

Prevalence and Associated Factors of Intestinal Parasitic Infection among Preschool Children in Sekota Town, Wag-Himra Zone, Northern Ethiopia; a community Based Cross-sectional study

Mesfin Wudu Kassaw (✉ mesfine12a@gmail.com)

Woldia University <https://orcid.org/0000-0002-6327-7723>

Ayele Mamo Abebe

Debre Birhan Health science college

Biruk Beletew Abate

Woldia University

Alemu Birara Zemariam

Woldia University

Ayalign Mengesha Kassie

Woldia University

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Abstract

Background: Intestinal parasitic infection triggered considerable gastrointestinal morbidity, malnutrition and mortality worldwide, particularly among young children in developing countries. In magnitude, Helminthiasis affect 10%–20% of pre-school children worldwide. In addition, small children below 5 years are uniquely susceptible to intestinal parasitic infestation in the poor community because of their childhood behavior like playing with soil and putting hand to mouth habit. Thus, the aim of this study is to assess the prevalence and risk factors of intestinal parasitic infection among pre-school children in Sekota town, Ethiopia. **Methods:** a community based cross-sectional study was completed on 378 preschool children in Sekota town from February 15 – March 10/2019. Stool specimens were collected and examined for intestinal parasites using wet mount and formyl-ether concentration techniques. The risk factors of intestinal parasite were also assessed using a pre-tested structured questionnaire. The data were entered and analyze using Epi-data version 4.1 and SPSS-version 23 statistical software respectively. Both bivariable and multivariable analysis was carried out. Potential co-linearity was considered and tested. Variables with P-value less than 0.05 in multivariable analysis were considered as statistically significant. **Results:** The prevalence of intestinal parasitic infection in Sekota town on wet mount and concentration techniques was 83 (21.9%) and 113 (29.9%) respectively. On multivariable analysis deworming (AOR, (95% CI), (2.5(1.5-4.3), presence of animal in the living room (AOR, (95% CI) (3.1(1.8-5.3), and occupation (AOR, (95% CI) (3.4 (1.1-10.0) were increase the odds of intestinal parasitic infections. **Conclusion:** The prevalence of intestinal parasitic infection in Sekota town is high, which is a public health problem. The risk factors that contribute for intestinal parasitic infection in this study are preventable and modifiable. These are deworming, having animals in the living room, and occupation. Therefore, care should emphasis on periodical deworming, and campaign either through health education or visiting the home of the community. Whenever possible financially, double and above rooms would be recommended for the community of the town, in particular the animals should be lived in isolated rooms. **Key Words:** Intestinal Parasites, Preschool, Sekota Town, Prevalence, Risk Factors

Background

Healthy children are a vital resource to ensure the future well-being of a community. Regardless of these, quality of family living conditions, prevalence, and mode of transmission of infectious disease and nutrition are among the strongest immediate determinants that causes morbidity and mortality in children younger than five years of age (1). Of these, intestinal parasites are the major problems of children, which colonize the gastro-intestinal tract and manifested as diarrhea, vomiting and or abdominal cramp (2).

The parasitic infestations are acquired by ingestion, and or penetration of the skin by the infective forms of the parasite (3). The infection was higher on children from mothers with poor hygienic practices. In addition, poverty, illiteracy, poor hygiene, lack of access to portable water and warm and humid tropical climate are some of the factors of intestinal parasitic infections in the tropical and sub-tropical countries (4).

Intestinal parasitic worm infections are distributed virtually throughout the world and are still a serious public health problem in the world, particularly in developing countries and they cause a variety of health hazard (1). It is estimated that approximately 3.5 billion persons are affected worldwide and cause clinical morbidity in 450 million. Many of these are children from developing countries. Of these infected people 1.47 billion are infected with round worm, 1.3 billion people are infected with hook worm and 1.05 billion are infected with whip worm (3).

Pre-school children, make up the prevalence between 10%–20% of the two billion people in helminthiasis worldwide. Among them, 21 million were infested with Hookworm, 122 million were infected with *A. lumbricoides* and 86 million were infected with *T. trichiura* (5). Intestinal parasitic infections are endemic worldwide and have been described as constituting the greatest single worldwide cause of illness and disease (6).

Every year 1,400 million children worldwide are infected with worm infection. Epidemiological surveys have revealed that, poor sanitation and inappropriate environmental conditions coupled with indiscriminate defecation, geophagy and contamination of water bodies are the most important predisposing factors to intestinal worm infection (7).

The prevalence and intensity of infection is especially high in developing countries, particularly among populations with poor environmental sanitation (8).

In Ethiopia, intestinal parasitic infections are widely spread (9). The distribution and prevalence of various species of intestinal parasites differs from region to region because of several environmental, social and geographical factors (10, 11).

Small children below 5 years are uniquely prone to intestinal parasitic infection in rural community because they play in the mud and dirt, suck their finger and nail, eat soil, no habit of hand washing before meal and after touching the dirty things, less toilet hygiene, low socio-economic status and poor sanitation coupled with low educational status of parents, particularly mothers, are the main factors influencing transmission, distribution and prevention of the infection (12, 13).

Parasitic infections are regarded as serious public health problem, as they cause iron deficiency anemia, growth retardation, physical and mental health problems, loss of weight in pregnancy and low birth weight (14).

The interventions against intestinal parasitic infection is based on control and prevention strategies including regular anti-helminthic treatment and improved water supply, sanitation and health education (15, 16).

Epidemics are a major health hazard in Sekota woreda because of the low level of environmental and individual hygiene and poor preventive public health services. Only 32.2% of Sekota woreda population had access to clean water. Seventy two percent of all urban residents had access to portable water and 11.7% of the households had access to protected well and spring water (17).

Most of the previous studies conducted in Ethiopia had focused on school age children, even limited studies had been reported the prevalence of intestinal parasitic infections among under-five children (9, 11, 16 and 18). Therefore, the data about intestinal parasite on preschool children in Ethiopia, is scarce. Therefore, this study is designed to assess prevalence and risk factors of intestinal parasitic infection among pre-school children in Sekota Town, Wag Himra Ethiopia.

Methods

Study Design, and Population

A community based cross-sectional study was carried out on 378 preschool children in Sekota town from February 15 – March 10/2019. The town has two kebelles and both kebelles were included in the study. Mothers and their child who completes the second years of birth day and less than the birth day of year six were the study population from the two kebelles.

Sample size determination and sampling procedure

The sample size, which is 384 was determined by using single proportion formula: $n = \frac{Z^2_{\alpha/2} * P(1-P)}{d^2}$. The population proportion used for calculation from previous study was (p=52.3%) (19). While calculating the sample, 10% non-response rate, 95% CI and 5% margin of error were considered.

Sampling procedure

Sekota town has two kebelles and the study participants were sampled from both kebeles using simple random sampling after accessing under five children registration book at the kebele office. The sample size was proportionally allocated to each kebele based on number of preschool children and study participants were selected from a list of preschool children, kebele registration. A total of 384 preschool children were supposed to be included in the study. Mothers' of a children whose children's stool sample was collected included for interview, while the child's mother cannot be reached, immediate care giver was interviewed. When there are two or more children selected from the registration book to be found in one house, only one of them were selected randomly and replacement was implemented for all such scenarios (Figure 1).

Data collection tools and procedures

The interview part like socio-demographic data were collected from mothers by four senior bachelor nurses who are experienced and took one day training using structured interview questioners. Mothers of a selected children were requested for their willingness to provide the stool samples on a small piece of plastic sheet or stool cup and for interview.

Stool sample collection and examination:

Stool specimens were collected by mothers after explaining the purpose to collect about 2g fresh stool sample of their own preschool child. A clean piece of plastic sheet was distributed to each selected mother and instructed to provide about 2g of fresh stool sample. The samples were received from mothers by one bachelor laboratory technologist. The microscopic examination, the transfer and the formyl ether concentration techniques were done by other three laboratory technologist independently and blindly.

Direct microscopic examination Direct microscopy was performed at the site of collection Sekota health center within 30 minutes of sample receipt for possible detections of parasites such as ova of *S. stercoralis*, motile trophozoite of *E.histolytica/dispar* and *G.lambliia*, parallel to helminths ova, cysts and oocysts of intestinal protozoa. A direct wet mount was prepared by emulsifying approximately 5g of stool using a drop of physiological saline on a slide.

Formal-ether concentration technique; an approximately 4gm of feces was emulsified in formol water suspension which was strained to remove large fecal particles. Into the strained feces, ether was added and then the mixed suspension was centrifuged. After discarding the supernatant, the sediment was examined under the microscope for cysts, oocysts, eggs and larvae of intestinal parasites to Sekota Hospital.

Data Analysis

The completeness of data was checked frequently during collection and entry to Epi-data version 4.1 and analyzed using SPSS version 24. The descriptive statistics were expressed as percentages and frequencies and the associations between independent variables and dependent variable was computed. Variables found to have an association at $P < 0.25$ in bi-variable entered to multivariable logistic regression to test for independent association. Potential co-linearity was considered and tested. Variables with P-value less than 0.05 in multivariable analysis were considered as statistically significant.

Data Quality

For each step standard operational procedure (SOP) was followed. The socio-demographic questionnaire was pre-tested on 5% (20 mothers) of the sample in Woldia town. The interview guide was edited accordingly for virtual data collection. Data was checked for its completeness, and missing information at each point by all investigators and data collectors. Data collectors, and laboratory technologists were taking a one-day training in two separate rooms.

One microscope and centrifuge were checked and labeled by senior laboratory technologist to be used for examining by discriminating from other Microscopes and centrifuges and both microscopic and

centrifuge-based examination were completed by senior laboratory professionals.

All the stool sample collectors, microscopic examiner, sample transferrers and formyl ether concentration examiners were blinded to minimize the bias up to the end of the research and later as a whole including the recheck of the sample.

Eligibility Criteria: all mothers with children aged (2-6 years) living in Sekota town at least for 1 year and willing to participate in the study was included while mothers having children who took standard intestinal parasite treatment for previous month and children who has seriously diseases were excluded.

Operational Definitions

Preschool children: all children between the age of 2 and 6 years who are not yet attending their 6 years of birth day.

Prevalence: the number of intestinal parasite case identified on formal ether examination during the study period in the study population.

Intestinal parasites: are parasites that can infect gastrointestinal tracts of the human body.

Parasitic infection: intestinal parasite infection/positive result confirmed by laboratory stool examination

Results

Children Socio-Demographic Characteristics

A total of 378 mother-child pair were involved in this study and yields a 98.4% response rate. Regarding the sex of pre-school children, 190 (50.3%) were males and 156 (41.3%) of the children were completed vaccination. Nearly half of the children, 206 (54.5%) were had history of diarrhea and 370 (97.9%) had no history of any diagnosed medical cases (**Table 1**).

Environmental characteristic

In 235 (62.2%) of households, there was latrine but majority of the remaining households used open field excreta disposal options, near the home, 82 (57.3%) and in the farm/river 44 (30.8%). In addition, 201 (53.2%) of the households had animals in the same house.

Prevalence of Intestinal Parasitic Infections

The prevalence of intestinal parasitic infections in Sekota town was determined using both wet mount and concentration techniques and there was 83 (21.9%) and 113 (29.9%) positive samples respectively. In the study area *E. histolytica*, *G. lamblia*, *A. lumbricoides*, Hookworm, and *H. nana* were examined. There was also a co-infection of *E. histolytica* and *H. nana* as well as *G. lamblia* and *H. nana* (Figure 2).

Risk Factors of Intestinal Parasitic Infections

All variables which had a p-value less than 0.25 in bi-variable analysis were transferred to multi-variable logistic regression analysis. In this study all variables were included for multi-variable analysis, because those variables which had p-value >0.25 were the interests of the authors. On multi-variable analysis deworming (AOR, (95%CI), (2.515(1.482-4.269)), Presence of animal (AOR, (95%CI) (3.104(1.829-5.267)), and occupation (AOR, (95%CI) (3.365 (1.132-10.005) were increase the odds of intestinal parasitic infections.

Discussion

The prevalence of intestinal parasitic infection among preschool children in Sekota town was 113 (29.9%). A total of five species of intestinal parasites were identified with the highest prevalence of *G. lamblia*, 55(14.6%), *H. nana*, 19(5%), *E. histolytica*, 17(4.5%), *A. lumbricoides* 6(1.6%), 18(4.8%) Hook worm and 6 (1.6%) mixed infection. This study is in line with a study done in Gonder, which reports the overall prevalence as 34.2% among primary school students. In all age groups, the predominant intestinal parasite detected was *Entamoeba histolytica/dispar*, followed by *Hymenolepis nana* and *Ascaris lumbricoides* (20). This similarity might be due to similar study setting, in which both studies are done in Urban.

But the finding of this study is lower than a study done in Shesha-Kekele, Wondo Genet, Southern Ethiopia, which reported the prevalence as 85.1% among under five children with one or more intestinal parasites. The prevalence of *T. trichiura*, *S. mansoni*, *A. lumbricoides*, *Hymenolepis nana*, and hookworm infections were 74.7%, 37.2%, 25.7%, 4.5%, and 5.9%, respectively (21). This exaggerated difference might be due to that the area, Shesha-Kekele known for having high prevalence of Soil transmitted helminthiasis and intestinal schistosomiasis (22), and the time period have significant impact, since the study was done before 8 years in relative to this study. Many things like quality of health care, socio-economic status, water and sanitation as well as awareness of the community, particularly, mother's awareness is improved overtime.

The finding of this study also lower than a study done in Bahir Dar (65.5%) (23), Dagi primary school (77.9%) (24), and Motta Town (68.4%) (25). This variation might be the result of different study period, which were done before at least 2 years and at maximum of 6 years earlier. This time difference affects the quality of health care service, when the time is late the care is also coming better and better. There is also a difference on the study population and setting. Those three studies done on school aged children comes from either Urban or rural but this study done on urban pre-school children.

Children who had no history of deworming increases the odds of intestinal parasitic infection 2.3 times (AOR, 95%CI), (2.321, 1.318-4.088) than their counter parts, who have history of deworming. The finding is supported with the reports of WHO and WB, that states deworming decreases intestinal parasitic infections (26, 27).

Children who lived in single room with domestic animals increases the odds of intestinal parasitic infection 3.1 times (AOR, (95%CI) (3.104(1.829-5.267) than their counter parts, which is in line with a

study done in Taiwan, (AOR = 4.249, 95% CI = 1.102–16.390, P = 0.0357) (28) and Burkina Faso (P = 0.008) that reported as animals increase the odds of intestinal parasitic infection (29). This might be either animals transmit zoonotic disease directly or cause to compromised the cleanness of the home indirectly. The lack of cleanness is a risk factor for intestinal parasitic infection.

In children of governmental employees, the odds of intestinal parasitic infection increase 3.4 times (AOR, (95%CI) (3.365 (1.132-10.005) than children of merchants. This might be due to the inflated shortage of water in the Sekota town. Therefore, those civic servants might not able to fetch sufficient water regularly and this might contribute for intestinal parasitic infection in addition to lack of time to care their children than small scale merchants, who spent in indoor with their children by doing their job like shopping, or restaurant or bar.

Conclusion

The prevalence of intestinal parasitic infection in Sekota town is high, which is a public health problem. The risk factors that contribute for intestinal parasitic infection in this study are preventable and modifiable. These are deworming, having animals in the living room, and occupation. Therefore, care should emphasis on periodical deworming, and campaign either through health education or visiting the home of the community. Whenever possible financially, double and above rooms would be recommended for the community of the town, in particular the animals should be lived in isolated rooms.

Limitation

Modified acid-fast staining technique was not used to detect *Cryptosporidium* species and cause to miss this species

As the collection period was short, potential seasonal fluctuations might have affected the actual prevalence.

Abbreviations

AOR- adjusted odd ratio, CI – confidence interval, SOP- standard operational procedure, SPSS- statistical package for social science, WB-world bank, WHO- World Health Organization

Declarations

Ethics approval and consent to participate

The ethical clearance was obtained from Institutional Review Board of Woldia University. A support letter was also obtained from Woldia University, research directorate office. Then after, a subsequent contact was made with the chairmen of the town administration and each kebeles. A written permission was also got from the chairmen of the administration and heads of the keblles. Written permission was also

obtained from Sekota zonal health department and then Sekota town health office. Written informed consent was obtained from all mothers who have preschool children and involved in the study after explaining the aim of the study. Anonymity and confidentiality were maintained by allowing opposition and or discontinuation of the interview and omitting the name and personal identification of respondents, both children and care givers, because it was not compelled to the study. The results were communicated with their health extension workers and health centres for better management of the patients. Child with intestinal parasitic infection treated with appropriate drug and dose by health personnel in Senbete and Bete health centres. Drugs were taken from EPHI and given for schistosomiasis and Hymenolepis nana infection.

Consent for publication

Participants (care givers) were informed and gave their written consent to publish the findings in repeatable international journals.

Availability of data and material

The raw material supporting the conclusions of this research will be available to researchers needing the data to use for non-commercial purposes through requesting the authors.

Competing interests

The authors declare that they have no conflict of interests

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Authors' contributions

Conceived the title and designed the study: MWK, KGT, AMA, ABZ, and BBA. Field study: MWK, ABZ, AMA, KGT and BBA. Analyzed the data: MWK, KGT and ABZ. Critically revising the work: MWK, KGT. Writing the final paper: MWK, AMA, ABZ, BBA, and KGT. In finalizing this paper, all authors have read and approved the final version of this manuscript.

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References

1. Allendre AJ, Spradly, WB. Infant, toddlers and preschoolers. *Community Health Nursing: Promoting and Protecting the Public's Health*. Lippincott Williams and Wilkins, Philadelphia, USA, 6th Ed., 2005. 2.
2. Loukopoulos P, Komnenous A, Papadopoulos E, Psychas V. Lethal *Ozolaimus Megatyphlon* infection in a green iguana (*iguana iguanarhinolopa*). *J. Zoo and Wildlife Med.* 2007; 38: 131-134. 3. Park K. *Textbook of preventive and social medicine*. Jabalpur: Banarasidas Bhanot. 18th ed. 2005. 4. Ulukanligil M, Seyrek A. Demographic and socio-economic factors affecting the physical development, hemoglobin and parasitic infection status of school children in Sanliurfa Province, Turkey *Pub Helth.* 2004; 118 (2): 151-8.
5. De Silva N.R. Impact of mass chemotherapy on the morbidity due to soil-transmitted nematodes. *Acta Tropica* 2003; 86(2- 3): 197-214 6. Sehgal, R., Gogulamudi, V. R., Jaco, J. V. and Atluri, V. S. R. Prevalence of intestinal parasitic infections among school children and pregnant women in a low socio-economic area, Chandigarh, North India. *Reviews of infection (RIF)*. 2010; 1(2):100- 103. ISSN: 1837-6746 7. Brooker, S., Hotez, P.J. and Bundy, D.A. Hookworm-Related Anemia among Pregnant Women: A Systematic Review. *Trop.Dis.* 2008;2: e291 8. Van Eijk, A.M., Lindblade, K.A. and Odhiambo, F. Infections among Pregnant Women in Rural Western Kenya; a Cross-Sectional Study. *PLoS Negl. Trop. Dis.* 2009; 3: 370 9. Amare M, Solomon G-S, Tesfaye K. Prevalence of intestinal parasitic infections among urban dwellers in southwest Ethiopia. *Ethiop J Health Dev.* 2007;21(1):12-7. 10. N.Opara K, Udoidung NI, Opara DC, Okon OE, Edosomwa EU, Udoh AJ. The Impact of Intestinal Parasitic Infections on the Nutritional Status of Rural and Urban School-Aged Children in Nigeria. *International Journal of MCH and AIDS.* 2012; 1(1):73-82 11. Ayalew A, Debebe T, Worku A. Prevalence and risk factors of intestinal parasites among Delgi school children, North Gondar, Ethiopia *Journal of Parasitology and Vector Biology* 2011; 3(5). 12. Hockenberry JM. Health problems of Toddlers and preschoolers, In: Wilson, S.L (Ed), *Wong's Essentials of Pediatric Nursing*. 7th ed., Mosby, Inc, USA, 2005 13. Okyay P, Ertug S, Gultekin B, Onen O, Beser E. Intestinal parasites prevalence and related factors in school children, a western city sample-Turkey. *BMC Public Health*, 2004, 4: 64 14. Rodriguez-Morales, A. J., Barbella, R.A., Case, C., Arria, M., Ravelo, M., Perez, H., Urdaneta, O., Gervasio, G., Rubio, N., Maldonado, A., Aguilera, Y., Vilorio, A., Blanco, J. J., Colina, M., Hernandez, E., Araujo, E., Cabaniel, G., Benitez, J. and Rifakis, P. Intestinal parasitic infections among pregnant women in Venezuela. *Infect Dis Obstet Gynecol.* 2006; 23:125 15. Albonico M, Montresor A, Crompton DW, Savioli L: Intervention for the control of soil-transmitted helminthiasis in the community. *Adv Parasitol.* 2006, 61:311-48. 16. Belyhun Y, Medhin G, Amberbir A, Erko B, Hanlon C, Alem A, et al. Prevalence and risk factors for soil-transmitted helminth infection in mothers and their infants in Butajira, Ethiopia: a population based study. *BMC Public Health.* 2010;10:21. 17. Amhara region on Disaster Prevention and Preparedness Commission (DPPC). *Strengthening Emergency response Abilities/SERA Project*; 2000 18. Tadesse D, Tsehaye A. Impact of irrigation on the prevalence of intestinal parasite infections with emphasis on schistosomiasis in Hintalo -Wejerat, north Ethiopia. *Ethiop J Health Dev.* 2008; 18(2). 19. Moges Lewetegn. Prevalence of Intestinal Parasites among Preschool Children and Maternal Knowledge, Attitude and Practice on Prevention and Control of Intestinal Parasites in Senbete and Bete Towns, North Shoa, Ethiopia. Addis Ababa University Research catalog, 2015. 20. Aschalew Gelaw, Belay Anagaw, Bethe Nigussie, Betrearon Silesh, Atnad Yirga, Meseret Alem, Mengistu Endris and

Baye Gelaw. Prevalence of intestinal parasitic infections and risk factors among schoolchildren at the University of Gondar Community School, Northwest Ethiopia: a cross-sectional study *BMC Public Health*, 2013, 13:304 <http://www.biomedcentral.com/1471-2458/13/304> 21. Liza A. Nyantekyi, Mengistu Legesse, Mulugeta Belay, Konjit Tadesse, Kebreten Manaye, Chanda Macias, Berhanu Erko. Intestinal parasitic infections among under-five children and maternal awareness about the infections in Shesha-Kekele, Wondo Genet, Southern Ethiopia, *Ethiopian Journal of Health Development*. July 2011 22. Erko B, Medhin G. Human helminthiasis in Wondo Genet, Southern Ethiopia, with emphasis on geo-helminthiasis. *Ethiop Med J*. 2003; 41:333-44. 23. Tamirat Hailegebriel. Prevalence of intestinal parasitic infections and risk factors among students at Dona Berber primary school, Bahir Dar, Ethiopia, *BMC infectious diseases*, 2017, 17:362. DOI 10.1186/s12879-017-2466 24. Mulat Alamir, Worku Awoke, Amsalu Feleke, Intestinal parasites infection and risk factors among school children in Dagi primary school, Amhara National Regional State, Ethiopia, *Health*, Vol.5, No.10, 1697-1701 (2013) <http://dx.doi.org/10.4236/health.2013.510228>) 25. Mulusew Andualem Asemahagn, Parasitic Infection and Risk Factors among the Primary School Children in Motta Town, Western Amhara, Ethiopia. *American Journal of Public Health Research*, 2014, Vol. 2, No. 6, 248-254 Available online at <http://pubs.sciepub.com/ajphr/2/6/6> 26. WHO, Helminth control in school-age children. Geneva: World Health Organization; 2011 27. World Bank Health-Nutrition-Population, www.worldbank.org/hnp, March 2003 28. Chien-Wei Liao, Kuan-Chih Chiu, Chen Chiang, Po-Ching Cheng, Ting-Wu Chuang, Juo-Han Kuo, Yun-Hung Tu, and Chia-Kwung Fan. Prevalence and Risk Factors for Intestinal Parasitic Infection in Schoolchildren in Battambang, Cambodia, *The American Society of Tropical Medicine and Hygiene*, 2017, doi:10.4269/ajtmh.16-0681 29. Séverine Erismann, Serge Diagbouga, Peter Odermatt, Astrid M. Knoblauch, Jana Gerold, Akina Shrestha, Tarnagda Grissoum, Aminata Kaboré, Christian Schindler, Jürg Utzinger and Guéladio Cissé, Prevalence of intestinal parasitic infections and risk risk factors among schoolchildren in the Plateau Central and Centre-Ouest regions of Burkina Faso. *Parasites and Vectors*, 2016: DOI 10.1186/s13071-016-1835-4

Figures

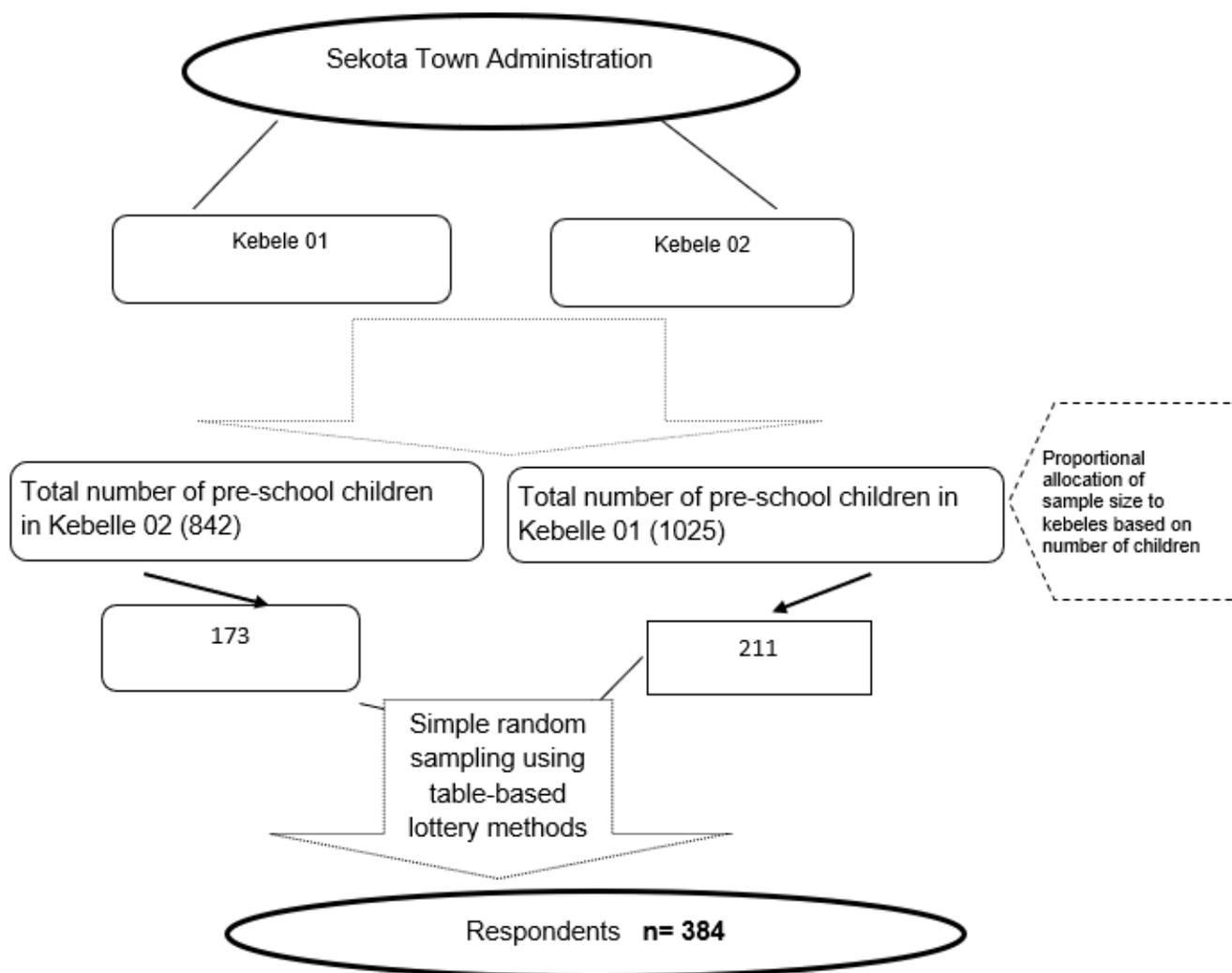


Figure 1: Schematic diagram of sampling procedure for the study on prevalence of intestinal parasites on preschool children, mothers' knowledge on its prevention in Sekota town, Wag Himra Zone, Northern Ethiopia.

Figure 1

Schematic diagram of sampling procedure for the study on prevalence of intestinal parasites on preschool children, mothers' knowledge on its prevention in Sekota town, Wag Himra Zone, Northern Ethiopia.

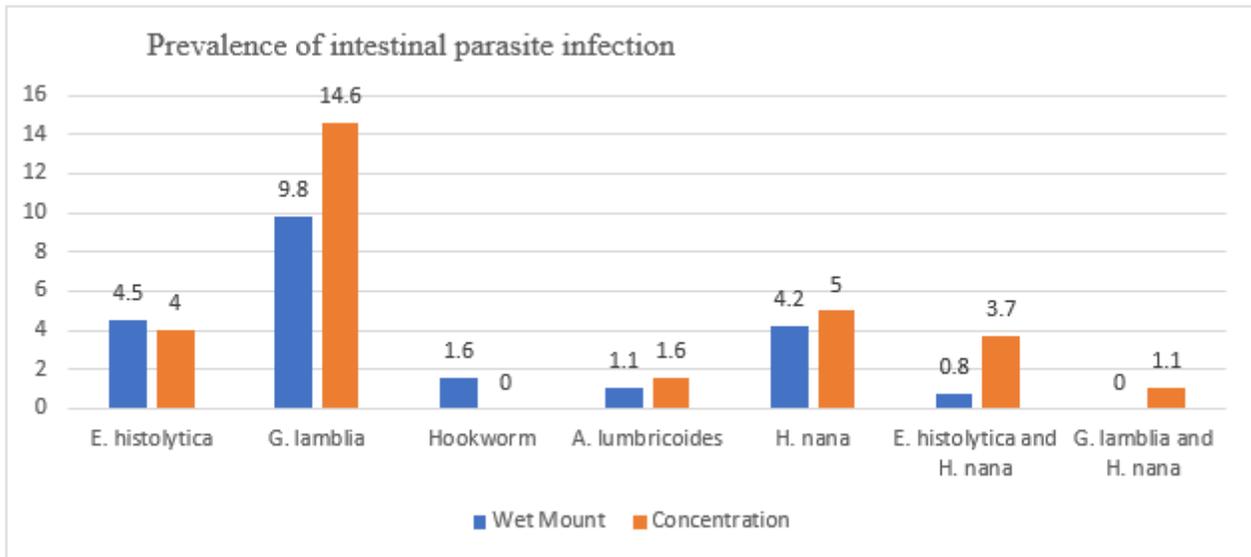


Figure 2

The prevalence of each intestinal parasite infection on wet mount and formal ether concentration techniques in Sekota town, in 2019

Supplementary Files

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