Prevalence, Distribution, and Pattern of Pathogenic Intestinal Parasites in Faecal Effluents Obtained from Abattoirs in Ogbomoso, Nigeria

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Abstract

Background: This study was undertaken to isolate and identify intestinal parasites in fecal effluents from abattoir. Intestinal parasitic infections are amongst the most common infections affecting approximately 3.5 billion people causing over 450 million ill health problems annually. The three major soil-transmitted helminths of global health concern are; *Ascaris lumbricoides*, *Trichuris trichiura* and *Hookworm*. They cause over one billion infections and two billions are at risk of infection.
Methodology: A total of 162 samples were examined out of which 70 faecal samples were collected from cow, 35 from pig, 35 from goat and 22 from sheep. These samples were processed using standard parasitological techniques (including macroscopy, microscopy; the Formol-ether concentration technique and zinc sulphate floatation technique).
Results: A total of 111 samples were found positive with one or more parasites giving an overall prevalence of 68.5%. The different parasites encountered include *Fasciolopsis buski* (8.6%), *Hookworm* (8.0%), *Ascaris suum* (7.4%), *Balantidium coli* (7.4%), *Fasciola hepatica* (7.4%), *Entamoeba histolytica* (7.4%), *Taenia species* (6.2%), *Fasciola gigantica* (4.3%) and *Toxocara species* (1.2%). Mixed infections of *Balantidium coli+Entamoeba histolytica* has the highest frequency of 4(2.5%) followed by *Entamoeba histolytica+Hookworm* and *Toxocara species+Balantidium coli* with the frequency of 3(1.9%) each, *Ascaris suum+Taenia species, Ascaris suum+Taenia species+Hookworm* and *Balantidium coli+Fasciola hepatica* with a frequency of 2(1.2%) each and *Toxocara species+Balantidium coli* recorded the lowest frequency of 1(0.6%).
Conclusion: This study shows that there are high degrees of fecal contamination of intestinal parasites. As a result of this, sanitary measures and Government policy should be strictly employed as this will go a long way to help check environmental contamination and reduce potential risks posed by these pathogens.
Keywords: Intestinal parasites, Fecal effluents, Abattoirs, Ogbomoso.

Introduction

Parasites are organisms that obtain their food from other living creatures. A well-adapted parasite does not kill its host because it depends on the host for a steady supply of food over a long period of time. Usually, parasites are smaller than their host and this distinguishes them from predators such as tigers, which also eat other living things. Some parasites live in only one species of animal but many parasites, particularly the worms, spend part of their lives reproducing sexually in a final or definitive host and developing asexually as larvae during another part of their life in an intermediate host of a different species [1]. Intestinal parasitic infections are amongst the most common infections affecting approximately 3.5 billion people causing over 450 million ill health problems annually [2]. Arguably, helminthiases constitute the most common parasitic infections in humans and animals throughout the world [3]. They represent

important public health problems with great economic impact in tropical and subtropical countries [1,4]. Prevalence and intensity of infection and the dynamics of transmission may vary according to the availability of hosts and to local environmental conditions. Many species are zoonotic, highly prevalent and difficult to control [5,6]. They may be transmitted from animals to humans, from humans to humans, or from humans to animals. Several parasites have emerged as significant causes of foodborne and waterborne illness [7]. Rates of transmission and exposure are dependent upon human behaviour, occupation, social practices and cultural beliefs together with poor hygiene, unsanitary animal husbandry and economic activities.

Infections in domestic ruminants are of special concern because of the potential contamination of surface and ground-waters through abattoir effluents, pasture runoff and use of manure as a spray on field. Outbreaks from water-borne Giardiasis in humans have been attributed to pasture run off leading to drinking water contamination [8]. Disease outbreaks have most often been attributed to the waterborne method of transmission. It is believed that human effluent is the major source of water contamination, but certainly contamination of water with infected animal faeces as is the case with abattoir effluents can lead to widespread infections in human and animals [1]. Abattoirs are facilities where livestock are slaughtered and are an important aspect in the food production chain [9]. There are several types of abattoirs, which differ in infrastructure and facilities, sanitation and Personal protective equipment (PPE) practices, and adherence to regulations. In each abattoir facility, worker exposure to animals and animal products increases their risk of infection from zoonotic pathogens. Backyard abattoirs and slaughter slabs have the highest risk of pathogen transmission because of substandard hygiene practices and minimal infrastructure [10,11]. These abattoir conditions can often contribute to environmental contamination and may play a significant role in disease outbreaks within communities [12].

The identification of pathogenic intestinal parasites in faecal effluents obtained from abattoirs is essential to understanding the role of abattoir environments in the spread of parasitic infections and it is crucial for food safety and public health [13]. With paucity of empirical information on the

burdens and associated predisposing internal (biological) and external (climatic and environmental) factors for parasitic diseases, such data are needed to serve as convenient and inexpensive source of information for the development of parasitic infections control programs in Africa [14]. Hence, this study aims to systematically identify and characterize the pathogenic intestinal parasites present in faecal effluents from abattoirs, using standard parasitological techniques (including macroscopy, microscopy; the Formol-ether concentration technique and zinc sulphate floatation technique). Also to determine the prevalence and types of parasites present. The research then intends to provide vital information for improving public health safety, implementing effective control measures, and developing strategies for better waste management in abattoir settings.

Methodology

Study area: The study was carried out at the Abattoir in Ogbomoso, Oyo State Nigeria.

Sample Size Determination: The total sample size from the study area was determined by using Handerson and Sundaresan standard formula: $N=Z^2PQ/D^2$. Where N is the number of samples that were collected; Z is the normal deviate (1.96 for an alpha of 0.05) corresponding to a confidence interval of 95%; P is the number infected from the previous one within the state; Q=1-P. D^2 is the precision of the estimates. The value of D was set at 5%. According to Adena and colleagues (2016).

$N=Z^2pq/d^2 = 1.96^2 \times 0.12 \times (1- 0.12)/ 0.05^2 = 162.$

Sample Collection: About 10g of the sample was immediately transferred in to screw cap specimen bottles with the label sex and age of pig, sheep, goats and cattle and was transferred to the laboratory for analysis and examination. A total number of 162 fecal samples were collected randomly from four different species of animal slaughtered in Abattoir, 70 fecal samples of cow, 35 fecal samples of pig, 35 fecal samples of goat and 22 fecal samples of sheep were collected. All samples were collected into clean transparent, wide mouth screw capped universal bottle for laboratory processing. All samples were properly labelled.

Ethical Clearance: No ethical clearance was sought because subjects for the studies are non-human. And for the questionnaire, the purpose of the study was first explained to the participants, and those who agreed to participate were interviewed.

The confidentiality of each respondent's answers was guaranteed.

Laboratory Analysis

Parasitological Analysis of Faecal Samples: Each of the stool samples was examined microscopically using saline preparation and Lugol's iodine preparation as described by Cheesbrough, Formol-ether concentration technique, and zinc sulphate floatation technique [15].

Examination Of Saline Wet Preparation: A drop of saline was placed on the center of clean grease free slide. With an applicator stick, small portion of the stool sample was picked (equivalent to the size of a match head) and was mixed with the drop of saline. The smear was covered with a coverslip. The preparation was examined using x10 and x40 objectives lenses of the microscope with the iris diaphragm closed and condenser lowered.

Iodine Preparation: A drop of iodine was placed on a clean grease free slide. With an applicator stick, small portion of the stool sample was picked (equivalent to a match head) and was mixed with the drop of iodine. The smear was covered with a coverslip. The preparation was examined using x10 and x40 objectives lenses of the microscope, with the iris diaphragm closed and condenser covered.

Formol-Ether Concentration Technique: About 1g of faeces with 10ml of fixative was mixed and left for at least 30 minutes. The suspension was strained into a 15ml conical tube through a sieve or double layer of gauze allocated into a small funnel and centrifuged at 3000g for 5 minutes. The supernatant was removed, and the sediment was broken with a wooden toothpick. 7ml of saline was added to the sediment; the tube was sealed with a stopper and mixed. 3ml of Diethyl ether was added; the tube was sealed with a rubber stopper and shaken vigorously for 30 seconds. The stopper was carefully removed after waiting for 30 minutes. The preparation was then centrifuged at 3000g for 3minutes. Plug of debris was detached from the tube with the help of an applicator 38 stick and the top three layers were poured off by inverting the tube with a brisk movement. The sediment was then mixed with the remaining liquid. A drop of the sediment was placed on the slide and covered with a coverslip. It was then examined using a microscope.

Zinc Sulphate Floatation Technique: This was demonstrated by Cheesbrough (2006). About 3g of

faecal material was emulsified in 30ml of distilled water in a beaker and was filtered through sieves with mesh of 30, 60, and 90mm. The strained material was immediately transferred into centrifuge tubes and centrifuged at 3000 revolutions per minute (RPM) for 5 minutes. The clear supernatant in each tube was discarded and solution (zinc sulphate) of specific gravity (S. G 1.2) was added to the sediment in each centrifuge tube until a convex meniscus was formed. Each tube was covered with a glass cover slip and allowed to stand for 10 minutes. Each cover slip was then gently lifted from each tube and a drop will be placed on a clean grease-free glass slide and was examined under x 10 and x 40 objectives of microscope for the presence of eggs of helminthes parasite.

Statistical Analysis: The relative number of different species of intestinal parasites was calculated and stratified by species and sex compared using Chi-square test. In all analyses, P value of **($p < 0.05$)** was set as the level of significance. The analysis was performed using *Statistical package for social sciences (SPSS)* software for Windows *version 28.0*

Results

A total of 162 abattoir effluent samples of cow, pig, goat and sheep were collected and examined for intestinal parasites, out of which 111 samples were positive for one or more of intestinal parasites giving an overall prevalence of 68.5%. Out of the 68.5%, 58% were single infections and 10.5% were mixed infections. Pigs recorded the highest prevalence of 77.1%, followed by goat and cow with prevalence of 68.6% and 65.7% respectively and the least prevalence was observed in sheep, 63.6%.

Figure 1 shows overall prevalence of intestinal parasites in faecal samples of animals used in this study. 46(65.7%) were positive for cow, 27(77.1%) were positive for pig, 24(68.6%) were positive for goat and 14(63.6%) were positive for sheep. Figure 2 is a pie chart that shows the shows the gender distribution with 54% (females).

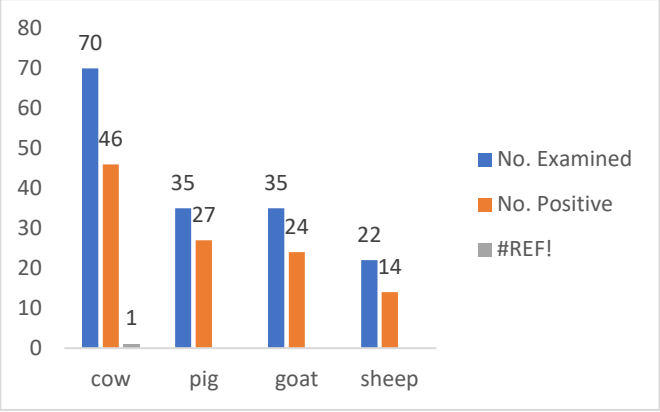

Figure 1: Number of samples examined by sex.

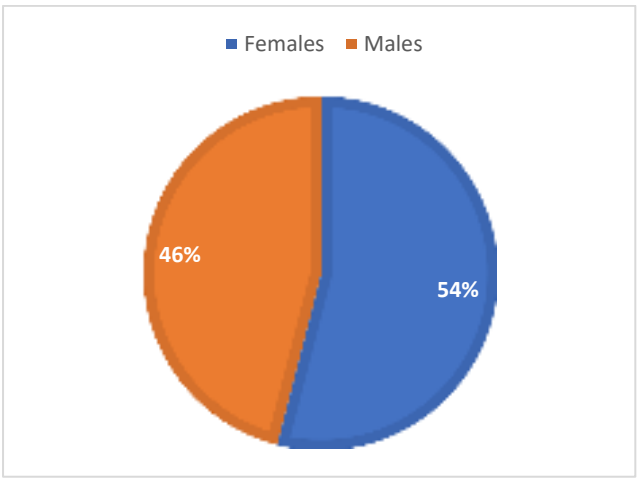

Figure 2: Overall prevalence of intestinal parasites

Figure 3 shows the frequency distribution of number of parasites seen in 162 fecal samples of which (19.1%) has only one parasite, (22.8%) has two parasites per sample, (21.6%) has three parasites per sample, (3.1%) has four parasites per sample, (1.9%) has five parasites per sample and (31.5%) was negative for any intestinal parasites.

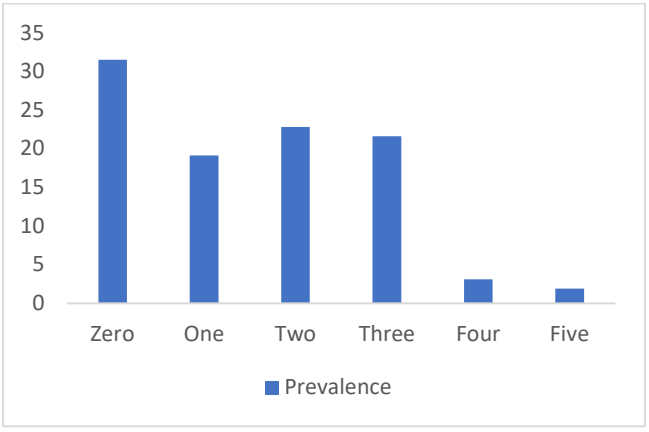

Figure 3: Distribution of number of parasites isolated per sample

Table 1 shows the frequency distribution of single parasite isolated from the studies. *Fasciolopsis buski* has the highest frequency of 14(8.6%), followed by *Hookworm* with frequency of 13(8.0%), *Ascaris suum, Balantidium coli, Fasciola hepatica* and *Entamoeba histolytica* with frequency of 12(7.4%) each, *Taenia species* with the frequency of 10(6.2%), *Fasciola gigantica* with the frequency of 7(4.3%) and *Toxocara species* with the frequency of 2(1.2%).

Table 1: Distribution of Single Intestinal Parasite Infection (n=162)

Parasite isolates	**Frequency**	**Percent**
Ascaris suum	12	7.4
Balantidium coli	12	7.4
Fasciola gigantica	7	4.3
Fasciola hepatica	12	7.4
Fasciolopsis buski	14	8.6
Hookworm	13	8.0
Entamoeba histolytica	12	7.4
Taenia species	10	6.2
Toxocara species	2	1.2
No parasite islotaed	68	42.0

Table 2 shows the frequency distribution of mixed infections with intestinal parasites. *Balantidium coli+Entamoeba histolytica* has the highest frequency with prevalence of 4(2.5%) followed by *Entamoeba histolytica+Hookworm* and *Toxocara species+Balantidium coli* with the frequency of 3(1.9%) each, *Ascaris suum+Taenia species, Ascaris suum+Taenia species+Hookworm* and *Balantidium coli+Fasciola hepatica* with a frequency of 2(1.2%) each and *Toxocara species+Balantidium coli* recorded the lowest frequency of 1(0.6%) in all the mixed infections.

Table 3 indicates that *Entamoeba histolytica* shows the highest prevalence of 100% in cow, mixed isolation of *Fasciolopsis buski+Taenia species* also recorded a prevalence of 100% in pig, mixed isolation of *Balantidium coli+Entamoeba histolytica* recorded a prevalence of 75.0% in goat while mixed isolation of *Entamoeba histolytica+Hookworm* recorded a prevalence of 66.7% in sheep.

Discussion

The gastrointestinal (GI) parasitism is one of the major health problems affecting the productivity of cow, pig, goat and sheep worldwide [16,17]. The presence of GI parasites in these animals depends greatly on predisposing environmental factors such as temperature and humidity[18,19]. This has been observed in some parasites of the *Strongylida* order, which prevail in cold climates or tropical conditions [20]. The study revealed the prevalence of intestinal parasites in animals slaughtered at Ogbomoso Abattoir Oyo state, Nigeria. Intestinal parasites exert negative effects on the health, reproduction, and performance of affected animals and this can be of major constraints to livestock productivity. This present study revealed an overall prevalence of intestinal parasites in the fecal samples to be 68.5%, with prevalence of 77.1%, 68.6%, 65.7%, and 63.6% in pig, goat, cow, and sheep respectively. This study is relatively higher than the prevalence of intestinal parasites recorded by Daminabo and colleagues [1] in Jos abattoir and it is extremely higher compared with 3.7% parasitic liver infection in Ruminants reported in a study [19]. This disparity in the prevalence is attributable to the fact that studies was carried out on liver of infected Ruminants [21] .

Seventy effluent samples from cows were examined, 46 (65.7%) were positive. This relatively high prevalence could be attributed to seasonal variation which has a direct impact on the

Table 2: Prevalence of Mixed Intestinal Parasite Infections (n=162)

Parasite isolates	Frequency	Percent
Entamoeba histolytica + Hookworm	3	1.9
Ascaris suum + Taenia species	2	1.2
Ascaris suum + Taenia species + Hookworm	2	1.2
Balantidium coli + Fasciola hepatica	2	1.2
Balantidium coli + Entamoeba histolytica	4	2.5
Toxocara species + Balantidium coli	1	0.6
Fasciolopsis buski + Taenia species	3	1.9
No parasite	145	89.5

Table 3: Pattern of Individual Intestinal Parasites in Relation to Animal Species

	Cow		Pig		Goat		Sheep	
Parasites isolated	**(n)**	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**
Ascaris suum	4	33.3	3	25.0	3	25.0	2	16.7
Balantidium coli	3	25.0	6	50.0	3	25.0	0	0.0
Fasciola gigantica	7	100.0	0	0.0	0	0.0	0	0.0
Fasciola hepatica	8	66.7	0	0.0	4	33.3	0	0.0
Fasciolopsis buski	5	35.7	1	7.1	4	28.6	4	28.6
Hookworm	3	23.1	3	23.1	3	23.1	4	30.8
Entamoeba histolytica	4	33.3	3	25.0	3	25.0	2	16.7
Taenia species	4	40.0	6	60.0	0	0.0	0	0.0
Toxocara species	2	100.0	0	0.0	0	0.0	0	0.0
E. histolytica + Hookworm	1	33.3	0	0.0	0	0.0	2	66.7
A. suum + Taenia species	1	50.0	1	50.0	0	0.0	0	0.0
B. coli + F. hepatica	1	50.0	0	0.0	1	50.0	0	0.0
B. coli + E. histolytica	0	0.0	1	25.0	3	75.0	0	0.0
Toxocara species + B. coli	1	100.0	0	0.0	0	0.0	0	0.0
F. buski + Taenia species	0	0.0	3	100.0	0	0.0	0	0.0
Ascaris +Taenia + Hookworm	2	100.0	0	0.0	0	0.0	0	0.0

qualitative and quantitative assessment of intestinal parasites in cattle as shown in a previous work of [22]. Higher prevalence of cattle parasites were reported in rainy seasons followed by winter, then summer. Temperature, humidity and rainfall are highly favourable factors for parasites. Age and Breed (Native or crossbreed) are also important factors that determine prevalence of parasites in cattle [23]. This study was carried out in winter and strictly on native cow. These explain the relatively high prevalence. Thirty-five effluents samples from pig were examined, 27(77.1%) were positive. This study recorded a high prevalence (50%) of *Balantidium coli* which agree with prevalence (60.7%) reported by [1] Daminabo and Damen, (2020) from Jos abattoir and a prevalence of 78% as reported in pig slurries of Alicante (Spain) analyzed by [24] Burton and colleagues. Burton study

was conducted with slurries from intensive farms. Olson and colleagues recorded the highest prevalence (47.2%) with Balantidium coli from pig farms without a strategic anti-parasite treatment regime [8].

In this study area, pigs are rarely raised in intensive farms. Hence infection by parasites could result from loose and uncontrolled foraging. Thus, pigs slaughtered at the abattoir could serve as source of zoonotic infections. Thirty-five effluent samples from Goat were examined, 24(68.6%) were positive. This prevalence was lower compared with 85.2% as recorded by [1] Daminabo and Damen (2020). The high prevalence recorded could be due to water logging found in and around the pasture lands during which enhance the availability of intermediate hosts, while the low prevalence in this study could be associated with the climatic conditions of Ogbomoso during which the study was conducted. It was winter and dry and therefore affecting (reducing) the chances of contact between host and parasites [25]. Twenty-two effluent samples from Sheep were examined 14(63.6%) were positive, this findings corresponds with 58% recorded by Daminabo and Damen (2020) from Jos abattoir and 57.5% prevalence [1]. These findings might be associated to the fact that infection of sheep lead to impaired immunity and mixed grazing on loose range lands with other animals [18]. The prevalence recorded from this study could also be attributed to mixed grazing as sheep rearing in most parts of the country is mostly carried out in an outdoor manner.

Conclusion and Recommendations

The prevalence of parasites in this work is on the high side. Generally, poor disease control practices, low level of enlightenment, climate, and lack of intensive farming are all predominating factors in the prevalence of intestinal parasites in slaughter animals brought to Ogbomoso Abattoir. Also, improper treatment of effluents from the slaughter house could predispose the neighbouring environment and its inhabitants to the risk of contamination and infection by these parasites. Zoonotic transmission of these diseases poses serious threats to man too. Furthermore, animals that graze on vegetation around the abattoir still pose a serious threat to health as the life cycle of some of the parasites (*Teania species*) are enhanced by the grazing action of these animals.

From this study, the following recommendations are hereby made. These include a thorough

renovation of the Abattoir with subsequent maintenance policies put in place will be very a welcome development, animals should be well inspected; treated of parasitic diseases (by deworming). It should be ensured that animals are in an apparently health state prior to slaughter, toilets facilities should be provided for staff and the public and well situated; and sanitary measures to be strictly employed as this will help to check environmental contamination. Finally, the importance of adopting appropriate abattoir wastewater treatment measures to prevent the chances of contaminating water bodies and ground water in Nigeria is therefore recommended. Determination of specific pathogenic microorganisms in abattoir wastewater and their health impacts is recommended.

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