Moroccan Journal of Agricultural Sciences
Vol 5 No 1 (2024): (March 2024), 45-50
Animal Production and Health

Diversity, prevalence and intensity of gastro-intestinal helminths parasitizing goats in abattoir of the Central Market of Douala

Jacques NACK — Department of Aquaculture, Institute of Fisheries and Aquatic Sciences, University of Douala, Cameroon
Carine Christelle YONKOU — Department of Animal Biology, Faculty of Science, University of Douala, Cameroon
Georges FONKWA — Department of Aquaculture, Institute of Fisheries and Aquatic Sciences, University of Douala, Cameroon

Gastrointestinal parasites are among the major threats to livestock health and production. The objective of this study was to determine the diversity, the prevalence and mean intensity of gastrointestinal helminths and associated risk factors in goats in abattoir of Douala-Cameroon central market. The digestive tracts of 73 randomly selected goats were examined for helminth parasites using the standard parasitological procedure. A total of 11 species belonging to the class Nematoda (7 species), Trematoda (Paramphistomum spp) and Cestoda (3 species) were identified. The overall prevalence (93.2%) and mean intensity (26.2) was high and low respectively. The overall prevalence was significantly ($p = 0.047$) higher (97.8%) in females compared to males (85.7%) and not affected by the goat age ($p = 0.603$). The goat age and sex had no significant ($p > 0.05$) influence on the mean intensities of parasite species. Multiple infestations (78.1%) were more frequent ($p < 0.001$) than single infestations (21.9%). Moreover, helminths showed organ specificity. The infested population of goats should be targeted and treated.

Keywords: Helminths, digestive tract, goats, abattoir, Cameroon

INTRODUCTION

Food animal production has become a strategic subsector for diversification of income and the fight against malnutrition and unemployment in urban and rural areas of Cameroon (Awah-Ndukum et al., 2010). Goats are among livestock that contribute to the coverage of the protein requirements of populations. They are reared under an extensive system, with little or no sanitary care. This often leads to mortality in herds and consequently production losses. In Sub-Saharan Africa, gastrointestinal parasites are responsible for the health threat and negatively affect livestock production through its associated morbidity, mortality, treatment and control costs (Ng'ang'a et al., 2004; Nwosu et al., 2007; Odoi, 2007; Kanyari et al., 2009). Moreover, most of these parasitic infections are zoonotic and thus could pose a hazard to public health.

In the absence of appropriate measures to regulate worm populations, severe clinical signs such as digestive disorders or anemia may develop, especially in the presence of the haematophagous species like Haemonchus contortus (Hoste et al., 2012). Data on the diversity and occurrence of gastrointestinal parasites of goats in Cameroon are scarce. A better knowledge and management of these parasites is a prerequisite to increase the productivity of cattle. The purpose of this study was to determine the diversity, the prevalence and mean intensity of gastrointestinal helminths and associated risk factors in trade goats in abattoir of the Central Market of Douala –Cameroon.

MATERIALS AND METHODS

Study area and population structure of goats

The study was conducted at the Zootechnical and Veterinary Center of New-Bell (ZVC) located in the Central Market of Douala-Cameroon from August to October 2018. A total of 73 goats sorted into age classes were examined for helminths recovery (Table 1). The necropsied goats were randomly selected from those to be slaughtered on the day of sampling. The goats sold at the ZVC came from the Northern, North Western and Western Regions of Cameroon through commercial transactions.

Post mortem examination of goats

Standard procedure was used for gastrointestinal helminthic examination of goats (Achi et al., 2003; Obi et al., 2020). Before animal slaughtering, the serial number, date, age and sex of goats were recorded. The age was estimated using the dental table while the observation of the external genital organs was helpful for sex determination. The rumen, abomasum, small intestine and large intestine were collected from each animal and processed from worms' recovery in the Laboratory of Parasitology and Ecology of the University of Yaoundé I-Cameroon. The rumen, the abomasum, the small intestine and the large intestine were opened lengthwise with a knife and the content washed through a sieve. The mucosa of the rumen was thereafter thoroughly rinsed with tap water. The sieve residues and the mucosa were examined macroscopically for worm recovery. All worms harvested in the rumen were kept in a labelled box containing 70% alcohol. The sieve residues of the abomasum, the small intestine and the large intestine were returned into a graduated bucket and water was added to a volume of 3l. After homogenization, an aliquot of 300 ml (1/10) was taken and observed under a binocular microscope (Euromex EduBlue brand) for parasites identification. An infected goat was coded as 1 and uninfected as 0. The adult worms present were recovered using a fine forceps and kept in 70% alcohol. The number of each parasite species found in the aliquot was multiplied by 10 (percent removal). Between two treated samples, equipment used was thoroughly rinsed with tap water and soap to prevent contamination. The criteria for morphological identification of parasites are those described by Hansen and Perry (1994) and Tamssar (2006).

Parasitological indexes studied and statistical analysis

The parasitological indexes studied were the prevalence and the mean intensity of infestation and defined after Bush et al. (1997). So, the prevalence (Pr) of infestation was the percentage of goats infested by a given parasite taxon while the mean intensity (I) was the average number of worms of a parasite taxon among the infested members of goats found in the sample divided by the number of goats infested by that parasite. The classification of the prevalence was that provided by Valtonen et al. (1997) and modified by Fonkwa et al. (2020).

The prevalence was therefore considered either as very low ($Pr < 10$ %), low ($10\ \% \leq Pr \leq 50\ \%$) or high ($Pr > 50$ %) corresponding respectively to rare/satellite, secondary/intermediate and frequent/core parasites. The mean intensity were classified after Bilong and Njiné (1998) i.e. either very low ($I < 10$); low ($10 \leq I \leq 50$); average ($50 < I \leq 100$) or high ($I > 100$).

The data was saved into an Excel spreadsheet (Microsoft Office 2016, USA) and analyzed with StatView 5.0 software (SAS Institute, Inc., IL, USA). The Pearson Chi-square (X2) test was used to compare the prevalence. The nonparametric Kruskal-Wallis test and the t-test of student were used respectively to evaluate the effect of goat age and sex on the mean intensities. The significance level was set to a probability value of less than 0.05.

RESULTS

Fauna of gastrointestinal helminths of goats in abattoir of Douala central market

The fauna of gastrointestinal helminths of goats (Table 2) showed a total of 11 species belonging to 11 genera, 3 classes (Nematoda, trematoda and cestoda) and 2 phyla namely nematyhelminths and platyhelminths accounting respectively for 63.6 and 36.4 % of species. The class Nematoda recorded the highest number of genera and species (7 species) followed by cestoda (3 species) and trematoda (1 species).

Prevalence and mean intensity of helminths parasitizing goats

The overall prevalence was high (93.2%) i.e. 68 goats parasitized out of 73 examined (Table 3) was significantly affected by the helminth species. The class nematoda recorded the highest ($X2=35.9$; $p < 0.0001$) prevalence (72.6%) followed by trematoda (28.8%) and cestoda (4.10%). Trichostrongylus spp was the most frequent or core species (72.6%) followed by Haemonchus contortus (68.4%) while Oesophagostomum columbianum (37.0%) and Paramphistomum spp (28.8%) recorded a low prevalence. The prevalence of other parasite species (63.6% of species) was very low. The mean intensities seem to be low. Trichostrongylus spp was the sole parasite exhibiting a high mean intensity (145). However a single goat could harbour up to 1200 individuals worms (H. contortus).

Prevalence of single and multiple infestations

The prevalence of single and multiple infestations as illustrated in figure 1 showed that mixed/multiple infestation was the most frequent ($X2=0.85$; $p < 0.001$) in 78.1% of the examined goats contrary to single infestation which accounted only for 21.9% of cases. The prevalence of multiple infestations dropped significantly ($X2=1.50$; $p < 0.001$) with the increasing number of associated parasite species. Indeed, 32.9% of the necropsied animals harboured two species of parasites while 26.0% and 12.3% accommodated respectively three and four or more parasite species.

Overall prevalence of infestation as per the sex and age classes of goats

The overall prevalence of infestation as per the sex and age classes of goats as presented in figure 2 revealed that goat were highly infested regardless of the age class. The prevalence was not affected by the age class ($X2=1.01$; $p = 0.603$). The prevalence was significantly ($X2= 3.94$, $p = 0.047$) higher (97.8%) in females compared to males (85.7%).

The subsequent analysis deals only with intermediate and core parasites since they are structuring in the community contrary to satellite or rare species.

Effect of goats' age classes on the prevalence of helminth species

The effect of goats' age classes on the prevalence of helminth species is presented in figure 3. Globally, the prevalence was higher in class 2 followed by class 1 and class 3. Trichostrongylus spp was the sole parasite showing a striking variation of the prevalence among age classes. In fact, its prevalence was significantly ($X2 = 18.2$; $p = 0.001$) higher in class 2 compared to other classes. Whatever the age class, Trichostrongylus spp and Haemoncus contortus recorded the highest ($p = 0.001$) prevalence compared to O. Columbianum and Paramphistomum spp. The prevalence of parasite species showed no significant difference ($X2 =7.47$; $p = 0.056$) within class 3 contrary to other age classes.

Goat age related mean intensities of gastrointestinal helminth species

The age of goats had no significant influence on the mean intensities of parasite species (Table 4). Trichostrongylus spp in the Abomasum (class 3) and Haemonchus contortus (class 2) were the only parasites with a high intensity ($I > 100$).

Prevalence of infestation according to helminth species and sex of goat

The prevalence of infestation according to helminth species and sex of goat (Figure 4) highlighted that Trichostrongylus spp mostly occurred in females than males compared to other parasite species. The sex of the goat showed no significant influence on the prevalence of parasite species.

Mean intensities of parasite species based on goat sex

The mean intensities of parasite species (Table 5) were not significantly ($p > 0.05$) affected by the sex of goats.

Prevalence and mean intensities of helminth species as per the target organs

The prevalence and mean intensities of helminth species as per the target organs as highlighted in table 6 indicated that four organs of the digestive tract were infested. The small intestine harbored more parasite species (7species) than the large intestine and abomasum parasitized by two species each while the rumen was infested only by one parasite species (Paramphistomum spp). Apart from Trichostrongylus spp which was common to the abomasum and small intestine, other parasites showed organ specificity. Haemoncus contortus, Trichostrongylus spp, Oesophagostomum columbianum were the most occurring parasites respectively in the rumen (28.8%), small intestine (64.4%) and the large intestine (37.0%). Whatever the target organ and parasite species, the mean intensity of infestation was not high.

DISCUSSION

The gastrointestinal helminths fauna of goats in abattoir of the central market of Douala-Cameroon was composed of 11 species previously identified (nematodes) in goats in the Northern part of Cameroon (Vondou, 1989) and several West African countries including Nigeria (Barineme, 1990), Guinea (Barry et al., 2002), Ivory Coast (Achi et al., 2003) and Burkina Faso (Belem et al., 2005). The high overall prevalence (93.2%) recorded is close to 98% obtained by Vondou (1989), Barineme (1990) and Achi et al. (2003). The fluctuation of the prevalence could be due to the fact that the study areas and periods are different.

Nematodes recorded the highest prevalence compared to Cestodes and Trematodes probably because Nematodes have a direct or monoxene life cycle whereas Trematodes and Cestodes need an intermediaire host (mollusc and mite respectively) to accomplish their life cycle. Thus, their infestation depends on the presence of the intermediate host. The highest prevalence recorded with Trichostrongylus spp (72.6%) and H. contortus (68.4%) is similar to that observed by Achi et al. (2003) in Ivory Coast. In addition, the highest mean intensity of these parasites suggests that they are very adapted to their host.

The fact that multiple infestations were more frequent than single infestations is recognized in small ruminants in general (Barry et al., 2002; Achi et al., 2003). Multiple infestations would be due to the multiplicity and diversity of parasite species (infesting larvae) present in the pasture and all receptive by the goats. The prevalence of multiple infestations dropped significantly with the increasing number of associated parasite species probably because of the interspecific competition between helminth species. As the number of associated species increases, the quantity of resources decreases and the higher the intensity of interspecific competition (lower prevalence). Hence, the competition was rougher in the combination of four parasite species than that of two species (Fonkwa et al., 2021).

Goats of two to three years old (class 2) were more parasitized than the other age classes probably because of the late maturation of the goat immune system (Hoste et al., 2010). The latter would not be mature until the age of 2-3 years. Thus, the higher prevalence of age class 2 goats compared to

those of class 1 (≤ 2 years old) is due to the fact that the former have been exposed to parasites for a longer time than the second and therefore more vulnerable to infestation. On the other hand, the lowest prevalence observed in animals > 3 years is due to the effectiveness of their immune response resulting from the maturation of the immune system. The prevalence of infestation was significantly higher in females compared to males because of the weakening of the immune system in breeding females (Mahieu and Aumont, 2009).

The nutrients found in the small intestine would explain why it harbored more parasite species (7species) than the large intestine and abomasum. The specificity of some parasite species to a particular organ or site selection may be explained by the fact that, this organ provides a suitable microbiotope for optimal development of each parasite (Fonkwa et al., 2021). The heterogeneity of biotopes (organs) generates different infestation sites which are habitat options for parasites (Ibrahim and Soliman, 2010). Furthermore, the organ specificity suggests an interspecific competition between parasite species. This would result in a competitive exclusion and the segregation of the infestation site (translocations or migrations of parasites) from an organ to another as per the Gause's principle. By so doing, parasite species adapt themselves to a new microbiotope by creating new ecological niches leading to speciation. It has been reported that the cohabitation between different Trematodes species in a given organ could result in hybridization (Holmes, 1973). Also, the nutrition mode of parasites can originate to organ specificity. Cestodes for example are always found in small intestine since they lack the digestive tract and feed by pynocytosis on small intestine nutrients. The infestation of both the abomasum and small intestine by Trichostrongylus spp suggests that this parasite has versatile or flexible nutritional pathway.

CONCLUSION

The present study carried out in the abattoir of the Central Market of Douala- Cameroon revealed the diversity of the gastrointestinal helminths of goats. Overall, the prevalence and mean intensity were respectively high and low. The age and sex of goats showed no significant influence on the mean intensities of parasite species. The prevalence of infestation related to helminth species was affected by the age of goats. The infested goat populations should be targeted and treated. Moreover, a synergistic action of veterinary and medical personnel is required to preserve both cattle and human health.

REFERENCES

Achi Y.L., Zinsstag J., Yèo N., Dea V. and Dorchies P.H. (2003). Épidémiologie des helminthoses des moutons et des chèvres dans la Région des savanes du Nord de la Côte d'Ivoire. Revue de Médecine Vétérinaire, 154, 3, 179-188.

Awah-Ndukum J., Caleb KA, Bradley G., Ane-Anyangwe I.N., Fon-Tebug S. and Tchoumboue J. (2010). Prevalence of Bovine Tuberculosis in Abattoirs of the Littoral and Western Highland Regions of Cameroon: A Cause for Public Health Concern. Veterinary Medicine International, Volume 2010, Article ID 495015, 8 p.

Barry A.M., Pandey, Bah S. and Dorny P. (2002). Etude épidémiologique des helminthes gastro-intestinaux des caprins en Moyenne Guinée. Revue Elevage Médecine Vétérinaire Pays tropicaux, 55 (2) : 99-104.

Bilong B.C.F. and Njine T. (1998). Dynamique des populations de trois monogènes parasites de Hemichromis fasciatus Peters, 1858 dans le lac municipal de Yaoundé, et intérêt possible en pisciculture intensive. Annale Faculté des sciences, Université de Yaoundé I., Série Sciences Naturelles et Vie, 34 (2) : 2954 -303.

Bush A.O., Lafferty K.D., Lotz J.M., Shostak A.W. (1997). Parasitology meets ecology on its own

terms. The Journal of Parasitology, 83: 575 – 583.

Fonkwa G., Kouam K.M., Tomedi E.M., Tchuinkam T. and Tchoumboue (2020). Epidemiology of Myxosporean Infections in Economically Important and Dietary Freshwater Fishes in the Sudano - Guinean Zone of Cameroon. International Journal of Oceanography and Aquaculture. 4 (1): 000187. 15p.

Fonkwa G., Kouam K.M., Tchuinkam T., Tomedi E.M. and Tchoumboue J. (2021). Myxobolus (Myxosporea: Myxobolidae) Polyinfection patterns in Oreochromis niloticus in Adamawa - Cameroon. International Journal of Fisheries and Aquatic Studies. 9(2): 123-130.

Hansen J. and Perry B. (1994). The epidemiology, diagnosis and control of helminth parasites of ruminants. 4th Edition, International Laboratory for Research on Animal Diseases, Nairobi, Kenya. 74p.

Holmes J.C. (1973). Site selection by parasitic helminthes: interspecific interactions, site segregation, and their importance to development of helminth communities. Canadian Journal of Zoology, 51:333-347.

Hoste H., Manolaraki F., Arroyo-Lopez C., Torres Acosta J. and Sotiraki S. (2012). Spécificités des risques parasitaires des chèvres au pâturage : conséquences sur les modes de gestion. Fourrages, 212, 319-328.

Hoste H., Sotiraki S., Landau S. Y., Jackson F. and Beveridge I. (2010). Goat–Nematode interactions: think differently. Trends of Parasitology, 26 (8): 376-381.

Ibrahim M.M. and Soliman F.M.M. (2010). Prevalence and site preferences of heterophyid Metacercariae in Tilapia zilli from ismalia fresh water canal, Egypt. Parasite ; 17:233-239.

Kanyari P., Kagira J. and Mhoma R. (2009). Prevalence and intensity of endoparasites in small ruminants kept by farmers in Kisumu Municipality, Kenya. Veterinary Parasitology, 51(4):137-141.

Mahieu M. and Aumont G. (2009). Effects of sheep and cattle alternate grazing on sheep parasitism and production. Tropical Animal and Health Production, 41 (2): 229-239.

Ng'ang'a C., Maingi N., Kanyari P. and Munyua W.K. (2004). Development, survival and availability of gastrointestinal nematodes of sheep on pastures in a semi -arid area of Kajiado District of Kenya. BMC Veterinary Research, 28(2):491-501.

Nwosu C.O., Madu P.P. and Richards W.S. (2007). Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi-arid zone of Northeastern Nigeria. Veterinary Parasitology, 144(1–2):118–124.

Obi C.F., Akata M.C. and Ezubelu O.J. (2020). Prevalence of gastrointestinal Helminth parasites of trade cattle in Aguata and Orumba South Local Government Areas, Southeastern Nigeria. Journal of Parasitic Diseases, 44 (3): 546-552.

Odoi A., Gotham J.M., Gachuiri CK. and Omore A. (2007). Risk factors of gastrointestinal nematode parasite infections in small ruminants kept in smallholder mixed farms in Kenya. BMC Veterinary Research, 3(6):1746-1186.

Tamssar M.N. (2006). Parasitisme helminthique gastro-intestinal des moutons abattus aux abattoirs de Dakar. Thèse de Médecine Vétérinaire, Ecole inter-Etats des sciences et Médecine Vétérinaire de Dakar, 2. 106p.

Valtonen E.T., Holmes J.C. and Koskivaara M. (1997). Eutrophisation, Pollution and Fragmentation : Effects on Parasite Communities in Roach (Ritilus rutilus) and Perch (Perca fluviatilis) in Four Lakes in Central Finland. Canadian Journal of Fisheries and Aquatic Sciences, 54: 572 –585.

Vondou D. (1989). Contribution à l'étude du parasitisme gastro-intestinal des petits ruminants au Cameroun septentrional (cas des nématodoses). Thèse de Médecine Vétérinaire, Ecole inter-Etats des sciences et Médecine Vétérinaire de Dakar, 37. 149p.

References