Prevalence of Gastrointestinal Parasites in Pigs in Bali

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Abstract

This study aimed to identify gastrointestinal parasites in pigs in Bali. A total of 117 pig feces samples were collected in Buleleng Regency (n = 67) and Jembrana (n = 50). Samples were examined microscopically using native, sedimentation, and floating methods. The results reported the prevalence of gastrointestinal parasites infecting pigs in Bali was 94.8% (111/117) infected with protozoa, namely *Eimeria* sp. (90.5%), *Entamoeba* sp. (26.4%), *Isospora suis* (6.8%), and *Balantidium* sp. (5.1%), while 99.1% (116/117) were infected with helminths, namely *Trichuris suis* (71.7%), *Strongyloides* sp. (64.9%), *Ascaris suum* (49.5%), *Oesophagostomum* sp. (6.1%), *Macracanthorhyncus* sp. (2.5%), and *Hyostrongylus* sp. (0.8%). Based on the tree regression analysis reported that the rearing system was related to the degree of gastrointestinal parasite infection in pigs in Bali.

Keywords: Bali, gastrointestinal parasites, pigs

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INTRODUCTION

Bali is one of the regions in Indonesia with a large pig population (Tulak *et al*., 2020). Pigs are an important source of animal protein for the Balinese people, especially in traditional and religious ceremonies (Suryani *et al*., 2020). The pig population in Bali has decreased from 817,489 in 2014 to 690,095 in 2018 (Pero *et al*., 2020). The cause of the alleviation in pig production is disease infection (Akbar *et al*., 2022). Gastrointestinal parasites are common infections in pigs, causing economic losses (Abongi and Njoga, 2020). Factors that influence pigs to be easily infected with the disease are parasites (life cycle, viability, pathogenicity, and immunogenicity), hosts (species, age, race, sex, nutrition, and immunity status), and the environment (geography, season, and rearing management) (Permadi *et al*., 2012).

Pigs in Bali are generally raised traditionally and semi-intensively (Putri *et al*., 2018). Traditional pig pens are pigs released wild on muddy soil mixed with feces (Fendriyanto *et al*., 2015) and the type of pen for pigs raised semi-intensively is permanent with brick or bamboo walls, cement floors, and zinc roofs (Bebas and Gorda, 2020). According to Patra *et al*. (2019), poor environmental hygiene and maintenance systems are the main factors in the elevation of gastrointestinal parasites in pigs. Protozoa and worms are types of gastrointestinal parasites in pigs and some are zoonotic such as *Ascaris* sp., *Trichuris* sp., *Balantidium coli*, *Entamoeba* sp., and *Blastocystis* sp. (Widisuputri *et al*., 2020; Sukoco *et al*., 2023).

The incidence of nematode worms was found in several areas in Indonesia, such as in Bali, 71.6% of pigs were infected with nematode worms, including *Ascaris suum* (33.2%), *Trichuris suis* (14.0%), Strongyl type 57.6% and *Macrachantorhyncus* sp. 2% (Fendriyanto *et al*., 2015). According previous study by Widayati *et al*. (2020) reported that 95% of pigs were infected with nematode worms in Papua, including *A. suum*, *Strongyloides ransomi*, *T. suis*, and Strongyl type, while Podung *et al*. (2020) reported that in North Sulawesi, pigs were infected with *A. suum* (30.4%) and *Oesophagustomum* sp. (4.3%). The incidence of protozoa in Bali was reported by

Agustina *et al*. (2016) at 91.6% consisting of *Amoeba* sp. (82.4%), *Balantidium* sp. (61.25%), and *Eimeria* sp. (54.8%). A study to monitor gastrointestinal parasites is crucial to be conducted in Bali. Thus, this study aimed to identify the level of gastrointestinal parasite infection based on the maintenance system in Bali Province.

MATERIALS AND METHODS

Ethical Approval

This study did not require ethical approval because it did not cause stress to the animals.

Study Period and Location

Sampling was carried out in January–February 2022. Sample examination was carried out at the Veterinary Parasitology Division Laboratory, Faculty of Veterinary Medicine, Universitas Airlangga.

Samples

This study evaluated 117 pig feces samples from Buleleng Regency (n = 67) and Jembrana (n = 50). Fresh pig feces samples were collected using gloves and supervised by veterinarians from the Animal Husbandry Services of Buleleng and Jembrana Regencies. The feces samples were divided into two, one was put into a pot container containing 2.5% potassium dichromate for protozoa examination and one was put into a pot container containing 10% formalin buffer. The pot containers were labeled and stored in a cool box during transportation.

Evaluation

The examination was carried out using the native, sedimentation, and floating methods. The native method was carried out directly by homogenizing 1 gram of feces sample and 2 drops of aquadest solution. The homogeneous feces sample was filtered, placed on an object glass and covered with a cover glass, then examined using a microscope (Pradana *et al*., 2015).

Examination by sedimentation method is a feces sample weighed as much as 2 grams and homogenized with distilled water with a ratio of 1:10. The homogenized feces sample is filtered and centrifuged for 5 minutes at a speed of 1,500 rpm. The supernatant is discarded and repeated up to 3 times. The sediment is taken slowly and placed on an object glass then covered with a cover glass and examined under a microscope (Rukmana *et al*., 2016; Pali and Hariani, 2019; Widisuputri *et al*., 2020). Examination by the floating method is the remaining sediment in the sedimentation method is added with 10 mL of saturated sugar solution and then centrifuged at a speed of 1,500 rpm for 10 minutes. The saturated sugar solution is dripped using a dropper pipette until it forms a convex on the surface of the tube and covered with a cover glass for 5 minutes then taken and placed on an object glass and observed under a microscope (Rehman *et al*., 2011; Widisuputri *et al*., 2020). Prevalence was calculated using the following formula:

$$\% = \frac{infected\ samples}{total\ samples} \times 100$$

The survey study looked at the presence of cysts or oocysts and egg worms in pig feces which were divided into two groups, i.e. groups of pigs aged < 6 months and groups of pigs aged > 6 months in traditional rearing systems and semi-intensive rearing systems.

Statistical Analysis

Data were presented descriptively and analyzed statistically using tree regression in the Statistical Product and Service Solution (SPSS) for Windows v.25 programs.

RESULTS AND DISCUSSION

Based on the results of microscopic examination of the total samples of pig feces in Bali, there were 111/117 positive samples for protozoa and 116/117 positive samples infected with helminths with a positive percentage of 94.8% protozoa and 99.1% helminths. The identification results found 10 types of gastrointestinal parasites in pigs in Bali with the highest prevalence being *Eimeria* sp. 90.5% (106/117), then followed by *T. suis* 71.7%

(84/117), *Strongyloides* sp. 64.9% (76/117), *A. suum* 49.5% (58/117), *Entamoeba* sp. 26.4% (31/117), *I. suis* 6.8% (8/117), *Oesphagostomum* sp. 6.1% (7/117), *Balantidium* sp. 5.1% (6/117), *Macracanthorhyncus* sp. 2.5% (3/117) and *Hyostrongylus* sp. 0.8% (1/117) (Table 1).

The prevalence of protozoa in Bali was dominated by *Eimeria* sp. 90.5% (106/117) where the prevalence in Buleleng Regency was 91% (61/67) and Jembrana 90% (45/50). Morphologically, the *Eimeria* sp. oocysts found were 22.04 x 12.40 µm in size, oval in shape, had colorless walls, had 4 sporocysts and each sporocyst consisted of 2 sporozoites with a sporulation period of 5 days (Figure 1). The prevalence in this study was much higher than the study by Widisuputri *et al*. (2020) which found that out of 100 pig feces samples in Bali, 78% of pigs were infected with *Eimeria* sp. while research by Tsunda *et al*. (2013) found that oocysts in *Eimeria* sp. vary, i.e. round, elliptical and oval, thus affecting the size of the *Eimeria* sp. oocysts.

Table 1. Prevalence of gastrointestinal parasites in pigs in Bali

Location	n	Positive Number (%)									
		Protozoa				Helminth					
		En	Ba	Ei	Is	As	St	Tr	Oe	Hy	Ma
Jembrana	50	14 (28)	2 (4)	45 (90)	8 (16)	36 (72)	18 (36)	40 (80)	3 (6)	1 (2)	2 (4)
Buleleng	67	17 (25)	4 (6)	61 (91)	0 (0)	22 (33)	58 (86)	44 (65)	4 (6)	0 (0)	1 (1)
Total	117	31 (26.4)	6 (5.1)	106 (90.5)	8 (6.8)	58 (49.5)	76 (64.9)	84 (71.7)	7 (6.1)	1 (0.8)	3 (2.5)

En= *Entamoeba* sp., Ba= *Balantidium* sp., Ei= *Eimeria* sp., Is= *Isospora suis*, As= *Ascaris suum*, St= *Strongyloides* sp., Tr= *Trichuris suis*, Oe= *Oesophagostomum* sp., Hy= *Hyostrongylus* sp., Ma= *Macracanthorhyncus* sp.

Table 2. Degree of gastrointestinal parasite infection in pigs in Bali

Degree of Infection	Protozoa			Helminth						
	En	Ba	Ei	Is	As	St	Tr	Oe	Hy	Ma
Mild (0–500)	✓	✓		✓		✓	✓	✓	✓	✓
Moderate (550–1500)					✓					
Severe (> 1550)			✓							

En= *Entamoeba* sp., Ba= *Balantidium* sp., Ei= *Eimeria* sp., Is= *Isospora suis*, As= *Ascaris suum*, St= *Strongyloides* sp., Tr= *Trichuris suis*, Oe= *Oesophagostomum* sp., Hy= *Hyostrongylus* sp., Ma= *Macracanthorhyncus* sp.

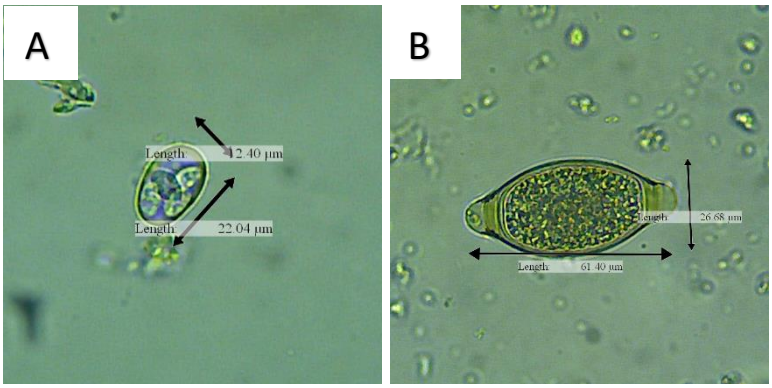

Figure 1. Identification of gastrointestinal parasites in pigs in Bali. (A) Oocysts of *Eimeria* sp. and (B) Eggs of *Trichuris suis*.

According to Fitri *et al*. (2021) sporulated *Eimeria* sp. oocysts can withstand under extreme environments on the sporulation time ranges from 4–16 days (Tsunda *et al*., 2013). The prevalence

of helminths in Bali is dominated by *T. suis* at 71.7% (84/117) where the prevalence in Buleleng Regency is 65.6% (44/67) and Jembrana 80% (40/50) with *T. suis* egg morphology measuring 61.40 x 26.68 µm, oval in shape resembling a lemon and brownish yellow (Figure 1). The prevalence of *T. suis* in Bali in this study was higher than that of Widisuputri *et al*. (2020) by 20%, Dwipayana *et al*. (2019) at the Denpasar Slaughterhouse by 5%, Yoseph *et al*. (2018) at the Denpasar Final Disposal Site by 55%, and in the traditional market by 14% (Fendriyanto *et al*., 2015).

Based on the results of the calculation of the degree of gastrointestinal parasite infection in pigs in Bali, it is categorized as a mild infection degree (0–500) is *Entamoeba* sp., *Balantidium* sp., *I. suis*, *Strongyloides* sp., *T. suis*, *Oesophagostomum* sp., *Hyostrongylus* sp. and *Macracanthorhyncus* sp.; moderate infection (550–1500) was *A. suum*; and severe infection (>1500) was *Eimeria* sp. (Table 2).

The results of statistical analysis on pigs aged < 6 months and > 6 months kept using traditional and semi-intensive rearing systems in Bali showed a significant effect on the degree of gastrointestinal parasite infection ($p < 0.05$). These results show that the prevalence value of the traditional rearing system in Buleleng Regency is 94.6% higher than Jembrana Regency 5.4% which follows the statement of Sudiastra and Budaarsa (2015) that the pig rearing system in Buleleng Regency is generally classified as traditional because almost all pigs are tied to trees without a floor and a zinc roof so that the muddy soil conditions due to being mixed with dirt make pigs easily infected with parasites. The prevalence of the semi-intensive rearing system in Buleleng Regency is 23% lower than Jembrana Regency 77%. The high prevalence value in the semi-intensive rearing system is due to risk factors in the form of location and management of pens, which are generally semi-intensive pens in Bali located in residential areas and have not fully paid attention to the cleanliness of the environment around the pen so that pigs are easily infected with diseases such as gastrointestinal parasites (Putra *et al*., 2021; Purnama *et al*., 2021). Semi-intensive farming cannot be separated from various parasitic disease problems because pig health can be influenced by various factors such as environmental conditions in the pen, rearing management, feed, seeds, diseases, and metabolic disorders (Purnama *et al*., 2020; Wiweka *et al*., 2020).

CONCLUSION

This study reported gastrointestinal parasites in pigs with a prevalence of protozoa of 94.8% (111/117) and helminths of 99.1% (116/117). The degree of gastrointestinal parasite infection in pigs in Bali was classified as mild for *Entamoeba* sp., *Balantidium* sp., *I. suis*, *Strongyloides* sp., *T. suis*, *Oesophagostomum* sp., *Hyostrongylus* sp. and *Macracanthorhyncus* sp., moderate for *A. suum*, and severe for *Eimeria* sp.. The rearing system factor was related to the degree of gastrointestinal parasite infection in pigs in Bali.

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AUTHORS' CONTRIBUTIONS

AKRTDP: Conceptualization, Project administration, Resources, Validation, Writing – original draft. AKRTDP, NDRL, MM, KK, MY, and DR: Conceptualization, Formal Analysis, Resources, Software, Visualization, Writing – review and editing. All authors have read, reviewed, and approved the final manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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