Indonesian Journal of
Tropical and Infectious Disease
Vol. 7 No. 6 September-December 2019

Research Report

IDENTIFICATION AND PREVALENCE OF GASTROINTESTINAL PARASITES IN BEEF CATTLE IN SIAK SRI INDRAPURA, RIAU, INDONESIA

Yuli Susana[1], Lucia Tri Suwanti[2,3,a], Endang Suprihati[2]
[1]Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, East Java, Indonesia.
[2]Department of Veterinary Parasitology , Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, East Java, Indonesia.
[3]Institute of Tropical Diseases, Universitas Airlangga, Surabaya, East Java, Indonesia.
[a]*Corresponding author: tswant@gmail.com; phone number: +6281226094872*

ABSTRACT

Gastrointestinal (GI) parasites infection are one of the major constraints cattle farm in tropical countries including Indonesia and some of GI parasites in cattle have the potential to transmit to humans. This study was aimed to identify and determine the level of prevalence of gastrointestinal (GI) parasites in beef cattle in Siak Sri Indrapura District, Riau Province, Indonesia. This research was conducted on 100 beef cattle consisted of, respectively, 32, 34 and 34 cattles from Bungaraya, Sabak Auh, and Dayun sub-district. The characteristic of sample such as age and sex cattle, cage management, feed and drinking water were recorded. Native, sedimentation and sucrose flotation methods were used to find protozoa and eggs worm. We assessed GI parasites based on finding eggs worm, protozoan cyst and coccidial oocysts in stool samples and identification of GI parasite was based on the morphology and size of the eggs worm and cysts or oocysts of protozoan. The result showed that all of 100 feces samples that examined 100% positive infection for parasites. There were eleven types of gastrointestinal parasites that have been identified, 6 genera of protozoan and 5 genera of worms. The prevalence of gastrointestinal parasites in beef cattles in Siak Sri Indrapura District were Blastocystis sp. (100%), Entamoeba sp. (90%), Eimeria sp. (53%), Giardia sp. (7%), Balantidium coli (4%), Cryptosporidium sp. (2%) Oesophagustomum sp. (45%), Toxocara vitulorum (20%), Moniezia expansa (9%), Trichuris sp. (5%), and Fasciola sp. (4%). In conclusion, Siak Sri Indrapura Riau is an endemic GI parasite and this can threaten the health of livestock and potentially as a zoonotic transmission.

Keywords: *Identification, Prevalence, Beef cattle, Gastrointestinal (GI) parasites, Siak Sri Indrapura Riau Indonesia*

ABSTRAK

Infeksi parasit gastrointestinal (GI) merupakan salah satu kendala utama pada peternakan sapi di negara-negara tropis termasuk Indonesia dan beberapa parasit GI pada sapi berpotensi menular ke manusia. Penelitian ini bertujuan untuk mengidentifikasi dan mengetahui tingkat prevalensi parasit gastrointestinal (GI) pada sapi potong di Kabupaten Siak Sri Indrapura, Provinsi Riau, Indonesia. Penelitian ini dilakukan pada 100 sapi potong yang terdiri atas 32 sapi dari Kecamatan Bungaraya, 34 sapi dari Kecamatan Sabak Auh, dan 34 sapi dari Kecamatan Dayun. Dilakukan pencatatan karakteristik sampel seperti umur dan jenis kelamin, manajemen kandang, pakan dan air minum. Deteksi parasit menggunakan metode natif, sedimentasi dan apung dengan sukrosa. Sapi dinyatakan terinfeksi parasit gastrointestinal berdasarkan pada penemuan telur cacing, kista protozoa dan ookista koksidia pada feses dan identifikasi parasit didasarkan pada morfologi dan ukuran telur, kista atau ookista protozoa. Hasil penelitian menunjukkan bahwa 100 sampel feses yang diperiksa 100% positif terhadap infeksi parasit. Terdapat 11 genus parasit gastrointestinal yang terdiri atas 6 genus protozoa dan 5 genus cacing. Prevalensi parasit gastrointestinal yang ditemukan pada sapi potong di Kabupaten Siak Sri Indrapura adalah Blastocystis sp. (100%), Entamoeba sp. (90%), Eimeria sp. (53%), Giardia sp. (7%), Balantidium coli (4%), Cryptosporidium

sp. (2%), Oesophagustomum sp. (45%), Toxocara vitulorum (20%), Moniezia expansa (9%), Trichuris sp. (5%), dan Fasciola sp. (4%). Kesimpulannya, Siak Sri Indrapura Riau merupakan daerah endemik parasit gastrointestinal dan ini dapat mengancam kesehatan ternak dan berpotensi sebagai penularan zoonosis.

Kata kunci: *Identifikasi, Prevalensi, Sapi potong, Parasit Gastrointestinal (GI), Siak Sri Indrapura Riau Indonesia*

INTRODUCTION

Gastrointestinal parasites infections are the major cause of gastroenteritis in livestock throughout the in world.[1] It is have impacts on public and animal health around the world, mainly in developing countries.[2] Some gastrointestinal parasites in cattle have the potential to transmit zoonoses to humans. The gastrointestinal parasites in cattle including *Trichuris* spp., *Strongyloides* sp., *Criptosporidium parvum*, *Balstocystis* sp., *Giardia* sp. and hookworms are zoonotic.[3,4,5,6] According to Marskole et al. "gastrointestinal parasites cause considerable global economic losses as a consequence of reduced weight gain, digestive disturbance, lowered production, impaired reproductive performance, abnormalities in infected organs, and mortality in infected animals".[2]

Riau Province has the potential for livestock development and Siak Sri Indrapura District is a center for developing cattle in Riau. However, health surveillance of livestock is still lacking, through this study a survey of the prevalence of parasitic gastrointestinal diseases was carried out and also to determine the presence of zoonotic parasitic infections in beef cattle in Siak Sri Indrapura District.

MATERIAL AND METHODS

Study Area

Beef cattles from three Sub-district: Bungaraya, Sabak Auh and Dayun, Siak Sri Indrapura District, Riau Province, Indonesia were targeted for sampling. The reason for sampling at the location is because in Bungaraya, Sabak Auh and Dayun sub-districts are a breeding center. The geographical position of Siak Sri Indrapura District is located at N10º 16' 30" E100º 54' 21" (**Figure 1**).

Faecal Samples Collection

Fresh stools (feces) were collected directly from the ground and after defecation without disturbing the animals and the study was also explained orally to all participants (the farmers). One hundred fresh stools were collected, using gloves from 32 cattles from Bungaraya sub-district, 34 cattles from Sabak Auh sub-district and 34 cattles from Dayun sub-district. Collection sampel was conducted during 7-26 January 2018. All stool samples were collected in labeled urine container sterile and were preserved in 2.5% potassium dichromate. The characteristic of sample such as age and sex cattle, cage management, feed and drinking water were recorded.

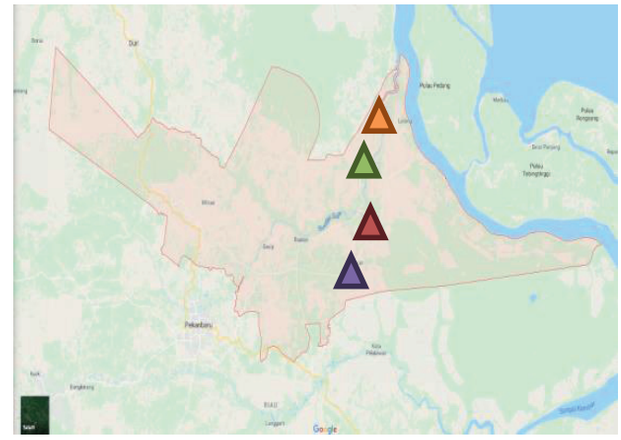

Figure 1. Map of location of sampling point. Pink color is Siak Sri Indrapura District. The shape of the triangle in the picture shows the sampling location: red color (district center of Siak Sri Indrapura); purple color (Dayun sub-district); green color (Bungaraya sub-district); and orange color (Sabak Auh sub-district).

Examination of Faecal Samples

Stool samples were analyzed at the Laboratory in Department of Veterinary Parasitology, Faculty of Veterinary Medicine, Airlangga University, Surabaya Indonesia. Samples were examined for eggs worm, cysts and oocysts for protozoa by native, sedimentation and sucrose flotation methods. For native examination, the stool sample was taken and placed on the glass object and covered and than observed under microscope. For sedimention, filtrate was centrifugated 1.500 rpm for 5 minutes (by centrifuge HC 1180T 8 HOLE WITH TIMER, China), supernatant was removed. This step was repeated until three time. Sediment was taken slightly and placed in a slide to observed under microscope. Then, remaining sediment was diluted in sucrose solution and centrifuged at 1.500 rpm for 10 minutes. Floated was added sucrose solution until end of tube and was covered by a cover glass. The cover glass was transferred to object glass, and observed under light microscope at 100x and 400x magnification. Identification of GI parasites were based on the morphology and size of the eggs, cysts or oocyts.[7]

RESULT AND DISCUSSION

The characteristics of stool samples were provided in **Table 1**. The age of cattles ranged from 3 months to 3 years, mostly more than one year, the majority of beef cattle population

are females, extensive management and the feed was grass and dranking was well water. Out of the three locations, the characteristics of stool samples in Siak Sri Indrapura District were almost the same, only the management in Sabak Auh sub district was better, extensive management is less than the other two places.

Table 2 and **Table 3** were showed the kind of the GI parasites that found. Eleven parasites were found, 6 genera of protozoa and 5 genera of worm. The six genera of protozoan were *Blastocystis* sp. (100%), *Entamoeba* sp. (90%), *Eimeria* sp. (53%), *Giardia* sp. (7%), *Balantidium coli* (4%), *Cryptosporidium* sp. (2%), and the five genera of worms were *Oesophagustomum* sp. (45%), *Toxocara vitolorum* (20%), *Moniezia expansa* (9%), *Trichuris* sp. (5%), and *Fasciola* sp. (4%). Almost of cattles infected by more than one genus GI parasites, only one cattle (from Dayun) infected with one genus parasite, *Blastocystis* sp. and there are mixed infections in the sample examined for up to seven genera parasites. **Figure 2** was showed the morphologically of the gastrointestinal parasites found in this study using a light microscope.

Table 1. Characteristics of Stool Samples in Siak Sri Indrapura, Riau

Characteristic Samples		Number of Beef Cattle in each Sub District (head/%)			Total Number (head/%) (n=100)
		Bungaraya (n=32)	Sabak Auh (n=34)	Dayun (n=34)	
Age	3 - 6 months	3(9.38%)	0(0%)	1 (2,94%)	4 (4%)
	>6 months – 1 year	9(28.12%)	14(41.18%)	5(14.70%)	28(28%)
	>1-2 years	11(34.37%)	15(44.12%)	15(44.12%)	41(41%)
	>2-3 years	9(28.12%)	5(14.71%)	13(38.23%)	27(27%)
Sex	Male	8(25%)	11(32.35%)	8(23.53%)	27(27%)
	Female	24(75%)	23(67.65%)	26(76.47%)	73(73%)
Cage Management	Intensive	8(25%)	16(47.16%)	2(5.88%)	26(26%)
	Semi Intensive	2(6.25%)	7(20.59%)	10(29.41%)	19(19%)
	Extensive	22(68.75%)	11 (32.35%)	22(64.71%)	55(55%)
Feed and drinking water	Grass, well water	0(0 %)	16(47.06%)	0(0 %)	16(16%)
	Grass, well water + salt	21(65.62%)	0(0 %)	0(0 %)	21(21%)
	Grass + waste of tofu, well water	0(0 %)	18(52.94%)	0(0 %)	18(18%)
	Grass + stump of oil palm+ rice bran, well water	8(25%)	0(0 %)	28(82.35%)	36(36%)
	Grass + stump of oil palm+ rice bran, pool water	0(0 %)	0(0 %)	6(17.65%)	6(6%)
	Grass + stump of oil palm+ rice bran, well water	3(9.38%)	0(0 %)	0(0 %)	3(3%)

Table 2. Prevalence of Gastrointestinal Parasites in Beef Cattles in Siak Sri Indrapura, Riau

Types Parasite		Number of positive (Prevalence %)			Total Number of positive (Prevalence %) (n=100)
		Bungaraya Sub District (n=32)	SabakAuh Sub District (n=34)	Dayun Sub District (n=34)	
Protozoa	*Blastocystis* sp.	32 (100%)	34 (100%)	34 (100%)	100 (100%)
	Amoeba sp.	25(78.13%)	34 (100%)	31(91.18%)	90 (90%)
	Eimeria sp.	30 (93.75%)	19 (55.88%)	4 (11.76%)	53 (53%)
	Giardia sp.	5 (15.63%)	0 (0%)	2 (5.88%)	7 (7%)
	Balantidium sp.	3 (9.38%)	0 (0%)	1(2.94%)	4 (4%)
	Cryptosporidium sp.	2 (6.25%)	0 (0%)	0 (0%)	2 (2%)
Eggs Worm	*Oesophagustomum* sp.	24(75%)	14 (41.18%)	7(20.59%)	45 (45%)
	Moniezia expansa	4(1.25%)	1(2.94%)	4 (11.76%)	9 (9%)
	Toxocara vitulorum	4(1.25%)	7 (20.59%)	9 (26.47%)	20 (20%)
	Trichuris sp.	2(6.25%)	0 (0%)	3(8.82%)	5 (5%)
	Fasciola sp.	1(3.13%)	0 (0%)	3(8.82%)	4 (4%)

Table 3. Prevalence of Gatrointestinal Parasites Infection in Beef Cattle Based on Single or Mix Infection

Infection (Single/Mix)	Number of positive (%)			Prevalence (%) (n=100)
	Bungaraya (n=32)	Sabak Auh (n=34)	Dayun (n=34)	
Single infection parasite	0 (0%)	0 (0%)	1 (2.94%)	1 (1%)
Mix infection with two parasites	3 (9.37%)	11 (32.35%)	16 (47.05%)	30 (30%)
Mix infection with three parasites	6 (%)	8 (23.52%)	8(23.52%)	22 (22%)
Mix infection with four parasites	11 (18.75%)	12 (35.29%)	5 (14.70%)	28 (28%)
Mix infection with five parasites	9 (28.13%)	3 (8.82%)	3 (8.82%)	15 (15%)
Mix infection with six parasites	2 (6.25%)	0 (0%)	1 (2.94%)	3 (3%)
Mix infection with seven parasites	1 (3.13%)	0 (0%)	0 (0%)	1 (1%)

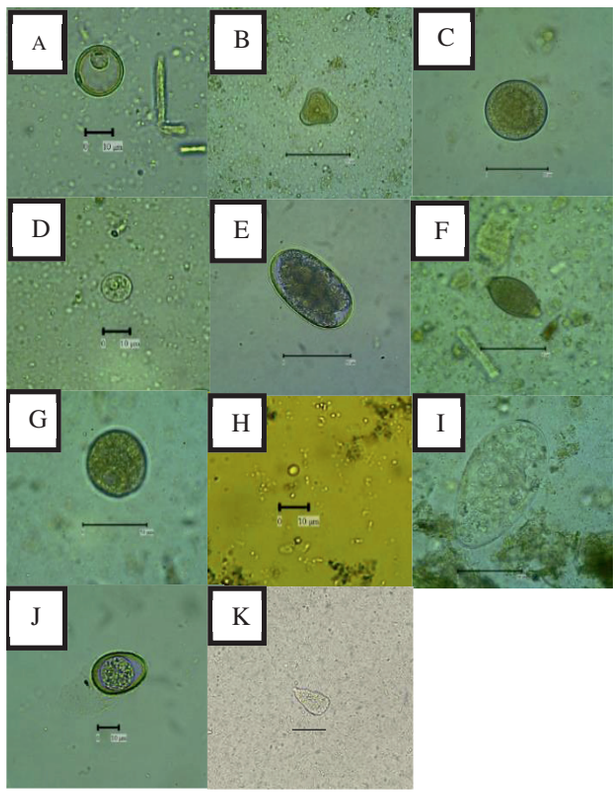

Figure 2. Morphological features of gastrointestinal parasites in beef cattle in Siak Sri Indrapura district, Riau Province. A). *Blastocystis* sp.; B). *Moniezia expansa*; C). *Toxocara vituorum*; D). *Entamoeba* sp.; E). *Oesophagustomum* sp.; F). *Trichuris* sp.; G). *Balantidium* sp.; H). *Cryptosporidium* sp.; I). *Fasciola* sp.; J) *Eimeria* sp.; K). *Giardia* sp.

This study is the first assessment of the prevalence of GI parasites in beef cattles in Siak Sri Indrapura District, Riau Province, Indonesia. The prevalence of GI parasites in beef cattles has been investigated in Riau Province by Rozi et al. it done in Tenayan Raya Pekanbaru Municipality and "they only emphasized on trematode worms, *Parampistomum* sp. and *Fasciola* sp".[8] The prevalence of *Fasciola* sp. infection in this study (4%) was much lower than their findings (50.43%; 49.02% in female and 60.71% in male). Although the prevalence is low, *Fasciola* infection must be aware because it has potential to infect humans. To date, *Fasciola* infection has been identified in human in many countries, with higher prevalence in farming communities in low income countries.[9]

In addition to *Fasciola* eggs worm, this study also found another parasites that are potentially zoonotic and its can be a source of transmission to human. They were *Blastocystis* sp., *Giardia* sp., *Balantidium* sp., *Cryptosporidium* sp., *Toxocara vitolorum* and *Trichuris* sp.

Blastocystis sp. is a parasite of the digestive tract of humans, livestock, birds, rodents, reptiles, dogs, pigs, cats and other animals.[10] The prevalence of *Blastocystis* sp. was high in this study, 100%. It raises the question, whether *Blastocystis* spactually a commensal protozoan or a pathogen. According to Parija and Padukone,[11] at date, understanding of the taxonomy, biology and pathogenity of *Blastocystis* sp. were not fully clear yet, although *Blatocystis* sp. has been identified 100 years ago, but, in the recent decades, many researchers have focused their research on the pathogenicity of *Blastocystis* sp. Several research have reported that *Blastocystis* infection has potential to be a zoonotic parasite, base on finding the same subtype in both animals and human,[12] among 17 subtypes of *Blastocystis* in mammals and birds, 9 subtypes (ST1-9) can infect humans.[13] Badparva et al.[6] reported that the most common subtype *Blastocystis* in cattle were ST5, followed by ST3 and ST6. It means that cattle with Blastocyst positive can be a source of transmission to human.

The prevalence of *Giardia* sp. and *Cryptosporidium* sp. in beef cattles in this study were 7% and 2%, respectively. It was lower than research conducted in Bangladesh by Ehsan et al.[14] they reported that the prevalence of *Giardia* sp. and *Cryptosporidium* sp. infection in calf in Bangladesh were 22% and 5%, respectively. Evidence that *Giardia* sp. and *Cryptosporidium* sp. are zoonotic parasites have been reported by several researchers. Wegayehu et al.[3] reported that while *Cryptosporidium* sp. and *Giardia duodenalis* infected children and cattle in Ethiopia. The prevalence of *Giardia* sp. infection in children was significantly associated with contact with cattle and manure. Both, direct transmission of *Giardia* sp. and *Cryptosporidium* sp. between cattle and their handlers (farmers) and indirect transmission through water ponds were also investigated by Ehsan et al.[14]

Balantidium infection (Balantidiosis) is a zoonotic disease and it can infect humans and animal through the fecal-oral route. According to Wisesa et al.[15] and Hussin and Al-Samarai,[16] cattles are highly suspectible to balantidiosis. The prevalence of *Balantidium* sp. infection in beef cattle in Siak Sri Indrapura Riau was lower (4%) compared in Bali cattle in Bali Province, it was 17.19%.[15] While, Hussin and Al-Samarai[16] showed the prevalence of *B. coli* in cattle and their breeder in Baghdad Iraq were 29.50% and 9.09%, respectively. Although considered an opportunistic pathogen, *Balantidium coli* can cause severe illness. Randhawa et al.[17] reported case chronic cattle diarrhoea due to *Balantidium coli* infection.

In this study, the prevalence of *Amoeba* sp. was found in 90 (90%) beef cattles. It was higher than parasite infection rate than that reported in Korea.[18] Until now, the role of *Amoeba* sp. in cattle is still not understood.

More than 50% the prevalence of *Eimeria* sp. in beef cattle in Siak Sri Indrapura Riau. It was higher than the prevalance of *Eimeria* sp. in Bali female cattle in Nusa Penida Bali, which was 12%,[19] and in Bali and West and East Nusa Tenggara, was 9.6%.[20] While in Bandung West Java, the prevalence of *Eimeria* sp. infection in dairy cattle was 44.75%.[21] *Eimeria* sp. infection (coccidiosis) is responsible for major economic losses in animal husbandry worldwide.[22]

The prevalence of *Moniezia expansa* in the city of Siak is 9%, where the prevalence is higher compared to the prevalence of *Moniezia expansa* in Bali and Rambon cattle in the Morowali district, Central Sulawesi, which was 2.5% and lower to the prevalence of *Moniezia* sp. in slaughterhouses in Pontianak City, West Kalimantan, at 11.25%.[23,24] In addition to *Taenia saginata*, a group of cestoda worm that can infect humans.[25] The results of the study in 2018, *Moniezia expansa* which infects livestock (cattle, sheep and goats), have also been reported in humans.[26]

The prevalence of *Toxocara vitulorum* infection in beef cattle in Siak Sri Indrapura Riau was higher (20%) compared with Saraswati et al.[27] finding in Bali cattle in Bali Province (2.2%). The role of *T. vitulorum* in toxocariasis in humans is still not understood,[28] although *T.vitulorum* larvae were carried out in somatic migration mice.

Toxocariasis (*Toxocara vitulorum*) which attacks cattle can be transmitted through oral fecal contamination, placenta (transplacenta) and milk (transmamary). *Toxocara* infection in animals can cause digestive tract disorders such as diarrhea, vomiting, constipation, intestinal damage to death. Besides infecting cows, *Toxocara vitulorum* can also infect spotted deer (*Axis axis*). *Toxocara* sp. infection causes diarrhea, loss of appetite, thinness and anemia, and even *Toxocara vitulorum* can cause pneumonia due to larval migration in the organs of the lung, liver organ damage and toxemia. Humans can be infected with Toxocariasis if they are eaten by infective eggs contaminated with dog, cat, livestock and soil feces, then the larvae hatch and then migrate through tissues and organs. It can cause visceral migrating larvae or larvae to migrate the eyes if they are trapped in a vein behind the eye which can cause permanent eye damage. The larvae was found in tissues (lung, liver and kidney) and milk are considered a source of transmission in humans.[29]

Mohd-Zain et al.[30] collected samples from playgrounds in Malaysia and found 95.7% *Toxocara* eggs and 88.3% another nematode. This prevalence shows very high contamination of local soil by parasitic eggs and can be a source of transmission to humans.[30]

Prevalence of *Oesophagustomum* sp. in beef cattle in Siak Sri Indrapura was 45% and this prevalence was higher than the prevalence of *Oesophagustomum* sp. in Badung Regency, Bali in 2011 and in the province of Bali in 2014, respectively, 1.85% and 0.27%.[31,32] *Oesophagostomum* spp. in ruminants was zoonotic worms that can cause a risk of environmental pollution and can lead to infection in humans.[33]

Prevalence of *Trichuris* sp. in Siak City, Riau is 5% of a total of 100 samples. This prevalence is higher when compared to the prevalence in Bali Province (1.5%) and lower than the prevalence of trichurosis in Bojonegoro District at 7.22% in the dry season and 5.19% in the rainy season. [32,34] The prevalence of trichurosis found in cattle in Bhutan is 4.31%,[35] and in Costa Rica (7.8-14.5%).[36] Meanwhile, the prevalence of trichinosis in dairy cows using intensive maintenance management is found to be much lower at 0.63% in Thailand,[37] and 1.2% in Ethiopia.[38] Prevalence of *Trichuris* sp. in Dayun sub-district is higher than in the regencies of Bungaraya and Sabak Auh by 8.82%. This is because livestock that are grazed have the potential to be infected with parasites higher than those who are fed in cages.[39] This statement also supports the results of the prevalence of *Trichuris* sp. in Sabak Auh District was 0%. More than 47% livestock management in the Sabak Auh Sub-district, was intensive management (Table 1). *Trichuris* was resistant to changes in temperature and humidity. On dry highlands, wet highlands (also Dayun sub-district), semi dry lands (Bungaraya and SabakAuh), *Trichuris* eggs can survive and develop for several years and cause infection in cattle.[32]

The advantages of intensive management were also shown in negative results (0%) in Sabak Auh for some parasites such as *Giardia* sp., *Balantidium coli*, *Cryptospodidium* sp., and *Fasciola* sp. (**Table 2**). Whereas that parasites have been discussed previously are zoonotic.

CONCLUSION

In conclusion, Siak Sri Indrapura District, Riau Province Indonesia is an endemic gastrointestinal parasite area and it can threaten the health of livestock and potentially as a zoonotic transmission.

ACKNOWLEDGMENTS

The author would like to thank the Department of Parasitology, Faculty of Veterinary Medicine, Universitas Airlangga for supporting this reseach. Thank you to the Regional Development Planning Agency of Siak district for sample taking permission. I would like to thank the Agency of Animal Husbandry and Fisheries for the support.

REFFERENCE

1. Ananta SM, Suharno, Hidayat Adi, Matsubayashi M. Survey on gastrointestinal parasites and detection of *Cryptosporidium* spp. on cattle in West Java, Indonesia. Asian Pac J. Trop Med. 2014; 7 (3): 197-201. doi: 10.1016/S1995-7645(14)60020-1
2. Marskole P, Verma Y, Dixit AK, Swamy M. Prevalence and Burden of Gastrointestinal Parasites in Cattle and Buffaloes in Jabalpur, India. Vet World. 2016; 9 (11): 1214–1217.
3. Wegayehu T, Adamu H, Petros B. Prevalence of *Giardia duodenalis* and *Cryptosporidium* species infections among children and cattle in North Shewa Zone, Ethiopia. BMC Infect Dis. 2013;13: 419.
4. Youn H. Review of zoonotic parasites in medical and veterinary fields in the Republic of Korea. Korean J Parasitol. 2009; 47 (Suppl.): S133-141.
5. Bawm S, Htun LL. Parasitic zoonoses in livestock and domestic animals of Myanmar and neighbouring countries. Asian J Anim Vet Adv [Internet]. Science Alert; 2015; 10 (11): 740–751. Available from: http://dx.doi.org/10.3923/ajava.2015.740.751.
6. Badparva E, Sadraee J, Kheirandish F. Genetic diversity of *Blastocystis* isolated from cattle in Khorramabad, Iran. Jundishapur J Microbiol. 2015; 8 (3): 4–7.
7. Meutchieye F, Kouam MK, Miegoue E, Nguafack TT, Tchoumboue J, Teguia A, Theodoropoulos G. A survey for potentially zoonotic gastrointestinal parasites in domestic cavies in Cameroon (Central Africa). BMC Vet Res [Internet]. BioMed Central; 2017 Dec 26 [cited 2018 Sep 12]; 13 (1): 196. Available from: http://bmcvetres.biomedcentral.com/articles/10.1186/s12917-017-1096-2
8. Rozi F, Handoko J, Febriyanti R. Infestation of Luke Worm (*Fasciola* sp.) and Stomach Worm (*Paramphistomum* sp) on Adult Bali Cattle in Tenayan Raya Pekanbaru Municipality. J Sain Veterine. 2015; 33 (1): 8–15.
9. Nyindo M A-HL. Fascioliasis: An ongo ing zoonotic trematode infection. Biomed Res Int. 2015: 1–27.
10. Yoshikawa H, Tokoro M, Nagamoto T, Arayama S, Asih PBS, Rozi IE, et al. Molecular survey of Blastocystis sp. from humans and associated animals in an Indonesian community with poor hygiene. Parasitol Int. 2016; 65 (6): 780–784.
11. Parija SC, Padukone S. *Blastocystis*: Pathogen or passenger? An evaluation of 101 years of research. Trop Parasitol. 2016; 6 (2): 163–164.
12. Osman M, Bories J, El Safadi D, Poirel MT, Gantois N, Benamrouz-Vanneste S, et al. Prevalence and genetic diversity of the intestinal parasites *Blastocystis* sp. and *Cryptosporidium* spp. in household dogs in France and evaluation of zoonotic transmission risk. Vet Parasitol [Internet]. Elsevier B.V.; 2015; 214 (1–2):167–170. Available from: http://dx.doi.org/10.1016/j.vetpar.2015.09.015
13. Cian A, El Safadi D, Osman M, Moriniere R, Gantois N, Benamrouz-Vanneste S, et al. Molecular epidemiology of *Blastocystis* sp. in various animal groups from two French zoos and evaluation of potential zoonotic risk. PLoS One. 2017; 12 (1): 1–29.
14. Ehsan AM, Geurden T, Casaert S, Parvin SM, Islam TM, Ahmed UM, et al. Assessment of zoonotic transmission of *Giardia* and *Cryptosporidium* between cattle and humans in rural villages in Bangladesh. PLoS One. 2015;10 (2):1–11.
15. Wisesa IBGR, Siswanto FM, Putra TA, Oka IBM, Suratma NA. Prevalence of *Balantidium*sp in Bali Cattle at different areas of Bali. Int J Agric For Plant. 2015; (1): 49–53.
16. Hussin AG, Al-samarai FR. Prevalence of *Balantidium coli* in cattle and cattle breeders in some regions of Baghdad in Iraq. Bang J Anim. Sci. 2016; 30–34.
17. Randhawa SNS, Singla LD, Randhawa CS. Chronic cattle diarrhoea due to *Balantidium* coli infection-a clinical report. J Vet Parasitol. 2010; 24 (2): 197–198.
18. Ismail HAHA, Jeon HK, Yu YM, Do C, Lee YH. Intestinal parasite infections in pigs and beef cattle in rural areas of Chungcheongnam-do, Korea. Korean J Parasitol. 2010; 48 (4): 347–349.
19. Indraswari AAS, Suwiti NK, Apsari IAP. *Eimeria auburnensis* and *Eimeria bovis* of Protozoa Gastrointestinal Infected on Female Bali Cattle in Nusa Penida. Bul Vet Udayana. 2017; 9 (1): 112–116.
20. Mastra IK, Saraswati, NKH, Sutawijaya IMG, Yunanto. Surveilance and Monitoring of Gastrointestinal Parasite Infection in Bali Cattle in Bali, West Nusa Tenggara and East Nusa Tenggara. Bul BBVet Denpasar. 2014; 26 (85): 1–12.
21. Sufi IM, Cahyaningsih U, Sudarnika E. Prevalence and Risk Factor of Coccidiosis in Dairy Cattle in Bandung District. JKH. 2016; 195–199.
22. Heidari H, Sadeghi-Dehkordi Z, Moayedi R, Gharekhani J. Occurrence and diversity of *Eimeria species* in cattle in Hamedan province, Iran. Vet Med (Praha). 2014; 59 (6): 271–275.
23. Widnyana IGN. Prevalence of Gastrointestinal worm parasite infection in Bali cattle and Rambon Cattle in Wosu Village, Bungku subdistrict, Morowali district. J Ilmiah Agro Pet. 2013; 10 (2): 1-8.
24. Tantri N, Setyawati TR, Khotimah S. Prevalence and Intensity of Parasitic worm eggs in cow (Bos sp.) feces in cow (*Bos* sp.) feces in Pontianak city sloughterhouse (West Kalimantan). J Protobiont. 2013; 2 (2): 102-106.
25. CDC. DPDx - Laboratory identification of parasites of public health concern. Center for Disease Control and Prevention. 2017.
26. Squire SA. Gastrointestinal helminths in farmers and their ruminant livestock from the Coastal Savannah zone of Ghana. Parasitol Res [Internet]. Parasitology Research; 2018; Available from: https://doi.org/10.1007/s00436-018-6017-1
27. Saraswati, NKH, Yunanto, Sutawijaya IGM. *Toxocara vitolorum* Prevalence in Bali Cattle in Bali Province. Bul BBVet Denpasar. 2015; 17 (86): 1–10.
28. Oguz B. Genetic Characterization of *Toxocara vitulorum* in Turkey by Mitochondrial Gene Markers (cox1). Acta Sci Vet. 2018; 46 (Januari): 1-6.
29. Indriyati L. Inventarization of Parasite Nematodes in Plant, Animal, and Human. Enviro Sci. 2017; 13 (3): 195–207.
30. Mohd-Zain SNM, Rahman R, Lewis JW. Stray animal and human defecation as sources of soil-transmitted helminth eggs in playgrounds of Peninsular Malaysia. J Helminthol. 2015; 89 (6): 740–747.
31. Arsani NM, Mastra IK, Saraswati NKH, Yunanto, Sutawijaya IGM. Epidemiology of Helminthiasis in Cattle in Bali Province. Bul Veteriner, BBVet Denpasar. 2015; 27 (87): 1–11.
32. Pramasudha AAR, Nyoman AS, Ida BMO. The Prevalence of *Trichuris* spp. In Bali Cattle According to the Layout Geographic of Bali Province. Udayana Veterinary Bulletin. Udayana Vet Bull. 2015; 7 (2): 202–208.
33. Karshima SN, Maikai BV, Kwaga JKP. Helminths of veterinary and zoonotic importance in Nigerian ruminants: A 46-year meta-analysis (1970-2016) of their prevalence and distribution. Infect Dis Poverty. Infectious Diseases of Poverty; 2018; 7 (1): 1–15.
34. Winarso A, Fadjar S, Yusuf R. Prevalence of Trichurosis in Beef Cattle in Kasiman Subdistrict, District of Bojonegoro, East Java. J Kaji Vet. 2015; 3 (2): 225–230.
35. Tshering G, Dorji N. Prevalence of Gastrointestinal Parasites in Free Range Cattle; a Case Study in Haa District Bhutan. J Anim Heal Prod. 2013; 1 (4): 36–37.
36. Jimenez AE, Fernandez A, Alfaro R, Dolz G, Vargas B, Epe C, et al. A cross-sectional survey of gastrointestinal parasites with dispersal stages in feces from Costa Rican dairy calves. Vet Parasitol. 2010; 173 (3–4): 236–246.
37. Jittapalapong S, Sangwaranond A, Nimsuphan B, Inpankaew T, Phasuk C, Pinyopanuwat N, et al. Prevalence of Gastro-Intestinal Parasites of Dairy Cows in Thailand. Kasetsart J Nat Sci. 2011; 45: 40–45.
38. Hiko A, Wondimu A. Occurrence of nematodiasis in Holstein Friesian dairy breed. J Vet Med Anim Heal. 2011; 3 (January): 6–10.
39. Bilal MQ, Hameed A, Ahmad T. Prevalence of gastrointestinal parasites in buffalo and cow calves in rural areas of Toba Tek Singh, Pakistan. J Anim Plant Sci. 2009; 19 (2): 67–70.