International Journal of Veterinary Science and Agriculture Research
Volume 5 Issue 6, November-December 2023
ISSN: 2582-4112, Available at www.ijvsar.com

Study of the Antiparasitic Efficacy of Papaya (*Carica Papaya*) Powder on Gastrointestinal Strongyles in Sheep, Madagascar

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Keywords: *Carica papaya, powder, sheep antihelmintic,*

Abstract: *Gastrointestinal strongyles are one of the main pathological constraints in small ruminant farming. The importance of these parasites has an impact on animal health and on the economic situation of livestock farmers. Antihelminthic action is one of the solutions to avoid these constraints. The overall aim of this work is to assess whether Carica papaya seed is effective as an antiparasitic agent against gastrointestinal strongyles in sheep. The experiment was carried out over 28 days. The study involved 24 sheep divided into 4 batches of 6 animals: an untreated control batch, a batch treated with albendazole at a dose of 5mg/kg, and a batch that received papaya seed powder at doses of 200mg/kg and 400mg/kg orally. Treatment in two batches was repeated weekly. The results showed that the most effective treatment was the batch treated with albendazole with a rate of 92.6%, followed by the batch treated with papaya seed at a dose of 200mg/kg of live weight with a rate of 59.21% and finally the batch treated with papaya seed at a dose of 400mg/kg of live weight with a rate of 28.57%. Fecal egg counts also showed a remarkable and significant reduction in helminth levels.*

I. Introduction

In developing countries, livestock farming plays a very important role in strengthening the economy. Disease is one of the main constraints on the development of livestock farming. Among these diseases, parasitosis is not insignificant because of the losses it causes to animal productivity [1]. In small ruminants, gastrointestinal nematode infestations are a real threat to livestock production [2].

However, small ruminant farming has insufficient zootechnical production with poor health supervision. This is partly attributable, among other things, to the way in which livestock are farmed, which is essentially based on grazing and encourages gastrointestinal parasitism, one of the major limiting factors for livestock farming in the tropics [3, 4].

In response to this problem, chemical anthelmintic treatments (albendazole) were developed. However, their repeated use has led to parasite resistance, resulting in major losses within the herd and a loss of income for farmers. In order to combat these parasites, farmers have looked for other ways to fight the disease using locally available plants. Plants contain secondary metabolites that can give them anthelmintic properties [5].

Papaya (*Carica papaya*) is a tropical plant whose fruit, root, leaves and seeds are used as anthelmintics in human [6] and veterinary [7] medicine [8, 9]. The latex extracted from papaya contains papain, which has high anthelmintic activity: a single dose of 4 to 8 g of latex in children and 6 to 16 g in adults is enough to destroy all worms in the digestive tract (taenia, ascaris and others) [7] [8]. In chickens, an aqueous decoction of papaya seeds reduces *E. coli* infestation by 40 to 65% of infestation by *Eimeria sp* [9].

The question arises: is the use of papaya seed as an antihelminthic in sheep effective?

The overall aim of this study was to assess the antiparasitic efficacy of papaya seed (*Carica papaya*) on sheep gastrointestinal strongyles in vivo.

II. Material and Methods

II.1. Study site

The study took place during the rainy period (17 March 2022 to 15 April 2022), in Madagascar, in the Fokontany of Ambohipeno, Rural Commune of Ambohimandroso, District of Amparafaravola, Region Alaotra Mangoro, Province of Toamasina. Madagascar (Figure 1).

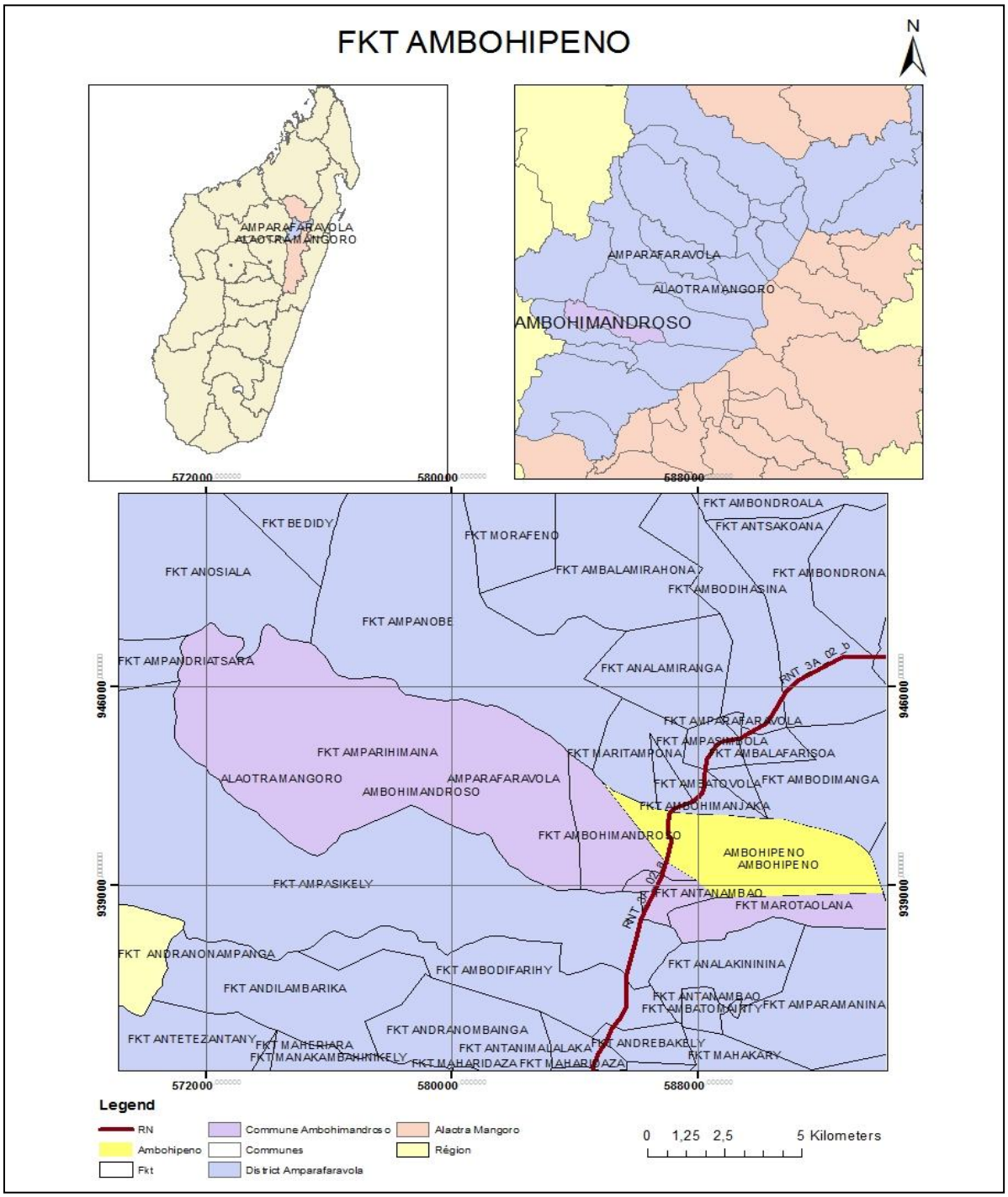

Figure 1: site of the study in the Fokontany Ambohimpeno, Fokontany of Ambohipeno, Commune rurale d'Ambohimandroso, District of Amparafaravola, Region Alaotra Mangoro, Province of Toamasina, Madagascar

II.2. Samples of *Carica papaya*

The study was carried out on 24 unsexed sheep of different breeds and ages. The animals had not received any antiparasitic treatment for three months prior to the experiment. The plant material used was papaya seed (*Carica papaya*) (Figure 2), which was collected from ripe fruit from the Ambohipeno fokontany.

Figure 2: (a) papaya seeds, (b) grounded seeds

Carica papaya seeds from ripe fruit were placed in a clean place away from light and dust for 5 days to dry, then ground using a grinder. The powder obtained was stored in iron cans at room temperature in a humidity-free chamber.

II.3. Experiment study

The experimental set-up consisted of four batches of six animals each. Numbered collars were placed on the neck of each animal for identification purposes. Each batch received a single treatment and the different treatments were administered orally. Of the 4 batches, two were control batches. The NT control batch received no treatment while the other control batch received albendazole as a treatment. The other two batches were treated with papaya seed.

The following treatments were administered to the different batches:

- Batch 1 was the untreated control batch;
- Batch 2 was treated with albendazole at a dose of 5 mg/kg ;
- Batch 3 was treated with papaya seed powder at a dose of 200 mg/kg live weight;
- Batch 4 was treated with papaya seed powder at a dose of 400 mg/kg live weight;

These animals were grazed together during the day and were not separated for the duration of the study.

The faeces to be examined were taken directly from the animal's rectum by fingers protected by a rubber glove. These samples were taken early in the morning and the faeces were immediately placed in plastic boxes containing 70° alcohol, labelled with the animal's identification number and the date of collection, and sent to the laboratory for analysis. Coproscopic analysis was carried out at the Laboratoire National de Diagnostic Vétérinaire (LNDV) in Anosimasina Itaosy, Antananarivo. Coprological analysis was carried out using the Mac Master quantitative method. Enrichment by flotation was carried out in saturated sodium chloride solution. The number of eggs per gram (EPG) of faeces used [10] was determined using the following formula:

EPG = N x 50

EPG: Number of eggs per gram of faecal matter
N: Number of eggs in the two compartments
50: Dilution coefficient
EPG reduction rates were calculated using the method of Kochapakdee *et al*., 1995 [11].

$$\text{Reduction rate of EPG (\%)} = 100 \times ((1-D2)/D1)$$

Where: D1: mean EPG of the batch treated at Day 0; D2: mean EPG of the batch treated at Day of analysis

Analyses of variance were performed using IBM SPSS statistics 20 software. The Tukey test was used to compare mean EPG reduction rates. Values of $p \leq 0.05$ are considered statistically significant.

III. Results

III.1. Level of infestation

Before treatment, four species of parasites were found, including *Haemonchus contortus, Oesophagostomum spp, Trichostrongylus sp and Téladorsagia sp*. The prevalence of *Haemonchus contortus* (100%), *Trichostrongylus sp* (100%) and *Téladorsagia sp* (100%) is very high, except for *Oesophagostomum spp*, with an infestation rate of 4.16%.
Three levels of digestive strongyles infestation were observed before treatment. Moderate gastrointestinal strongylosis affected half (50% EPG 400 to 1000) of the sheep. Whereas 45.83% had a low infestation with an OPG of less than 400 and 4.16% had a high infestation with an EPG of 1000 or more.

Table 1: Parasite egg excretion levels (Bastiaensen *et al*., 2003) [12].

Degree of infestation	Low	Moderate	High	Massive
Egg Per Gram	< 400	400 < N <1000	1000 < N < 2500	> 2500

III.2. Reduction rates

The following table shows the reduction rates in strongyle egg excretion levels for each experimental batch.

Table 2: Variation in reduction rate of eggs in animal faeces during experimentation

TREATMENT	EPG	Reduction rates			
	D0	D7	D14	D21	D28
TN	258,33±125^{a*}	22,5^{a*}	59,21^{a*}	63,95^{a*}	41,51 ^{a*}
ALB	450,00±250^{a}	92,60^{b}	88,89 ^{b}	72,22 ^{a}	43,16 ^{a*}
PAPAYE 200mg	633,33±222,22^{a}	15,79^{a}	59,21 ^{c}	37,20 ^{b*}	10,59 ^{a*}
PAPAYE 400mg	583,33±238,89^{a}	28,57 ^{a}	18,57 ^{c}	10,26 ^{a*}	17,65 ^{a*}

TN: untreated; ALB: treated with albendazole; PAPAYE 200mg: treated with papaya seed at a dose of 200mg/kg body weight; PAPAYE 400mg: treated with papaya seed at a dose of 400g/kg body weight with

repeated weekly dosing. (*) expresses an increase in the excretion of parasite eggs. (a) and (b) in the same column indicate a significant difference in values ($p<0.05$).

The different batches excreted eggs throughout the duration of the trial and to a very variable extent. Before treatment, no significant difference was observed between the EPGs of the animals in the four batches. The batch treated with albendazole had a better egg reduction rate from day 7 to day 21 of treatment, with rates of 92.6%, 88.89% and 72.22% respectively. Among the batches treated with *Carica papaya* seeds (papaya), the batch treated with the 200mg/kg body weight dose showed a higher or lower rate (59.21%) on day 14 and there was a significant difference ($p<0.05$) between the reduction rate of the two control batches and the batches treated with papaya seeds.

IV. Discussion

IV.1 Prevalence of parasites

At the beginning and throughout the trial, sheep were more infected by gastro-intestinal parasites, particularly strongyles (*Haemoncus, Trychostrongylus sp, Strongylus sp*.) 100% than by other cestode parasites (*Fasciola* 46%, *Monezia* 45.83%). These results are identical to those obtained by Faihunen 2017 in sheep in Benin and Komoin-oka *et al*., 1999 [13] in Côte d'Ivoire. This similarity may be due to the climate and husbandry practices.

IV.2 Degree of infestation by the digestive strongle

At the start of the experiment, 4.16% of the sheep reached a massive degree of infestation, i.e. more than 1000 EPG. This result is similar to those reported from Ambovobe Androy [14] and Ambositra [15] with a degree of infestation of 0% and 0.83% respectively. This similarity can probably be explained by the climate and geo-ecological conditions of the pastures. This phenomenon could be linked to the poor nutritional state of the livestock [16], the geo-ecological conditions of the environment [17] and the humid tropical climate [18] which is favourable to the growth and survival of the infesting stage of the parasite in the pastures, resulting in high parasite pressure and a high probability of exposure of the animals to the parasites.

IV.3 Egg excretion per gram of faeces

The levels of faecal excretion of parasite eggs were comparable in the 4 batches, 14 days after treatment, no significant difference ($p > 0.05$) was noted but more than half of the faecal excretion containing strongle eggs of sheep given papaya seed 200mg/kg live weight decreased. In sheep fed papaya seed at 400mg/kg bodyweight, faecal excretion of strongle eggs increased slowly.

The low efficacy of the highest dose (400 mg/kg) is similar to the phenomenon observed by Van Nueten (1972) [19] who showed that at high doses, the paralysing effect of tetramisole diminished [9].found no significant differences between the doses (5 g/l and 10 g/l) of aqueous decoctions of papaya seed in chickens. According to these authors, the lower concentration seemed to produce a better effect. This equality is due to the active principle of the drug. Higher doses may cause the active ingredient to disappear.

IV.4. Rate of reduction in faecal egg excretion

The batch treated with papaya seed at a dose of 200mg/kg live weight reduced egg excretion by up to 59.21% and by up to 28.57% for the batch treated with papaya seed at 400mg/kg live weight. This is at variance with previous work on sheep on station [20] which showed that papaya seed showed antiparasitic efficacy at an optimum dose of 100 mg/kg in lambs and 200 mg/kg in adults, with efficacy rates of over 80%. This difference may be due to the climate and the way the animals are reared.

However, despite this imprecise nature, this study showed that papaya seed reduces the excretion of strongyle eggs in small ruminants. Even under optimal conditions, Fabiyi (1973) [21] showed that systematic treatments, or even one or two treatments, are not enough to completely eliminate the parasites.

V. Conclusion

In all animal production systems, animal health is very important for improving zootechnical performance. This study was carried out in the rural commune of Ambohimandroso, Amparafaravola district, Alaotra Mangoro region. The aim was to determine the antihelminthic efficacy of papaya seed on gastrointestinal parasites of sheep in order to help improve the system for treating small ruminant parasites. To do this, a trial was carried out on 24 sheep with two doses of papaya seed, one dose of albendazole and a control batch.

The aim was to demonstrate their antihelmintic activity in sheep, particularly against gastrointestinal strongyles.

Based on the results, papaya seeds could be recommended for use against gastrointestinal parasites in small ruminants in this study area. Administration of papaya seeds at a dose of 200mg/kg PV to sheep resulted in a reduction in parasite egg excretion of up to 59.21% on the 14th day after treatment. This study is also of economic and veterinary interest. It provides an overview of the status and level of gastrointestinal parasitism in sheep. It helps farmers in their pest control activities, as well as other stakeholders in the sector concerned. Maintaining the health of these animals will boost the source of income for local livestock farmers.

In financial terms, the study shows that the use of papaya seeds at a dose of 200mg/kg PV as an antihelmintic for sheep results in a reduction in the excretion of parasite eggs of up to 59.21%, while the cost is derisory compared with abendazole. This treatment reduces the burden on farmers in terms of parasite treatment for sheep.

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