho, & Henriques. (2014). The role of livestock functions in the well being and development of Timor-Leste rural communities. *Livestock Research for Rural Development*, 26.
- Copland, Afonso, Fontes, & Serrao. (2003). *The role of livestock in the development of East Timor—constraints and potential*. Paper presented at the ACIAR Proceedings.
- Da Costa, Piggins, & Da Cruz. (2003). Agriculture: new directions for a new national East Timor (Timor-Leste).
- De Carvalho, Suartha, & Dharmawan. (2016). ELISA TEST FOR ANTIBODY OF CLASSICAL SWINE FEVER VIRUS IN TIMOR-LESTE. *Revista Científica Multidisciplinar da Sociedade Timorenses*, 88.
- Dhand, & Khatkar. (2014). Statulator: An online statistical calculator. Sample size calculator for estimating a single proportion.
- Huynh, Aarnink, Drucker, & Verstegen. (2007). Pig production in Cambodia, Laos, Philippines, and Vietnam: a review. *Asian Journal of Agriculture and Development*, 4(1), 69-90.
- Noronha, Agbisit Jr, Estrella, & Dizon. (2017). Productivity of Native Pigs in Subsistence Farming and Their Roles in Community Development in Timor-Leste.
- Oka, & Dwinata. (2011). STRONGYLOIDOSIS PADA ANAK BABI PRA-SAPIH. *Buletin Veteriner Udayana*, 3(2), 6.
- Roepstorff, & Nansen. (1998). *Epidemiology, diagnosis and control of helminth parasites of swine* (Vol. 3). Rome: FAO Rome.
- Sawford, Do Karmo, Da Conceicao, Geong, Tenaya, Hartawan, & Toribio. (2015). An investigation of classical swine fever virus seroprevalence and risk factors in pigs in Timor-Leste. *Preventive veterinary medicine*, 122(1-2), 99-106.

Anexos

1. Pig record form

PIG RECORD FORM (One form per pig)

ID Agrikultor		Bairo	
ID Fahi		Aldeia	
Naran fahi na'in		Suco	
Loron		Postu Administrativu	

1. Rasa: - Lokal (1) : _____ - Macau (2): _____ - Cross: (1) vs (2): _____	2. Seksu: <input type="checkbox"/> F <input type="checkbox"/> M <input type="checkbox"/> Kapa M	3. Estimasaun idade _____ Fulan
		_____ Tinan

4. Oinsa hetan fahi ne? <input type="checkbox"/> Hahoris iha ne: <input type="checkbox"/> Sosa: <input type="checkbox"/> Prezenti:	Seluk-isplika: _____ Fulan/Tinan		
--	-------------------------------------	--	--

5. BCS/Skor kondisaun isin _____ /5*	6. Simtoma ruma? Sim / Lae	sekarik sim – deskreve simtoma iha ne:
--	--------------------------------------	--

7. Istoría vasinasaun CSF	Sim Lae	Sekarik sim: Vasina ikus liu hodibainhira?	_____ Fulan/Tinan?
8. Tratamentu Parazita	Sim Le	Sekarik sim: Tratamentu ikus hodibainhira? Tratamentu ho saida?	_____ Fulan/Tinan?

9. Antes ne'e, Animal ida ne moras ga lae? moras karik hodibainhira?	<input type="checkbox"/> Sim <input type="checkbox"/> Lae _____ fulan/tinan	Sekarik sim, sinal klinika: Tratamentu karik fo saida? _____
---	---	---

10. Kolekta Fezes: <input type="checkbox"/> Sim <input type="checkbox"/> Lae	Resultadu: <input type="checkbox"/> + <input type="checkbox"/> -	Sekarik pozitivu, parazita saida ho nia epq? detallu: - - - - -
---	---	---

11. Skin scraping: <input type="checkbox"/> Sim <input type="checkbox"/> Lae	Resultadu: <input type="checkbox"/> + <input type="checkbox"/> -	Sekarik pozitivu, detallu:
---	---	-----------------------------------

12. Temperatura	_____	13. Todan: _____ kg
------------------------	-------	-----------------------------------

*Body condition score 1: krekas los – 5: Bokur los

Examiner (tenke dotor) : _____

Signed and dated : _____

2. Pictures of survey activities

a. The research team and INCT monitoring team



2. Sample collation, and detail pig observations and treatment during the survey



3. Parasite identification by veterinarian



4. Pig handling during the survey

