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Research Article

Prevalence of Gastro-Intestinal Helminths in Slaughtered Cattle in Walungu Territory, South Kivu Province, Eastern Democratic Republic of Congo

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Abstract

An abattoir cross sectional survey was carried out to determine the prevalence of gastrointestinal parasitic helminths in slaughtered cattle at Kankinda and Mugogo Municipal abattoirs located in Walungu territory, South Kivu province, eastern Democratic Republic of Congo. Using qualitative and quantitative coprological examination, 200 fecal samples were tested. Gastrointestinal helminths' eggs were detected in only 148 samples tested giving an overall prevalence of 74%. The most diversity class was nematodes with four species, followed by trematode and cestode with two species in each, both representing species abundances of 44.4%, 22.2% and 22.2% respectively and only one protozoan species was identified (11.1%). However, the prevalence of helminths in relation to sex and age group revealed no statistical difference at *P* value >0.05. The exotic breed presented the highest infection rate of 72.5% (OR=4.6, 95% CI: 1.9–11.1; *p*=0.0004) compared to the local breed. Similarly high prevalence of helminthes was found in slaughtered cattle from local farms 90.6% (OR=4.1; 95% CI: 1.9–9.5; *p*=0.0001) compared to cattle imported from Rwanda. The prevalent helminthes species identified were *Eimeria bovis* (74%), followed by *Schistosoma bovis* (41%); *Hymenolepis diminuta* (39%); *Toxocara vitulorum* (32.5%) and the least species observed were *Fasciola gigantica* (18%); *Strongyloides papillosus* (11.5%); *Trichonstrongylus* sp (7%); *Haemonchus* spp (6.5%); and *Moniezia* spp (6%). These findings reflect a growing burden of gastrointestinal parasite infections at abattoir level. Therefore, a proper management, improved hygiene and regular deworming practices should be institutionalized for prevention and control of parasitic infections in livestock.

Keywords: Parasitic infection; Public health; Bovine; Prevalence; South Kivu

Abbreviations

DRC: The Democratic Republic of Congo; GDP**:** Gross Domestic Products; Km: Kilometer; Mm: Millimeter; Ml: Mililiter; RPM: Rotor per Minute; CDC: Centre for Disease Control; OR: Odds Ratio; P: Probability; CI: Confidence of Interval; CRSN: Centre de Recherche en Science Naturelle

Introduction

Livestock farming is among the major sectors representing a valuable asset in both traditional and modern agriculture in Sub-Saharan Africa, as well as in other tropical and sub-tropical regions of the world providing animal protein, milk, and beef during festivities around the world, flexible income for family units, employment, farm energy and manure [1]. The Democratic Republic of Congo (DRC) is one of the countries in Africa with huge livestock resources that play a crucial role in the livelihoods of the majority of Congolese and contributing 9.2% of the gross domestic products (GDP) while cattle production solely contributes to more than 50% of the total meat which is one the most important livestock products consumed in the country [2]. However, this sector is hampered by the presence of several diseases including helminthes infections causing not only high mortality frequently causing losses of animal, but also decrease of meat and milk production, this situation discourages investment in livestock industry [3].

Helminth parasites are potential health hazard to livestock and produce enormous economic losses; they decrease animal productivity through a reduction of feed intake and feed conversion efficiency, loss of blood and may cause death [4]. Clinical signs in the infected stock include gastroenteritis, anaemia and malabsorption sequel to gut damage by parasitic larvae and coccidial schizonts [5].

In tropical and sub-tropical regions where marginal levels of nutrition exacerbate the detrimental effects of infection, animal deaths due to nematode infections are very common [6]. The trematodes, cestodes and protozoans are also important parasites that affect ruminant livestock. Some of these are zoonotic and therefore a threat to public health [7]. Abattoirs are instruments for the insurance of wholesome meat and meat products as well as providing abattoir by-products for livestock base industries. More importantly, abattoirs are used for the purpose of surveillance against animal and zoonotic diseases. The importance of abattoir records in analysis of prevalence rate and planning strategy for the control of livestock diseases cannot be undermined [8]. Several studies have therefore been conducted

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Table 1: Prevalence of gastrointestinal helminthes obtained from slaughtered cattle in Walungu territory in relation to sex, breed, age group and origin of animals.

Variable	Category	Number Anim.	Positives n(%)	Negatives n(%)	OR	95%CI	*P*-value
Sex	Male	31	28(90.3)	3(9.7)	1	-	-
	female	169	135(79.8)	34(20.1)	2.3	0.6 – 8.1	0.085
Breed	Local	119	11(9.2)	9(20.2)	1	-	-
	Mixed	19	8(42.1)	11(57.9)	16.8	5.3 – 52.3	0.0001
	Exotic	62	45(72.5)	17(27.5)	4.6	1.9 –11.1	0.0004
Age group (month)	0–12	10	7(70.0)	3(30)	1	-	-
	12–24	112	99(88.3)	13(11.7)	0.3	0.07– 1.3	0.076
	>24	78	57(73.0)	21(27)	0.8	0.2– 3.6	0.41
Origin of Animal	Local farms	107	97(90.6)	10(9.4)	1	-	-
	Imported from Rwanda	93	65(69.8)	28(30.2)	4.1	1.9 – 9.5	0.0001

OR: Odds Ratio; CI: Confidence of Interval; Anim.: Animals; N: Number

on epidemiological control of gastrointestinal parasites, mostly in sheep and goats [4,9-11]. Not much, however, has been done with respect to gastrointestinal parasites in cattle. In addition, limited and incomplete information regarding prevalence of helminth parasites of cattle is available in Walungu territory in the eastern of DR Congo.

Therefore, the present study was undertaken in Kankinda and Mugogo municipal Abattoirs to determine the prevalence of various gastrointestinal helminth parasitic infections in slaughtered cattle. The findings generated from this study will help to strategize the best possible ways in curtailing the worm burden on cattle as well as to keep these records for future studies and research.

Materials and Methods

Study design and study sites

An abattoir survey was conducted based on cross sectional study during routine meat inspection and on randomly selected cattle slaughtered at Kankinda and Mugogo Municipal abattoir of Walungu territory from February to June 2016. Walungu is a large region with a surface area of 1800Km^2, and a population of about 716671 habitants that is located between latitude 2°38' South and longitude 28°40' East with major activities being livestock and crop production.

Because of their location and the large number of animals sold and slaughtered in these abattoirs, they serve as a major source of meat consumed in this region. Cattle slaughtered in these abattoirs are mostly sourced from different cattle rearing regions of South Kivu province and some from East Africa neighboring countries including Rwanda and, Burundi and Uganda. Hence these abattoirs may serve as a good source of sentinel survey for disease including helminthic infections coming from different areas of South Kivu province and beyond. The territory experience two main seasons namely a rainy of 9 months starting on September up to May; the second is a dry season for 3 months (June, July and August). The annual average rainfall range is around 1300mm.

Sample collection and preservation

At abattoir market day's visits were done in every Tuesday and Saturday at the Kankinda and Mugogo markets respectively, in Walungu territory during a period of six months (January- June 2016), as early as 8:00am when the animals are taken to the abattoir. The animals were identified and labeled as male or female. Systematic random sampling method was used in selecting cattle that were present at the abattoirs and bought to be slaughtered.

Faecal samples were collected by rectal palpation before slaughtering the animal , using a glycerine lubricated latex glove from 200 cattle of different age into well-labeled sterile polythene bags and transported in ice-cooled containers and kept in the refrigerator until processing in the Parasitology laboratory, Department of Animal Science at the Faculty of Agricultural and Environmental studies Université Evangélique en Afrique within 24 hours of their collection where they were examined for helminth egg. Formalin (10%) was added into the samples to avoid hatching of the eggs; for each animal tested, parameters such as the sex, breed, animal geographical origin and age group scores were recorded.

Laboratory identification of gastrointestinal helminthic parasites in faecal samples

Each faecal sample was tested for helminth parasites by formol ether technique [12,13]. In addition, eggs were identified on the basis of their morphological features using the protocol as described previously [14]. A sedimentation technique was also used to detect trematode eggs in the samples.

Briefly, in a tested tube, 4ml of 10% formol saline was emulsified after mixing with 1g of stool sample; a cloth gauge was used for filtering the mixture into a new test tube. Diethyl ether (3–4 ml) was added and shaken vigorously and allowed to stand for two minutes. The mixture was then centrifuged at 1000 revolutions per minutes (1000rpm) for 3 minutes. Faecal debris from the side of the tube was loosened using a glass rod and the tube inverted to pour off the supernatants. The tube was returned to its original upright position and the fluid from the side of the tube allowed draining to the bottom. To allow the fluid from the side draining to the bottom, the tube was then returned to its origin upright position.

Thereafter, the tube was tapped with finger as well as Pasteur pipette to mix the deposit. A drop of sediment was taken and applied on a microscope slide where it was covered with a cover slip; ×10 and ×40 objectives were then used for examination under the microscope [12,13]; Lugol's Iodine was also used as a stain. Identification of parasites was done using standard keys [14]. Investigation and identification of *Fasciola* was done according to their distinct morphological characteristics following the standard guidelines [5].

Table 2: Diversity of gastrointestinal helminthes from cattle slaughtered in Kankinda and Mugogo Municipal abattoir in Walungu territory East DR Congo.

Parasite class	Species	Number animal tested	Number positives	Prevalence (%)
Nematode	*Trichonstrongylus* sp	200	14	7
	Strongyloides papillosus	200	23	11.5
	Haemonchus spp.	200	13	6.5
	Toxocara vitulorum	200	65	32.5
Trematodes	*Schistosoma bovis*	200	82	41
	Fasciola gigantica	200	36	18
Cestodes	*Moniezia* spp	200	12	6
	Hymenolepis diminuta	200	78	39
Protozoa	*Eimeria bovis*	200	148	74

Table 3: Helminth distribution and abundance in slaughtered cattle.

Helminth classes	Abattoirs		OR	95% CI	*P* value
	Kankinda (n=100)	Mugogo (n=100)			
Nematodes	67	48	2.21	1.22-3.81	0.003
Trematodes	63	55	1.39	0.79-2.45	0.127
Cestodes	45	45	1	0.57-1.74	0.556
Protozoa	75	73	1.12	0.58-2.08	0.375
Average (%)	**62.5**	**55.25**	**1.33**	**0.75–2.34**	**0.16**

OR: Odds Ratio; CI: Confidence of Interval; N: Number

Data analysis

The prevalence of each species of gastrointestinal parasite was computed as:

P=n/d

where: p is the prevalence, d is the number of individuals having the gastrointestinal helminth at a particular point in time; and n the number of individuals in the population at risk at that point [15]. Data obtained were subjected to descriptive statistical analysis using percentages in determining the prevalence rates in the different breeds, sex, and body condition score groups. Prevalence of helminthosis in relation to sex, breed, and body condition score was analyzed using Chi-square statistical test using Epi Info. 7 Centre for Disease Control (CDC) software. The results were considered significant at P value <0.05.

Results

Coprological examination

From the total of 200 cattle examined, gastrointestinal helminth eggs were detected in 148 giving an overall prevalence of 74%. The prevalence of helminthes in relation to sex revealed no statistical difference (p value=0.085) by the fact that 90, 3%. (28/31) of the male and 79.8% (135/169) of the female were infected respectively (Table 1). However, there was a significant difference of the prevalence of helminthes according to the breed where by the exotic breed presented the highest infection rate of 72.5% (OR=4.6, 95% CI: 1.9–11.1; p=0.0004) followed by mixed breed 42.1% (OR=16.8; 95% CI: 5.3–52.3; p=0.0001) when compared to the local breed (Table 1). Similarly the helminths infection varied significantly in relation to the origin of the animal with high prevalence found in cattle from local farms 90.6% (OR=4.1; 95% CI: 1.9–9.5; p=0.0001) compared to cattle imported from neighboring country (Rwanda). However, no significant difference was observed according to the age group (p=0.07) but a higher percentage of gastrointestinal helminth infection of 88.3% was however observed in cattle belonging to age group between 5 to 10 years and this age group of cattle showed higher likelihood of being infected with gastrointestinal helminth when compared to those that are in age group between 0 to 5 years (OR=0.3; 95% CI:0.07-1.3) (Table 1).

Diversity and species composition of gastrointestinal helminth in cattle slaughtered at Kankinda and Mugogo municipal abattoirs

After foecal sample examination, a total of 9 gastrointestinal helminthes species belonging to 4 genera namely nematode, cestode, protozoa and trematodes were identified. Among them, 4 species of nematodes, 2 species of trematodes, 2 species of cestodes and one species of protozoan (Table 2). The class of nematode represented the most diversity class 44.4% (4/9), followed by trematode and cestode (22.2%) each containing each 2 species each out of the nine identified and the lowest class was Protozoa (11.1%) with only one species identified (Table 2).

The most dominant helminths in the two abattoirs study belong to the class of Protozoan. A x^2 test showed that there was a significant difference in the abundance of various helminth classes. In addition a significant difference was observed in the distribution of helminthes classes where nematodes helminthes were more identified in cattle slaughtered at Kankinda compare to cattle in Mugogo abattoirs (OR = 2.21, 95% CI: 1.21–3.81; p=0.003) (Table 3).

However, no statistical difference was detected in the prevalence of helminthes recorded from cattle at Kankinda and Mugogo municipal abattoirs (OR = 1.33, 95% CI: 0.75–2.34; p=0.160) (Table 3).

Among the 9 species collected, the most prevalent species was *Eimeria bovis* 74% (148/200), followed by *Schistosoma bovis* 41% (82/200); *Hymenolepis diminuta* 39% (78/200); *Toxocara vitulorum* 32.5% (65/200); *Fasciola gigantica* 18% (36/200); *Strongyloides papillosus* 11.5% (23/200); *Trichonstrongylus* sp 7% (14/200); *Haemonchus* spp 6.5% (13/200); and *Moniezia* spp giving the least species 6% (12/200) (Table 2).

Discussion

The result of the present study clearly indicates that cattle slaughtered from the Kankinda and Mugogo Municipal abattoirs of Walungu region (eastern of DR Congo) were infected with a wide variety of gastrointestinal parasites including nematodes, cestodes, trematodes and protozoa from the months of January to June. During this rainy season, the higher prevalence observed could be attributed to the high moisture content and lower temperature which favour the growth and development of larvae on pasture, inturns favours, contact between the host and parasites. Higher parasitic infection during rainy season was reported in some studies [16,17].

The overall prevalence of gastrointestinal helminth infection was 74% in the cattle examined, thus providing valuable information on the burden of helminths among cattle in Walungu district since animals slaughtered in these abattoirs are representative of cattle in the whole district. This finding was almost in conformity with other stude [18,19] that found respectively 79.9% and 83.7% of helminthes infestation in cattle. There is high probability to find high worm burden in cattle on overgrazed communal pastures, leading to severe disease and death [20]. This situation may explain the reason of getting big number of infested cattle as more that 80% of farmers in the study district are small-scale famers who utilize subsistence farming practices and fed their animal by using communal grazing that is also cited as major cause for the poor veld condition as well as poor livestock production. However, the overall prevalence of helminth obtained from this study was higher than the prevalence obtained by in South-western Nigeria [21] and in South-eastern Nigeria [22] where a seroprevalence of 41.6% and 50.8% respectively were obtained. These differences could be due to the periods or seasons in which the studies were conducted, the management system, topography climatic condition that favors the survival of infective stage of the parasite and intermediate hosts as well as the sources of cattle sampled in the various regions.

Among the different age groups, there was no significant difference found in the overall prevalence of parasites, despite the fact that calves (0-1 year old) were given prophylaxes (dewormed monthly). There was a decrease in infection rate (prevalence) as age increased. This may be due to the result of acquired immunity with age which is manifested by humoral immune response through frequent challenges and expel the ingested parasite before they establish infection [23,24]. The variation in prevalence among the age groups in the present results were similar to some other findings [25,26].

Thus, no association was recorded between sex and parasitic prevalence ($p<0.05$). The absence of sex related deference agreed with the previous findings [27-30].

However, this finding is indeed in contrast to the finding obtained in Bukavu city (DRC) reporting that male are highly infested than female [31]; other reports showed female animals showed higher parasitic infection than males despite similar management practice due to the fact that female animals are more susceptible than male and hence sex is determinant factor in influencing prevalence of parasites [32,33]. In addition, a study has done indicating that the male cattle were more likely to be infected with helminth than the female [34]. This was justified by approving that male animals are more aggressive when feeding and thus likely to pick up more ova of helminths on the pasture.

The result of the current study showed significantly higher prevalence of gastrointestinal parasite ($p<0.05$) in exotic breed (72.5%) as well as in mixed breed (42.1%) compare to the local breed (9.2%). This finding is in agreement with study conducted in Bukavu city [31]. However they are in contrast with studies that showed higher helminth infection in local breed than in cross and exotic breeds [30,35]. This may be explained by different factors like, the type of management system used in the area where most of cattle breeds in the study region are kept under extensive management system mean free grazing system which allow a favorable parasite cyclicity in the farm [36]. Furthermore, lack of use of the anthelmintic drugs by resource-poor small stock farmers. Or the anthelmintic drugs used against internal parasites are not probably effective. However, currently there is still controversy among different authors on the issue of breed susceptibility to internal parasites.

The result of present study showed that origin of animal has significant effect on the prevalence of parasite helminth; being higher in animals coming from Rwanda than in animal from local farms ($p<0.05$); this difference may have resulted from difference in management system used in the region, topography, deworming practices [37] as well as the existence of favorable environmental factors necessary for the prolonged survival and development of infective larval stage of most helminthes [38]. According to this study, the no difference the prevalence of gastrointestinal parasite across abattoir sites may be due to similarity in management system and limit knowledge of the farmers about parasitic diseases. Almost all farmers in the region where both abattoirs are located implement extensive management system and farmers have limit access to anti-helmentic drugs.

Furthermore, our investigation revealed that nematode types were the most diverse helminthes identified; these results are in contrast with previous studies conducted in India, Ethiopia, and eastern Nigeria [39-41] showing that trematodes as the most prevalent helminthes. This dissimilarity could however be attributed to the differences either in geographical or climatic conditions and ecology since the presence of trematode infections is known to dependent on availability of the intermediate hosts.

The most abundant parasite species were *Eimeria bovis, Schistosoma bovis, Hymenolepis diminuta and toxocara vitulorum* belonging to classes such as protozoan, trematodes, cestodes and nematodes respectively. *Eimeria bovis* was the most prevalent parasite, this is probably related to its high fecundity, which means that it is likely that the larvae are ingested in higher numbers than those of other genera but also under favourable conditions moistrure, temperature of 5°C to 8°C they maintain infectivity for several months and may even survive the winter season [42], whereas the

least prevalent parasites identified in this study was *Moniezia* spp (6%) which is in agreement with the report obtained in small holder dairy farms [33,39]. Also *F. gigantica* occurred least probably because the intermediate host might be scarce.

Among the nematodes, *Toxocara vitulorum* was the predominant species. These results are different with studies carried out in Ghana [43] and in South Africa [44] reporting Strongyles and Haemonchus as the most abundant nematodes in cattle. In addition, the prevalence found in this study is higher than the one reported Adedipe in Nigeria [21].

Conclusion

These findings testify that the majority of cattle brought for slaughter in Kankinda and Mugogo abattoirs were highly infested with several internal helminthes parasites that are known to adapt easily even to harsh conditions. Most of these infected cattle are slaughtered to produce meat that is consumed by human population. These may present a public health problem and an important epidemiological implication since they can serve as source of infection for calves. Therefore, an effective chemotherapy, an appropriate meat inspection, regular control measure are needed as well as famers education in the proper use of antihelminthes to prevent infestation of human and to enhance food sufficiency not only in quantity but also in quality.

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