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Prevalence of Soil-transmitted Helminthiasis among Aetas in Brgy. Villa Maria, Porac, Pampanga

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Abstract: Soil-transmitted helminth (STH) infections remains a major public health issue in the Philippines. Majority of the infected individuals are resided in impoverished regions such as indigenous peoples. World Health Organization (WHO) reported indigenous peoples including Aetas to be highly vulnerable to parasitic infections, particularly STH. Despite of this report, there are insufficient data about soil-transmitted helminthiasis among Aetas. This study aimed to determine the prevalence of soil-transmitted helminths and its infection rates among Aetas in Brgy. Villa Maria, Porac, Pampanga. Fecal samples of 223 Aetas were processed by Formalin Tween Concentration Technique and examined microscopically. The overall prevalence of STH infections among Aetas is 71.3% (159/223). In terms of infection rates, 49.7% (79/159) had single infection while 50.3% (80/159) had mixed infections. *Ascaris* spp. is the most prevalent STH by single infection while *Ascaris* spp. + *Trichuris* spp. are the most common STH by mixed infections. The occurrence of STH in a community suggests continued practice of open defecation or improper disposal of human and animal wastes that continually contaminate the soil. It also indicates the poor practices of sanitation and hygiene that had effectively transmitted STH infection within the community.

Key Words: Soil-transmitted helminths; Aetas; Formalin Tween Concentration Technique; Prevalence; Infection

1. INTRODUCTION

Soil-transmitted helminth (STH) infections affected almost 2 billion individuals worldwide, about 24% of the human population. *Ascaris* spp. mainly *Ascaris lumbricodes* (intestinal roundworm), *Trichuris* spp. primarily *Trichuris trichiura* (whipworm), *Necator americanus* and *Ancylostoma duodenale* (hookworms) form the major species of soil-transmitted helminths (STH) which commonly parasitized humans (World Health Organization [WHO], 2018). Soil-transmitted helminthiasis remained a major public health issue in the Philippines. 16 over 17 regions are endemic with more than 50% overall prevalence (Ross *et al.,* 2017). STH infections lead to morbidities such as nutritional deficiencies, anemia and diminished cognitive and physical development (Strunz *et al.,* 2014; Tefera *et al.,* 2017). Soil-transmitted helminths usually thrived among impoverished regions where lack of clean water, improper sanitation and hygiene occurred (Sanchez *et al.,* 2016).

Aetas are one of the main indigenous groups in the Philippines, inhabited more than 50 over 78 provinces (Balila, *et al.* 2013). Indigenous groups including Aetas were reported to be highly vulnerable to parasitic infections particularly STH. It

is due to their unfavorable hygienic and sanitary conditions in their environment. Their lack of direct access of safe water and indiscriminate disposal of human and animal wastes had caused these conditions (WHO, 2009; Minter, 2010). Few reports were published about the prevalence of soil-transmitted helminths and other intestinal parasitic infections among indigenous peoples in the Philippines. The documented prevalence had ranges from 37.8% to 97.4% obtained from schoolchildren and secondary students (Belizario *et al.,* 2011; Sumagaysay & Emverda, 2011; Ng *et al.,* 2014).

An insufficient data about soil-transmitted helminthiasis among Aetas in all ages existed. The present study aimed to determine the prevalence of soil-transmitted helminths and its infection rates among the general population of Aetas in Brgy. Villa Maria, Porac, Pampanga.

2. METHODOLOGY

2.1 Study area and Population

Barangay Villa Maria (15°05.220'N 120°29.332'E) located in Porac, Pampanga is comprised of 3 sites: Bana, Libutad and Tarik with population of 921 individuals with 181 households, dominantly resided by Aetas. A health center and a public school (from Elementary to Senior high school) are established in the area. Health workers served the area once a week. Mass deworming was employed last August 2018. Majority of the Aetas were engaged in agricultural activities supported by both government and private sectors. Close habitation of Aetas to their livestock was also evident in the area.

2.2 Sampling size

The study sample size for Aetas was determined by this formula (Charan & Biswas, 2013).

$$\text{Sample size} = \frac{Z_{1-\alpha/2}{}^2 p(1-p)}{d^2}$$

where:

p= obtained prevalence from the population in a previous study

d= margin of error

Z 1 a/2 = standard normal variate of 1.96 at P-value of 0.05

The overall prevalence of 78% obtained among Temuan and Mah Meri, indigenous subgroups (across all ages) in Malaysia (Chin *et al.,* 2016) was used as reference data for the sample size of the study. 264 was the sampling size for Aetas and was randomly divided in the three sites (88 samples in each site).

2.3. Fecal sampling

One-time sampling of feces from Aetas was done per week (1st week-Bana, 2nd week- Libutad and 3rd week-Tarik). Stool cups, tongue depressor, clear plastic, clean and broad sheet of paper were provided, one day before collection day. They were instructed to defecate onto a sheet of paper and transfer the sample of feces onto the stool cup by tongue depressor within the day of collection. They were also instructed to only take an amount of feces (smallest finger size) that had not been in contact with another surface such as ground, grass or dirt. One fecal sample per Aeta with identification label was collected in the morning and was stored in ice boxes prior transportation to De La Salle University Science and Technology Research Center.

2.4. Fecal examination

All samples were stored in refrigerator set at 4°C for not more than 7 days prior laboratory analysis. Fecal samples were processed by Formalin-Tween Concentration, method established by Methanitikorn *et al.,* (2003). 2 g of fecal samples in 20 ml distilled water was emulsified. The suspension was filtered into each of two 15ml-conical tubes. Both tubes were centrifuged at 1,500 rpm for 2 minutes then the supernatant was discarded. 10 ml of 10% formalin was added on both tubes and fixed for at least 10 minutes, after 1 ml of 5% of Tween 20TM was also added. Both conical tubes were closed and shaken vigorously in an inverted position for 30 seconds.

Both tubes were centrifuged again at 1,500 rpm for 2 minutes then the 3 layers were discarded afterwards. The sediments were mixed using wooden stick and transferred in glass slides. Two slides

contained 1-2 drops of iodine solution and other 2 slides without stain (Methanitikorn *et al.*, 2003). Four slides for each processed fecal sample were examined microscopically. Each sample was morphologically identified based on WHO Bench Aids for the diagnosis of intestinal parasites (1994).

2.5 Quality Control

Based on the published WHO Guidelines for the Evaluation of Soil-Transmitted Helminthiasis and Schistosomiasis at Community level by Montressor *et al.*, (1998). The thesis adviser acted as the team leader and re-read 10% of the processed slides each day for confirmation, without the prior knowledge of the initial results.

2.6 Data Analysis

The prevalence of soil-transmitted helminths in Aetas was calculated by dividing the number of infected Aetas with the total number of examined Aetas. Prevalence was represented as percentage.

2.7 Ethical Considerations

Prior to the implementation of this study, permission from the National Commission for Indigenous People, Region 3 (NCIP) and Mayor's office were obtained. Consultations with the officers and workers of Municipal Health office were carried out. The Barangay Captain was informed and gained approval. Brgy. health officers, parents and guardians of the children, minority and no read, no write individuals were coordinated. Parental consent was sought prior to conduct of research for child's and minor's participation. The results of this study were communicated to the Porac's Municipal Health office. All Aetas found positive with soil-transmitted helminths were referred to the Health office of the Municipality of Porac for proper treatment.

3. RESULTS AND DISCUSSION

Table 1 showed the prevalence of STH among Aetas at the three sites (Bana, Libutad and Tarik) in Brgy. Villa Maria, Porac Pampanga. Only 223/264 Aetas participated and an overall prevalence of 71.3% (159/223) was determined. Among the three sites, Tarik with 76.2% (64/84) has the highest prevalence followed by Bana and Libutad with prevalence of 69.1% (47/68) and 67.6% (48/71), respectively (Table 1).

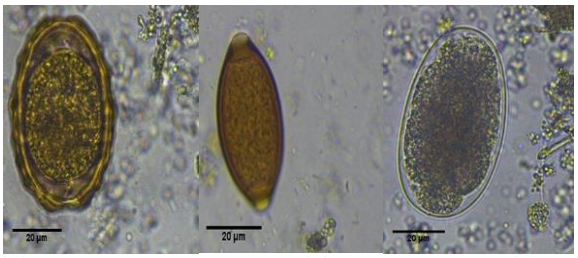
Table 1. Prevalence of Soil-transmitted helminths among Aetas in three sitse (Bana, Libutad & Tarik) in Brgy. Villa Maria, Porac, Pampanga

Sites	No. of Examined	No. of Infected	Prevalence, %
Bana	68	47	69.1
Libutad	71	48	67.6
Tarik	84	64	76.2
Total	223	159	*71.3

*Overall prevalence

The identified STH eggs present were *Ascaris* spp., *Trichuris* spp. and hookworms (Figure 1). Fertilized *Ascaris* spp. egg is round, golden yellow to brown color and has distinct mamillated layer. *Trichuris* spp. egg is brown shell colored with bipolar plugs while hookworm eggs (*Necator americanus* and/or *Ancylostoma duodenale*) are described as "bluntly rounded morulated ova" with clear shell.

Figure 1. Photomicrographs of STH eggs under 400x magnification, Scale bar = 20 µm.



(A) Fertilized *Ascaris* spp., (B) *Trichuris* spp., (C) hookworms

Table 2 showed the STH infection rates in Aetas at the three sites in Brgy. Villa Maria, Porac. 49.7% (79/159) have single infections while 50.3% (80/159) have mixed infections with at least two species of helminths. *Ascaris* spp. with 22.6% (36/159) is the most prevalent STH by single infection succeeded by *Trichuris* spp. 13.8% (22/159) and hookworms 13.2% (21/159). *Ascaris* spp. + *Trichuris* spp. were the most prevalent in mixed infections with 19.5% (31/159), followed by *Ascaris* spp. + *Trichuris* spp. + hookworms with 13.8% (22/159), *Ascaris* spp.+ hookworms with 9.4 %

(15/159) and *Trichuris* spp. + hookworms at 7.5% (12/159) as the least (Table 2).

Table 2. Soil-transmitted helminth infection rates in Aetas at the three sites in Brgy. Villa Maria, Porac, Pampanga (n=159)

Type of Soil-transmitted helminth	Bana, n	Libutad, n	Tarik, n	Total, n, (%)
Single Infection	20	28	31	79 (49.7)
Ascaris spp.	10	12	14	36 (22.6)
Trichuris spp.	5	11	6	22 (13.8)
Hookworms	5	5	11	21 (13.2)
Mixed Infections	27	20	33	80 (50.3)
Ascaris spp. +*Trichuris* spp.	16	6	9	31 (19.5)
Ascaris spp. + hookworms	2	4	9	15 (9.4)
Trichuris spp. + hookworms	3	2	7	12 (7.5)
Ascaris spp. + *Trichuris* spp. + hookworms	6	8	8	22 (13.8)

The parasitological data on Aetas implied that infections with STH remain a public health issue, particularly in indigenous peoples communities. It complemented with the nationwide survey done by the Department of Health (DOH) in 2001-2005. It stated that Ascariasis/ roundworm infection, Trichuriasis/ whipworm infection and hookworm infection are the main causes of intestinal helminths in the Philippines (DOH, 2005). The abundance of *Ascaris* spp. in single and mixed infections may refer to its higher fecundity, resistance and transmission. Its adult female resided in host's small intestine can lay approximately 200,000 ova each day.

It has higher fecundity than adult female *Trichuris* spp. that lay 2,000 to 20,000 eggs per day. It has also the shortest duration (10 days) to become infective in soil than eggs of *Trichuris* spp. (15 to 30 days) (Izurieta *et al.*, 2018; Shah & Shahidullah, 2018). Higher resistance of *Ascaris* spp. caused it to be infective in soil for longer years. The characteristics of its ova had contributed to its higher resistance. Its egg shell is 3-4 µm thick and composed of lipoidal inner layer, chitinous middle layer and protein outer layer. Easy and high adherence of the ova of *Ascaris* spp. to fruits, vegetables, flies and dust particles expanded its transmission to a definitive host (Blaszkowska *et al.*, 2011; Beyhan *et al.*, 2016; Payne *et al.,* 2017).

The lower prevalence of hookworms than *Ascaris* spp. and *Trichuris* spp. may be attributed to shorter life expectancy (3- 10 days) of their infective larva (Ngonjo *et al.,* 2016). It may also be due to the lower number of eggs produced per day by the female adult hookworms, *N. americanus* (10,000) and *A. duodenale* (30,000) compared to the female adult *Ascaris* spp. (200,000) (Bala, 2010; Tang *et al.*, 2014; Shah & Shahidullah, 2018). *Trichuris* spp. have higher resistance than hookworms. Data obtained from the experiments of Hossain & Bhuiyan (2016) and Manz *et al.,* (2017) proved the longer viability of *Trichuris* spp. ova in soil.

The findings of this study imply persist host-soil contact, soil contamination of feces with STH eggs and favorable environmental conditions. These implications are attributed to persist practices of open defecation and indiscriminate disposal of human and animal wastes because these wastes are possible sources of STH eggs. Soil plays an important role in converting STH eggs to its respective infective stages (Mohaghegh *et al.*, 2017). It is also responsible for the transmission of these parasites to a definitive host, such as humans (Belizario & de Leon, 2015). Favorable environmental conditions aid in the development and perpetuation of these STH eggs. (Anuar *et al.,* 2014; Lacuesta *et al.* as cited in Sumagaysay & Emverda, 2011). The results of this study also indicated the sustenance of poverty, poor sanitation and hygiene behavior and environmental contamination in the community (Ng *et al.,* 2014; Fikresilasie, 2015).

4. CONCLUSION

The overall prevalence soil-transmitted helminthiasis among Aetas is 71.3% (159/223). From this, 49.7% (79/159) were detected to have single infections while 50.3% (80/159) have mixed infections. *Ascaris* spp. is the most common helminth

by single infection while *Ascaris* spp. + *Trichuris* spp. are the most common in mixed infections. The occurrence of STH in a community indicates the presence of poverty, poor sanitation and hygiene practices as well as environmental contamination mainly caused by open defecation or improper disposal of human and animal wastes.

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