OPEN ACCESS
Advances in Animal and Veterinary Sciences

Research Article

Prevalence and Diversity of Gastrointestinal Endoparasite in Madura Cattle at Papabaru, East Java, Indonesia

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Abstract | This study aimed to describe the gastrointestinal endoparasite in Madura cattle at four Madura regency, East Java, Indonesia. A total of 400 samples of Madura cattle were collected from four sub-district at Pamekasan Regency as follows: Pakong, Pasean, Batumarmar, and Waru (PAPABARU). The collected feces were examined using whitlock sedimentation methods. The specific species was identified by their morphology. A total 43 Madura cattles were infected by nematode worm as follows: *Oesophagostomum sp.*, *Cooperia sp.*, *Capilaria sp.*, *Ostertagia sp*, and *Moniezia sp*) while, 14 Madura cattles infected by trematode worms (*Fasciola sp and Paramphistomum sp*). The prevalence of gastrointestinal endoparasite was found as follows: *Cooperia sp.* 31%, *Fasciola sp.* 12%, *Oesophagostomum sp.* 6%, *Moniezia sp.* 4%, *Paramphistomum sp.* 2%, *Capilaria sp.* 2%, and *Ostertagia sp.* 2%. To sum up, endoparasite infection of cattle is common in PAPABARU. Studies found that the prevalence of endoparasite and geographical distribution are needed and effective for prevention and control. It is concluded, prevalence rate is vital in monitoring the impact on the infection, health, and maintenance of Madura cattle population. Where areas, Madura cattle have good resistance to the parasitic infections there is need to design and implement a policy of helminth parasite in Madura district.

Keywords | Endoparasite, Gastrointestinal, Madura cattle, Nematode, PAPABARU

Received | August 27, 2022; **Accepted** | September 15, 2022; **Published** | September 22, 2022
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Citation | Aryani I, Suyadi S, Hartutik H, Kuswati K (2022). Prevalence and diversity of gastrointestinal endoparasite in madura cattle at papabaru, east java, indonesia. Adv. Anim. Vet. Sci. 10(10): 2171-2177.
DOI | http://dx.doi.org/10.17582/journal.aavs/2022/10.10.2171.2177
ISSN (Online) | 2307-8316

INTRODUCTION

East Java Province is the national center of cattle, which is Madura Island contributes 22% to the beef cattle population in East Java (BPS, 2022). Based on the regulation of the Ministry of Agriculture Number: 150 / Kpts / PK.020/ 2 / 2017 and the Decree of the Regent of Pamekasan number 188 / 173 / 432.131 / 2015, there were four sub-districts in Pamekasan Madura Regency: Pakong, Pasean, Batumarmar, and Waru (PAPABARU) chosen as the centers of breeding of Madura cattle. Madura cattle is one of the Indonesia local cattle that are widely spread in Java Island, specifically in Madura Island. Since, Madura cattle have capability tolerant hot climates and marginal environments they have greatest potentials. Madura cattle has greatly contributed to the development of local animal husbandry in Indonesia. Besides, Madura cattle recommended to low feed quality, easy to breed, and resistant to various infectious diseases. In otherwise, the provision of feed for animals is a major contributor to land and water use greenhouse gas emission (Adli, 2021). In line, overfishing and reduction in available land and water resources in huge archipelago island like Indonesia on which crops can be grown has led to an increasing potential disease.

Determination of novel solution meet the animal health balancing of production animals is key to development of animal industry in future trends (Sjofjan and Adli, 2021).

Health and disease control is key factors successes of animal management. In contrast, diseases in livestock that is still a global problem triggering significant economic losses is *helminthiasis* (Zahlizar, 2017). Helminthiasis is infectious diseases that caused by endoparasite. These infectious diseases were relatively decreasing the production and economical at Madura regency. *Helminthiasis* is a strategic infectious animal disease caused by invertebrate endoparasites from the phylum *Platyhelminthes* and *Nemathelminths*, which are detrimental. Little is known about gastrointestinal parasite infectious in Madura cattle. Endoparasite source from phylum nematode reported numerous diseases in animals. Furthermore, caused major burdens on animal production and global health (Lashari and Tasawar, 2011). The Directorate General of Livestock and Animal Health, Ministry of Agriculture, Republic Indonesia (2010) states that losses due to helminth infestations can reach until four billion rupiah per year due to decreased livestock production and productivity, and increasing the mortality. The life cycle, mode of transmission, and infective phase of *helminth* endoparasites are different for each species, but the infected host mostly shows a similar immune response (Pal and Chakravarty., 2020). The host immune response to *helmint*h infection is non-specific and involves T helper 2 (Th_2) cells characterized by increased IL-4, IL-5, IL-9, and IL-10 in blood plasma. Furthermore, chronic infection causes mobilization of *eosinophils*, accumulation of intestinal mast cells, and production of immunoglobulin E, which causes tissue damage and is immunopathological so that it will increase bacterial and virus infections due to immunosuppressive reactions (Andiarsa et al., 2012).

Moreover, this will have an impact on decreasing production and productivity (Pal and Chakravarty., 2020). Endoparasite infection also causes a decrease in food consumption and feed conversion ratio (Kanyari et al., 2009). The problem because it absorbs macronutrients from the host. In addition, the imbalance of nutrient absorption inhibits the growth process, which is the leading cause of reproductive disorders in livestock (Terefe et al., 2012). Glucose is the primary source of Adenosine Triphosphate (ATP), needed for body cell metabolism. Lack of glucose can inhibit metabolic processes such as synthesis of gonadotropin-releasing hormone (GnRH) (Boland, and Lonergan. 2003), which hinders follicle development and estrogen-progesterone release. Low blood protein levels also affect the occurrence of repeated breeding (Boland and Lonergan. 2003). However, there has been no research published about *helminthiasis* infections in the gastrointestinal tract of Madura cattle in Pamekasan Madura Regency: Pakong, Pasean, Batumarmar, and Waru (PAPABARU).

MATERIALS AND METHODS

Ethical approval

Ethical approval for the study was given by the Animal Care and Use Committee, University of Brawijaya, based on the laboratory examination of cattle feces without treatments. The samples were collected as per sampled, directly from the rectum without disturbing the animals. In addition, during collecting samples were accompanied by a responsible veterinarian.

Study area, population, and design

A cross study was conducted to determine the prevalence of endoparasite on the gastrointestinal. The study period was chosen to investigate the main risk factors influencing the prevalence and intensity of endoparasite infection in the Madura cattle. This research was conducted at five districts located in Pamekasan District, Pakong, Pasean, Batumarmar, and Waru sub-districts (PAPABARU). Fecal samping was conducted at sites with different altitudes. Pamekasan (340 meters above from sea level) (Latitude: -7° 09' 24.48" S Longitude: 113° 28' 28.56" E); Pakong (250 meters above from sea level) (113°19-113° 58 E South Latitude and 6°51-7°31 LS. East Longitude); Pasean (50 meters above from sea level) (-6.912468 and the longitude is: 113.584754); Batumarmar (16 meters above from sea levels) (6.9611788" S, 113.4964191" E); and Waru (159 meters above from sea level) (6°53'23.14"S and a longitude of 111°29'19.32"E or -6.88976 and 111.4887).

Faecal sample collection and analysis

A total of 400 faecal samples were collected for this research. Faecal samples were taken randomly from Madura cattle. In addition, a semi-structured interview was conducted due to interviews with predefined domains of interest, and the questions, were directed in a certain direction. Because of the language, a native translator was needed. In this case, it is important first to understand how the interpreter translates some words. Later, there is a clear understanding of the given translation.

The qualitative analysis used were flotation and deposition methods to identify the type of helminth that infected Madura cattle based on the shape and size of the eggs. Moreover, the quantitative analysis was taken using Whitlock chamber method to determine the number of helminth eggs per gram of faecal (EPG).

Identification

First, the samples were collected and immediately from the rectum. Second, a polythene bags were prepared and liquid potassium bichromate at 2.5% were prepared for

identification. The fulleborn floating methods was conducted following (Heidari et al., 2014) method. Third, the identification of endoparasite was taken on Animal Health Laboratory Unit, Tuban, East Java using Atlas of Parasitology following (Hidayati, 2014) method. Moreover, Helminth Arthropods, and Protozoa determined following (Soulsby, 1986) method.

Degree of gastrointestinal endoparasite infestation

The identification of helminth egg was following Brotowidjoyo (1987). While, the score of infection rate following (Budiharta, 2002) score as follows: if, less than 200 eggs (score 1); if 200-700 eggs (score 2). If more than 700 eggs (score 3) (Table 1).

Table 1: Index of infection category

No	Infection category	Frequency (%)
1	Always	99-100
2	Almost	90-98
3	Usually,	70-89
4	Frequently	50-69
5	Commonly	30-49
6	Often	10-29
7	Occasionally	1-9
8	Rarely	>0, -1
9	Very Rarely	>0.01-0.1
10	Almost Never	0.01

Prevalence

The prevalence of the helminth was expressed in number of particular parasites divided by the number of hosts examined in the parasite's species.

P= (founded results: total of founded/ number of samples examined) x 100% (Budiharta, 2002).

Data analysis

Prior to statistical analysis, descriptive analysis using Proc Means for multiple variate was carried out using SAS OnDemand for Academics (ODA, Cary, NC,USA). The results were presented as standard error mean (SEM). In the end, association between parameters significance probabilities was conducted if ($p < 0.05$). The following model was used:

$Y_{ij} = \mu + T_i + e_{ij}$

Where Y_{ij} was parameters observed, μ was the overall mean, T_i the number of prevalence found, and e_{ij} the amount of error number.

RESULTS AND DISCUSSION

Prevalence of gastrointestinal nematodes of Madura cattle encountered in the selected area

The examination was done for this study using direct flotation and deposition methods revealed overall prevalence of 58% of gastrointestinal endoparasite in Madura cattle originating from the PAPABARU area which are being infected and parasites with one or combinations species of endoparasites. Pakong and Waru sub-districts have the highest prevalence rate distribution of helminth cases, 12% and 11%, respectively in the incidence of *cooperia sp* infection (Table 2) (Figure 3). If compare with (Williams and Bunkley, 1996) the normal prevalence has a range of 10%-20%. Furthermore, *Cooperia sp* also infected the Madura cattle in Pasean and Batumarmar sub-district, about 6% and 2%, respectively (Table 2) (Figure 1). Occasionally rate infection category or infection in the prevalence range 1% - 9% (Williams and Bunkley, 1996). In addition, not only helminth but also protozoa were found namely (*Eimeria* spp., *Blastocystis* spp., and *Balantidium* spp.) but in the Kamal district (Hastutiek et al., 2019). The wide distribution of *Cooperia sp* related to the helminth's life cycle, which does not pass through an intermediate host. The life cycle span also determines the number of eggs. The shorter and simpler the life cycle is the faster the life cycle of helminths (Koesdarto, 2001). *Paramphistomum sp* and *Ostertagia sp* have the lowest prevalence and distribution 2%, respectively (Table 2) (Figure 2). Compare with Hastutiek et al. (2019) showed that the prevalence usually occurs in the cattle aged from six months to two years approximately 70-75%. This infection founded in Pakong sub-district, while the *fasciola sp* infection is found not only in Pakong sub-district but also in Pasean sub-district at 8% and 4%, respectively (Table 3). Moreover, the prevalence of *fasciola sp* and *paramphistomum sp* in Pakong and Pasean sub-district is considered low. Nevertheless, it still has to be considered and handled immediately because the incidence of *paramphistoum sp* infection in calves mostly increasing the mortality. Surprisingly findings, these infectious caused and damaged to tissued or cattle and make the selling value are decreasing (Hassan, 2011), increasing of mortality (Juyal et al., 2003), and decreasing fertility (Mogdy et al., 2009). Rearing costs will be high due to the use of drugs and longer non-return rate and days-open Period (Bilal et al., 2009).

Topographic factors and wide variations of livestock species in Pakong Sub-district (Limousine and crossbreed) cause the high diversity of helminth species that infect those areas. Genetic variation, species, age, and immune factors in animals will affect their resistance to parasitic infections and parasite development in such areas (Levine,

Table 2: Prevalence index of gastrointestinal endoparasite on Madura cattle based on the sub-district

No	Sub-district	Type	Frequency (%)	Standard error mean (SEM)	Category
1	Batu Marmar	*Capilaria sp*	2	0.2	Occasionally
		Moniezia sp	4	0.3	Occasionally
		Cooperia sp	2	0.3	Occasionally
2	Waru	*Cooperia sp*	11	1.2	Often
3	Pakong	*Paramphistomum sp*	2	0.2	Occasionally
		Fasciola sp	8	2.1	Occasionally
		Ostertagia sp	2	0.2	Occasionally
		Oesophagustomum sp	4	0.3	Occasionally
		Cooperia sp	12	2.3	Often
4	Pasean	*Cooperia sp*	6	0.3	Occasionally
		Oesophagustomum sp	2	0.2	Occasionally
		Fasciola sp	4	0.2	Occasionally

Table 3: Prevalence rate index of gastrointestinal parasite on Madura cattle based on the sub-district

No	Sub-district	ppm	fsc	Moni*	Cpl*	Cpr*	Ostr*
1	Batumarmar	-	-	Σ 4 host infected @EPG 50 and 50	Σ 2 host infected @EPG 50 and 50	Σ 2 host infected @EPG 50 and 50	-
	Infection rate	-	-	slight	slight	-	-
2	Waru	-	-	-	-	Σ 11 host infected @EPG 50 and 50	-
	Infection rate	-	-	-	-	slight	-
3	Pakong	Σ 2 host infected @EPG 1 and 1	Σ 8 host infected @ EPG7,1,1,5,5,1,1, and 7	-	-	Σ 6 host infected @EPG 100,50,150, 100,50,50,50,100,50 ,50,100, and 150	Σ 2 host infected @EPG 100 and 100
	Infection rate	slight	slight	-	-	slight	slight
4	Pasean	-	Σ 4 host infected @EPG 1,1, and 1	-	-	Σ 6 host infected @EPG 100,50,50,50,50 and 100	-
	Infection rate		Slight			Slight	

EPG – egg per gram; Moni - *Moniezia sp*; Cpl - *Capilaria sp*; Cpr - *Cooperia sp*; Ostr - *Ostertagia sp*; Oesm - *Oesophagustomum sp*

1990). The area of Pakong Sub-district is the smallest compared to the other PAPABARU areas (3,071 ha, with an altitude of 250 meters above sea level) in addition, Pakong Sub-district also has an agricultural irrigation system (BPS, 2022). Moreover, it has more vegetation than other areas in PAPABARU. Good humidity and loose soil make helminth larvae, both nematodes and trematodes, able to survive and grow by number in the Pakong Sub-district area (Abbasi et al., 2012). Surprisingly finding, there is low level parasites on the gastrointestinal in adults' cattle, which may due to the development of the immunity. Age is one factor onset of infection in body of cattle (Lashari and Tasawar, 2011). There is correlation between low body weight of ruminant and the highest endoparasite in the body (Lashari and Tasawar, 2011). The low variation of helminth infection in Batumarmar Sub-district compared to the other three sub-districts is caused by Batumarmar's location, rocky plain lowland. This condition makes it difficult for endoparasite larvae to complete their life cycle. Other factors that might cause the increasing of prevalence were the extensive systems. The ruminant is grazed and herded together in the same area while, the grazed area were carrier of the parasite and host. Furthermore, the extensive environment potentially correlation since between faecal, parasites, and host are closer contact during grazing (Badran et al., 2012). The prevalence of livestock parasites is determined by various factors, including geographical location, environmental conditions, cowshed quality, sanitation and hygiene, cowshed density, temperature, humidity, and vegetation (Egido et al., 2001). The higher rate of

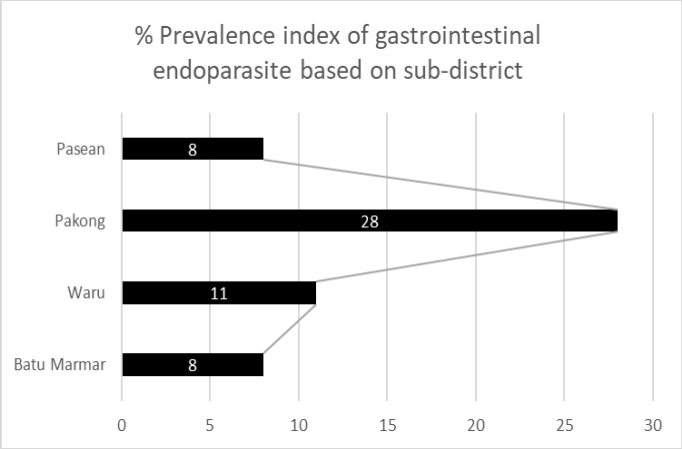

Figure 1: % Prevalence index of gastrointestinal endoparasite based on sub-district

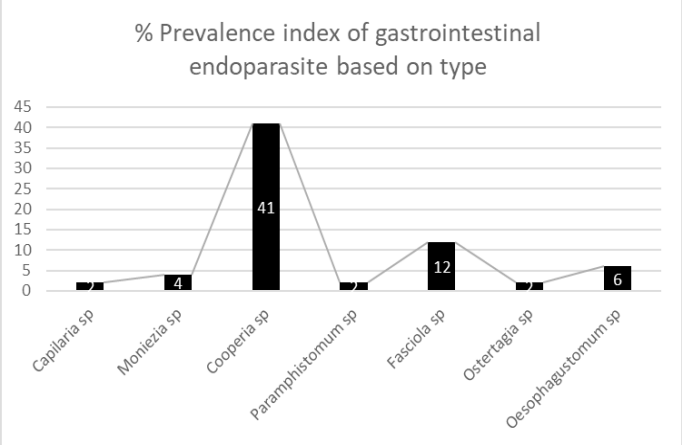

Figure 2: % Prevalence index of gastrointestinal endoparasite based on type

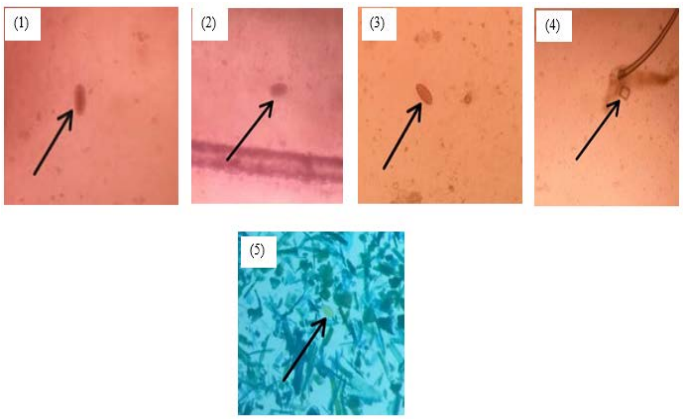

Figure 3: Eggs of endoparasites identified in Madura cattle in the PAPABARU sub-district (1) *Cooperia sp* (2) *Oesophagustomum sp* (3) *Capilaria sp* (4) *Moniezia sp* (5) *Cooperia sp* with (400x zooming scale)

prevalence during the rainy season is due to the existence of a suitable microclimate for the survival and propagation of free-living larval stages of parasites at several places (Allwin et al., 2016). The parasitic ova, snails and other intermediate host get a favourable humid sub-tropic climate for development in the plane grazing areas with shallow temporary stagnated water (Allwin et al., 2016). In addition, the grazing may influence the diversity of the parasites (Badran et al., 2012). Although gastrointestinal parasites have different predilections in the digestive tract, the geographic distribution of parasites, in general, depends mainly on climate (especially rainfall), vegetation, and livestock density. In line, the environmental conditions with low water, humidity, and temperature were suspected for growth and survival of parasites (Mulatu et al., 2017). The number of fluctuation infection were associated with seasonal changes and amount of prevalence in rainy season (Mulatu et al., 2017).

Infection rate gastrointestinal nematodes of Madura cattle encountered in the selected area

The endoparasite infectious were founded in all PAPABARU with low infection rates (Table 2).

The spreader of these helminth might be from poorer sanitation and hygiene in small-local farmers. The time of cleaning housing in small-local farmers were twice a day. Their cleaning by removal the fecal using the water into the bunk without any treatment. Surprisingly finding, Hastutiek et al. (2019) the sanitation founding at Madura also known to be unfit since the fecal that were dumped right around the cages. This condition can elevate the risk of infection. Their designed the traditional and without any disposal treatment. Using brush and combination between hot-water or detergent were recommended to prevent infectious disease (Wafiatiningsih and Bariroh, 2008). Rainy season might cause increasing the number of infections increasing (Hastutiek et al., 2019). In contrast, the low levels of infection were detected in cattle reared in an intensive system and were kept in wooden barn with raised floor that were cleaned regularly while those in extensive rearing system were kept in places which were not regularly cleaned (Badran et al., 2012).

The infectious was found in the productive Madura cattle in PAPABARU subdistrict. There is another factor might cause this infectious disease such as cattle, estrogen hormone, and parasites. The estrogen hormone was boosting the reticuloendothelial system and converting the antibodies for defenses against the endoparasite. Compared with the cows the bulls are more resistant to get the infectious disease (Rozi et al., 2015). Furthermore, the low level of infection might from the injection given both by livestock official of East Java Province and livestock official of Pamekasan Madura. They began to administering the injection since 2018 using the *Upaya Khusus Sapi Induk Wajib Bunting* (UBSUS SIWAB) program, while the SAPI *KERBAU KOMODITAS ANDALAN NEGERI*

(SIKOMANDAN) in 2020. SIKOMANDAN program also doing pregnancy test for reproductive cows, rectal palpation, and healthy check. Compared with the other method, rectal palpation usually recommended to checked the productive cows. The detected pregnant cows will injection of vitamins, while negative cows will be injected using deworming medicine. In addition, the Pamekasan district were developed and implemented *Inseminasi buatan satu tahun satu kelahiran pada ternak sapi* (INTANSATU SAKA). These programs were focusing to reproductive cows by doing regular deworming, improve recording systems, and implementing artificial insemination simultaneously. Surprisingly finding, epidemiological investigation on deworming of domestic cattle revealed that, regular deworming was not practiced, unless mass vaccination and deworming camps are conducted (Allwin et al., 2016).

Surprisingly findings, the low infection rate in productive Madura cattle compared with the crossbred cattle (Kartikasari, 2014). In addition, Rahayu (2015) mentioned age is one factor that affected the natural and active immunity in the bodies. The prevention of gastrointestinal infections cannot rely only on regular deworming but also on paying severe attention to cowshed hygiene management (Nurcahyo et al., 2021). Continuously, deworming can cause parasite resistance to the drugs given. In the administration of deworming drugs several factors will be affected such as the long-term effects of treatment, the immune response of the individual, and the timing of drug administration must be considered (Charlier et al., 2016). Since, the data collected from the questionaries indicated that the farmers mostly over 40 years old with only elementary school. They had low understanding to understanding in receiving the cases founded as well as treatment to anticipated this helminthiasis. In agreement from Hastutiek et al. (2019) during collected data from farmers mostly there were already 50 years old and low education without attended to school. Their also hard to receiving information as well as new ideas and technology to improve their cattle performances. Counseling about the importance of cowshed management to farmers is needed.

CONCLUSIONS

It is concluded that, prevalence rate is vital in monitoring the impact on the infection, health, and maintenance of Madura cattle population. Where areas, Madura cattle have good resistance to the parasitic infections there is need to design and implement a policy of helminth parasite in Madura district. The occurrences of a much lower level of parasite in Pasean and Batu-Marmar subdistrict which is have low topography. The dry and low humidity. Making it difficult for parasites to survive and complete its life cycle. However, control of parasitic gastrointestinal infections must be a priority to minimize the development, infections, and spread of the disease more widely. Last, the Madura cattle must be supported regularly dewormed programs and the control of intermediate host must be identified. Last, further research in whole Madura Island will lead to concrete results and must be identified among different sex and ages.

ACKNOWLEDGEMENTS

Authors wish thank you to local farmers PAPABARU, Madura, East Java, Indonesia. Second, East Java Provincial Livestock Unit, Surabaya, East Java, Indonesia. Last, the authors wish say thank you to whom all who help to finish these articles.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

NOVELTY STATEMENT

There has been no research published about helminthiasis infections in the gastrointestinal tract of Madura cattle in Pamekasan Madura Regency: Pakong, Pasean, Batumarmar, and Waru (PAPABARU) both reported prevalence and infection rate.

AUTHOR'S CONTRIBUTION

IA collecting data, doing the research, preparing manuscript SS conceptualization, supervision, review the manuscript; HH supervision, KK conceptualization, review the manuscript, conceptualization

REFERENCES

Adli D.N. (2021). The effect of replacing fish meal with Sago larvae meal (SLM) on egg production and quality of laying hens. Livest. Res. Rural Develop. 33(7): 1-8.

Abbasi. T., Tauseef S.M., Abbasi S.A. (2012). Biogas Energy. Springer, New York Dordrecht Heidelberg. London. https://doi.org/10.1007/978-1-4614-1040-9

Allwin B., Balakrishnan S., Kumar N.V., Jayathangaraj M.G., Vedamanickam S., Gopal S. (2016). Prevalence of gastrointestinal parasites in Gaur (Bosgaurus) and domestic cattle at interface zones of the Nilgiri Hills, Tamil Nadu. India J. Vet. Sci. Technol., 7(1): 1-6.

Andiarsa D., Hairani B., Meliyanie B., Fakhrial G (2012). Helminth infection, immunity and allergy. Epidemiol. Zoonosis J. 4:47-52.

BPS (2022). Badan pusat statistik; populasi sapi Madura di Indonesia. Jakarta.

Badran I., Abuamsha R., Aref R., Alqisi W., Alumor J (2012). Prevalence and diversity of gastrointestinal parasites in small

ruminants under two different rearing systems in Jenin district of Palestine. An-Najah University J. Res.-A. 26(1): 1-18.

Bilal M.Q., Hameed A., Ahmad T (2009). Prevalence of gastrointestinal parasites in buffalo and cow calves in rural areas of Toba Tek Singh, Pakistan. J. Anim. Plant Sci. 19 (2): 67-70.

Boland M.P., Lonergan P (2003). Effects of nutrition on fertility in dairy cows. Adv. Dairy Techol. 15:19-33

Brotowidjoyo M.D. (1987). Parasites and parasitism. Media Sarana Press, Jakarta.

Budiharta S. (2002). Capita Selecta Veterinary Epidemiology. Veterinary Public Health Section. Faculty of Veterinary Medicine.Gadjah Mada University; Yogyakarta. Bogitsh BJ, Clint EC, Th.

Charlier J., Valérie D.W., Edwin C (2016). Decision making on helminths in cattle: diagnostics, economics and human behavior. Irish Vet. J. 69(1):1-5. https://doi.org/10.1186/s13620-016-0073-6

Directorate General of Livestock. (2010). Epidemiology of Nematodiasis in Indonesia. Agriculture department, Jakarta.

Egido J.M., De Diego J.A., Penin P (2001). The Prevalence of Enteropathy due to Strongyloidiasis in Puerto Maldonado (Peruvian Amazon). Brazilian J. Infect. Dis. 5:119-123 https://doi.org/10.1590/S1413-86702001000300003

Hassan M.M., Hoque M.A., Islam S.K.M.A., Khan S.A., Roy K., Banu Q (2011). A prevalence of parasites in Black Bengal goats in Chittagong, Bangladesh. Int. J. Livest. Prod. 2(4): 40-44.

Hastutiek P., Yuniarti W.M., Djaeri M., Lastuti N.D.R., Suprihati. E., Suwanti L.T. (2019). Prevalence and diversity of gastrointestinal protozoa in Madura cattle at Bangkalan Regency, East Java, Indonesia. Vet. World. 12(2): 198. https://doi.org/10.14202/vetworld.2019.198-204

Heidari H., Dehkordi Z.S., Moayedi R., Gharekhani J. (2014) Occurrence and diversity of *Eimeria* species in cattle in Hamedan Province, Iran. Vet. Med., 59(6): 271-275.

Hidayati A (2014). The development of character education curriculum for elementary student in west sumatera. Int. J. Educat. Res. 2(6) 189-198.

Juyal P.D., Gupta M.P., Kaur K., Kaur S., Bal M.S., Hassan S.S (2002). Paramphistomos in domestic ruminants. Punjab Vet. J. 2(1): 100- 102.

Kanyari P., Kagira W., Mhoma R (2009). Prevalence and intensity of endoparasites in small ruminants kept by farmers in Kisumu Municipality, Kenya. Livest. Res. Rural Develop., 21(202): 12-15.

Kartikasari I. (2016). Prevalence and degrees of worms trac infection in cattle digestion ongole crossbreed and Limousin in sub-district of Tikung Lamongan Regency. Thesis. Veterinary Medicine of Airlangga University.

Koesdarto (2001). Model of Cycle control of cattle toxocariasisis infection with essential oil fractionation of temuireng (curcuma aeruginosa roxb) rhizome essential oil in madura island. J. Exact Med. Res. 1(2): 114-122.

Lashari M.H., Tasawar Z (2011). Prevalence of some gastrointestinal parasites in sheep in southern Punjab, Pakistan. Pakistan Vet. J. 31(4): 295-298.

Levine (1990). Edisi Indonesia: Parasitologi Veteriner. Gadjah Mada University Press, Yogyakarta.

Mogdy H., Al-Gaabary T., Salama A., Osman A., Amera G (2009). Studies on paraphistomiasis in ruminants in kafrelsheikh. J. Vet. Med. 10(1): 116- 136. https://doi.org/10.21608/kvmj.2009.107145

Mulatu N., Deneke Y., Ibrahim N (2017). Prevalence and diversity of gastrointestinal nematodes of cattles in and around Jimma Town, south western Ethiopia. Bullet. Anim. Health Prod. Africa. 65(4): 765-774.

Nurcahyo R.W., Ekawasti F., Haryuningtyas D., Wardhana A.H., Firdausy L.W., Priyowidodo D, Prastowo J (2021). Occurrence of gastrointestinal parasites in cattle in Indonesia. In IOP Conference Series: Earth Environ. Sci. 686(1): 012-063. https://doi.org/10.1088/1755-1315/686/1/012063

Pal A., Chakravarty A. K. (2019). Genetics and Breeding for Disease Resistance of Livestock. Academic Press, UK https://doi.org/10.1016/B978-0-12-816406-8.00019-X

Rahayu S. (2015). Prevalence of Gastrointestinal Nematodiasis in Bali Cattle (Bos sondaicus) in Maiwa District, Enrekang Regency. Thesis: Faculty of Medicine, University Makassar Hasanuddin, Makassar, Indonesia.

Rozi F., Handoko J., Febriyanti F (2015). Infestation of Luke worm (fasciola sp) and stomach worm (paramphistomum sp) on adult bali cattle in tenayan raya pekanbaru municipality. J. Sains Vet. 33(1):8-15.

Sjofjan O., Adli D.N (2021). The effect of replacing fish meal with fermented sago larvae (FSL) on broiler performance. Livest. Res. Rural Develop. 33(2).

Soulsby E.J.L. (1986). Helminths, Arthropds and Protozoa of Domesticated Animals. The English language book society and bailliere. Tindall, UK.

Terefe D., Demissie D., Beyene, D., Haile S (2012). A prevalence study of internal parasites infecting Boer goats at Adami Tulu agricultural research center, Ethiopia. J. Vet. Med. Anim. Health. 4(4): 12-16.

Wafiatiningsih B.N.R. (2008). Optimizing the Use of Palm Waste-Based Feed Through Nematodiasis Control Management in East Kalimantan. Samarinda Agricultural Technology Study Center. East Kalimantan.

Williams E.H., Bunkley W.L. (1996). Parasites of offshore big game fishes of Puerto Rico and the western Atlantic. Puerto Rico Department of Natural and Environmental Resources, San Juan, PR, and the University of Puerto Rico, Mayaguez, PR

Zalizar L (2017). Gastrointestinal Helminthiasis in Dairy Cattle. Jurnal Ilmu- Ilmu Peternakan. 27(2):1-7. https://doi.org/10.21776/ub.jiip.2017.027.02.01