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A comparative study of the efficacy of piperazine and *Carica papaya* for the control of helminth parasites in village chickens in Zambia

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Introduction

Village chickens play vital roles in the livelihoods of those people keeping them. Backyard poultry provide a critical source of food and income for people in developing countries (Lans et al. 2007) and so is the case in Zambia. However, their productivity has been hampered by many constraints resulting in low flock sizes (Kusina and Kusina 1999). Among the constraints is the problem of external and internal parasites (Abebe et al. 1997). In Africa, the control of these parasites is limited by the high cost of anthelmintics, their uncertain availability and the increasing frequency of drug resistance (Naidoo et al. 2008). Therefore, possible alternatives such as the use of plant products that function by mechanisms other than those of chemotherapeutics, with the additional advantage of a natural origin have been recommended (Naidoo et al. 2008). Besides, the cost of treatment with alternative traditional methods (herbs) is negligible when compared with the cost of conventional medicines. In addition to being very inexpensive, herbal preparations have good medicinal value (Mbaria et al. 1998).

Therefore, in a quest for provision of safe animal products, a number of studies on use of herbal therapy especially in poultry, have been conducted many of which have reported a number of herbal products that are of potential use as therapeutic or prophylactic agents against bacteria (Arshad et al. 2008), protozoa (Nweze and Obiwulu 2009; Naidoo et al. 2008; Arshad et al. 2008) and viruses (Kong et al. 2006). However, only a few herbal products (Lans et al. 2007; Purwati and He 1991) have been reported to be potential antihelmintic agents in poultry.

The objective of the current study was to compare the efficacy of *Carica papaya* latex with that of piperazine in the control of nematode parasites in village chickens as well as assess the effect of treatment on productivity (weight gain).

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Table 1 Occurrence of nematode species in various organs per treatment group

Treatment	Crop		Proventriculus		Small intestine		Caeca				Total worm recovery per treatment group
	G. ingluvicola		*T. americana*		*A. galli*		*H. gallinarum*		*A. suctoria*		
	no.	%	no.	%	no.	%	no.	%	no.	%	no.
Piperazine	2	0.7	45	14.6	2	0.7	4	1.3	255	82.8	308
Papaya	2	0.4	42	7.8	2	0.4	24	4.5	464	87.0	537
Control	3	0.5	93	14.9	3	0.5	15	2.4	510	81.7	624
Total	7	0.5	180	12.3	7	0.5	43	2.9	1229	83.7	**1,469**

Materials and methods

The experimental village chickens were sourced locally. Thirty (30) chickens with an age estimate of 5–6 months and live weight range of 0.6–1.1 kg were purchased. Each chicken was tagged with a number marked on insulation tape and stuck around one leg. Commercial feed (broiler finisher) and water were provided *ad libitum* to all chickens. They were then distributed randomly among three treatment groups (piperazine, papaya or control) using simple random method to ensure that each of the 30 chickens had an equal chance of being into any of the three treatment groups. In the piperazine group, chickens were treated with piperazine *per os* at manufacturer's recommended rate of 1.25 g per litre of drinking water. In the second group, chickens were treated with a single treatment of 20% (v/v) watery solution of papaya latex *per os* at a dose rate of 0.8 g (0.7 ml)/kg live weight. The third group was the control, in which no anthelmintic was given to the chickens.

At baseline, chickens were weighed and their EPGs assessed before they were treated and given the commercial feed. At two weeks post-treatment, the chickens were weighed after which they were humanely slaughtered and necropsied as described by Permin and Hansen (1998). An assessment of worm burden was then carried out. Only nematode worms were collected, counted and identified. Drug efficacy was calculated according to Wood et al. (1995).

Results

On day 10 post-treatment, nine chickens from piperazine group, six from papaya and eight from the control were negative on EPG. At slaughter, one chicken in the piperazine, two in the papaya and one in the control remained positive on EPG. Of the 30 chickens necropsied, nematodes were recovered from 28 (93.3%) chickens. Overall five nematode species recovered from the experimental chickens were *Allodapa suctoria* (83.7%), *Tetrameres americana* (12.3%), *Heterakis gallinarum* (2.9%), *Ascaridia galli* (0.5%) and *Gongylonema ingluvicola* (0.5%) (Table 1). There were no significant differences ($p>0.05$) in mean values of nematodes recovered from the three treatment groups (Table 2). The efficacy of piperazine was 50.6% while that of papaya was 13.9%. The largest number of worms was recovered from chickens with the least mean live weight gains. The results also showed that there were no significant differences ($p>0.05$) in the mean live weight gains between treatment groups (Table 3).

Table 2 Comparison of mean worm counts recovered from the three treatment groups, piperazine, papaya and control two weeks post-treatment

Treatment group	n	Mean	± SD	Range
Piperazine	10	30.8	18.3	0–62
Papaya	10	53.7	23.0	20–98
Control	10	62.4	61.8	0–160

Table 3 Comparison of mean weight gains from the three treatment groups, piperazine, papaya and control two weeks post-treatment

Treatment group	n	Mean	± SD	Range (kg)
Piperazine	10	0.24	0.13	0.0–0.4
Papaya	10	0.16	0.15	−0.1–0.4
Control	10	0.13	0.09	−0.0–0.3

Discussion

Our study demonstrated high prevalence of nematode infections in Zambian village chickens similar to findings by Phiri et al. (2007). The highest mean live weight gains were in piperazine group followed by papaya group with the control group having the lowest. The low efficacy of piperazine found in this study is in agreement with that reported by Ziela (2000), who found it to be only 17.0% efficacious in the natural habitat of local chickens as compared to albendazole and levemazole. The 13.9% efficacy of papaya was much lower than the 100% efficacy reported by Mursof and He (1991). Mursof and He (1991) conducted their experiment in laying hens which were experimentally infected with a single nematode parasite species, *Ascaridia galli.* Our study, however, looked at naturally infected village chickens most of which had mixed infections.

Even though by day 10 post-treatment most chickens in the treatment groups were negative on EPGs, worms were found at necropsy 14 days post-treatment. This suggests that even when worms were present in the chickens they were not shedding eggs, an aspect which may be important in reducing environmental egg contamination. A reduction in EPGs even in the control group may have arisen due to a high plane of nutrition given to all chickens. Improved nutrition could have boosted the immunity in chickens because host immunity may result in a marked extension of the prepatent period and a lower egg output by female parasites (Permin and Hansen 1998). Koski and Scott (2001) reported that malnutrition promotes the establishment, survival and fecundity of nematode, but the magnitude of the effect depends on factors such as host species, parasite species, magnitude of the infection, severity of the nutritional deficiency, and presence of single or multiple infections and single or multiple nutritional deficiencies. It is possible that a higher concentration of papaya or two treatments at a 7 day interval could have yielded a higher efficacy.

In Trinidad and Tobago, boiled green papaya fruit (*Carica papaya*) has been reported to induce milk let-down when fed to pigs (Lans et al. 2007). A study by Arab et al. (2006) showed that the extract artemisinin of the plant *Aretemisia sieberi* could reduce coccidial infection in broiler chickens, while treatment of broiler chickens with *Tulbaghia violacea*, *Vitis vinifera* and *Artemisia afra* resulted in higher feed conversion ratios than the untreated controls (Naidoo et al. 2008).

Results of the current study suggested that treating chickens against nematode infections with papaya latex could result in reduction in worm burdens and hence higher weight gains. Our findings further implied that better nutrition could improve live weight gains in village chickens even if they are parasitized by nematodes. However, a longer experimental period is necessary to verify this. Our study was limited by the small sample size coupled with the short experimental period and thus extrapolation of the findings should be made with caution. We recommend that a similar experiment be set up in the natural habitat of the local chickens involving a bigger number of chickens without use of any commercial feed to avert the influence resulting from well balanced nutrition.

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References

Abebe, W., Asfaw, T., Genete, B. and Dorchies, P. H., 1997. Comparative studies of external parasites and gastro-intestinal helminthes of village chickens kept under different management systems in and around Addis Ababa (Ethiopia). Revue de Ve'te'rinare, 148, 497–540.

Arab, H.A., Rahbari, S Rassouli, A., Moslemi, M.H. and Khosravirad, F., 2006. Determination of artemisinin in Artemisia sieberi and anticoccidial effects of the plant extract in broiler chickens. Tropical Animal Health and Production, 38, 497–503

Arshad, N., Zitterl-Eglseer, K., Hasnain, S. and Hess, M., 2008. Effect of *Peganum harmala* or its beta-carboline alkaloids on certain antibiotic resistant strains of bacteria and protozoa from poultry. Phytotherapy Research, 22, 1533–1538.

Kong, X.F., Hu, Y.L., Yin, Y.L., Wu, G.Y., Rui, R., Wang, D.Y. and Yang, C.B., 2006. Chinese herbal ingredients are effective immune stimulators for chickens infected with the Newcastle disease virus. Poultry Science, 85, 2169–2175.

Koski, K.G. and Scott, M.E., 2001. Gastrointestinal nematodes, nutrition and immunity: Breaking the negative spiral. Annual Review of Nutrition, 21, 297–321.

Kusina, J.F. and Kusina, N.T., 1999. Feasibility of Agriculture and household activities as they relate to Livestock Production in Guruve District of Mashonaland Province with emphasis on Poultry Production. *Report for Household Agricultural Support Program (HASP), Zimbabwe,* September, 1999.

Lans, C., Georges, K. and Brown, G., 2007. Non-experimental validation of ethnoveterinary plants and indigenous knowledge used for backyard pigs and chickens in Trinidad and Tobago. Tropical Animal Health and Production, 39, 375–385.

Mbaria, J.M., Maitho, T.E., Mitema, E.S. and Muchiri, D.J., 1998. Comparative efficacy of pyrethrum mare with albendazole against Sheep gastrointestinal nematodes. Tropical Animal Health and Production, 20, 17–22.

Mursof, E.P. and He, S., 1991. A potential role of papaya latex as an anthelmintic against patent *Ascaridia galli* infection in chicken. Hemera Zoa, 74, 11–20.

Naidoo, V., McGaw, L.J., Bisschop, S.P., Duncan, N. and Eloff, J.N., 2008. The value of plant extracts with antioxidant activity in attenuating coccidiosis in broiler chickens. Veterinary Parasitology, 153, 214–219.

Nweze, N.E. and Obiwulu, I.S., 2009. Anticoccidial effects of Ageratum conyzoides. Journal of Ethnopharmacology, 122, 6–9.

Permin, A. and Hansen, J. W., 1998 Epidemiology, Diagnosis and control of Poultry Parasites. *No. 4, FAO Animal Health Manual, Food and Agricultural Organization, Rome, Italy.*

Phiri, I.K., Phiri, A.M., Ziela, M., Chota, A., Masuku, M. and Monrad, J., 2007. Prevalence and distribution of gastrointestinal helminths and their effects on weight gain in free-range chickens in Central Zambia. Tropical Animal Health and Production, 39, 309–315.

Purwati, E. and He, S., 1991. Pengaruh gatah papaya (*Carica papaya*) terhadap *Ascaridia galli* pada ayam. Hemera Zoa, 74, 1–5.

Wood, I.B., Amaral, N.K., Bairden, K., Duncan, J.L., Kassai, T., Malone, J.B.Jr., Pankavich, J.A., Reinecke, R.K., Slacombe, O., Taylor, S.M. and Vercruysse, J., 1995. World Association for the Advancement of Veterinary Parasitology (W.A.A.V.P.). Second edition of guidelines for evaluating the efficacy of antihelmintics in ruminants (bovine, ovine, caprine). Veterinary Parasitology, 58, 181–213.

Ziela, M., 2000. A comparative study of gastrointestinal nematode infections in traditional and commercial chickens and effects on anthelmintic treatment on production, (MSc thesis, University of Zambia).