



Adverse Effects and Anti-Cestodal Activity of Crude Rhizomes Extract of *Dryopteris filix-mas* in Dogs in Jalingo Metropolis, Taraba State, Nigeria

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ABSTRACT

Medicinal ferns have been used for their wide spread medicinal potentials but their phytochemical and biological properties remain comparatively unexplored. Therefore, the current study was designed to evaluate the adverse effects and anticestodal activity of crude powder extract of *Dryopteris filix-mas* (*D. filix-mas*) in the treatment of canine cestodosis. In this study, a total of sixteen (16) dogs of both sexes with gravid segments of tape worms at their anal region were used. *Dryopteris filix-mas* used, was harvested from Chabbal Gudali Village, Mambilla Plateau in Sardauna Local Government Area of Taraba State. The rhizomes were crudely prepared in to powder extracts and was administered orally at the rate of 0.25 ml/kg body weight in fresh cow milk early in the morning (6:00 to 6:40 AM). These dogs were confined, kept off-feed and carefully monitored for 5-8 hours for any adverse effects. One-hour post-administration, nausea, emesis, profuse salivation and restlessness were observed in the dogs. These dogs were heavily fed 5 hours post-treatment. Severe rectal obstruction occurred in one of the dogs by twisted bunch of incapacitated worms and Faecal samples were collected from all the study-dogs 4 weeks post-treatment and screened for presence of cestodes eggs using simple floatation method. All the 16 study-dogs tested negative ensuring 100% response to treatment. Chi-Square test of rate of response to treatment with regard to gender, revealed no significant difference ($P>0.05$). In conclusion *D. filix-mas* is very efficacious for expulsion canine cestodes and is recommended for oral dose in combination with light doses of non-oily laxatives to ease evacuation.

Keywords: *Dryopteris filix-mas*, Crude extract, Adverse-effects, Gravid-segments, and Anticestodal activity.

INTRODUCTION

Certainly, extracts of leaves, rhizomes, root stock, stem bark and seeds of medicinal ferns including *Dryopteris filix-mas* (*D. filix-mas*) have been processed, evaluated and used for treatment and management of many disease conditions (Britto *et al.*, 2012). World Health Organization (WHO) reported that 80% of the rural populists patronize traditional medicine and most of these therapies involve the use of leaves, rhizomes, barks, and roots extracts of

plants (Mahmoodi *et al.*, 2015). About 300 species of ferns including *D. filix-mas* have been used as medicinal plant in Chinese traditional medicine (Ding *et al.*, 2012) and were used for the treatment of skin tumefaction, hepatitis, fever, tumor and bacterial infections. These components of fern have been used as veterinary vermifuge. *D. filix-mas* (L) Schott have been used traditionally for the treatment of various

ailments by the indigenous people of hills area in Bangladesh (Zhang *et al.*, 2012).

Dryopteris filix-mas (male fern) is a common fern of temperate Northern hemisphere, native to Europe, Asia, North America and Africa including Nigeria (Dryon, 1997). *Dryopteris* ferns are usually found around damp shaded areas, understory, on ledges, rocks, and screes (Eskanderi *et al.*, 2012). Scientifically, *Dryopteris* fern belong to Kingdom Plantae, Division Pteridophyta, Class Pteridopsida, Order Polypodiales, Family Dryopteridaceae, Genus *Dryopteris*, Species *Dryopteris filix-mas* (Uwumarongie, 2016). *D. filix-mas*, *D. oreades* and several other fern species of Veterinary importance are found abundantly on the Mambilla Plateau in Sardauna Local Government Area of Taraba State, which has temperate climatic condition all year round, almost equivalent to that of Europe (Idris and Musa, 2021). On the Mambilla plateau, *D. filix-mas* was observed to be easily destroyed by act of over-grazing by cattle hence, abundantly confined to in-accessible areas by cattle and grow between rocks, screes, ledges and steep slopes.

This fern grows and attains the height of 18-24 inches in highly fertile loamy soil and 14-18 inches on less fertile soil. *D. filix-mas* is called “Agugu” and “Mama-Agugu” in Fulfulde and Mambilla languages respectively. *D. filix-mas* requires very high of amount rainfall and is sensitive to draught and overgrazing. The stems together with the leaves dry-up during the hot dry season and re-generate with the commencement of the rainy season. The root system has an underground stem (rhizome) which bears numerous small roots. Each rhizome is covered with several minutes spongy-like scales which is denser at apex of the rhizomes which when peeled-off, reveals yellowish-gray substance. This yellowish-gray substance have been processed into powder extract and used traditionally for effective expulsion of helminthic parasites within Communities on the Mambilla Plateau in Nigeria (Valko *et al.*, 2007).

The term helminthes referred to parasites that live in the gastro-intestinal tract of their hosts,

receiving nourishment and protection while disrupting the absorption of nutrients of their hosts thereby causing weakness and diseases (Bhaita *et al.*, 2006). Helminthes are classified as Cestodes, Trematodes and Nematodes (Jirillo *et al.*, 2014).

Cestodes are members of the Class Eucestoda, hermaphrodite, segmented endoparasites with an elongated dorso-ventrally flattened (tape like) body without alimentary canal and food nutrients are absorbed through the body surface (cuticles) (Bhaita *et al.*, 2006). Morphologically, cestode usually consist of the head (scolex), neck which is an un-segmented portion situated just posterior to the scolex, which continuously produces proglottids (segments) by metameric repetition of their reproductive organ called proglottidization and body (strobila) which contains chains of immatured, and matured segments (Bhaita *et al.*, 2006).

Trematodes are members of the class Trematoda, with dorso-ventrally flattened, un-segmented body (leaf-like). The body cuticle may be smooth or may bear spines, (hooks). The scolex may generally have two suckers which serves as organ of attachment. The mouth opening is at the anterior part and is surrounded by the oral suckers, but most trematodes absorb food through the general body surface while in some cases, blood, tissue, cells, serum etc. are ingested through the mouth (Bhaita *et al.*, 2006). Nematodes are members of the class Nematoda which are either free-living or parasitic. The body of a nematode is un-segmented, dorso-ventrally cylindrical and elongated with tapering ends. Digestive system is tubular, with a simple opening (mouth) at the anterior end which is surrounded by two or three lips leading directly to oesophagus and anus posteriorly (Bhaita *et al.*, 2006).

Although, several studies have been conducted on fern plants in countries like Iran, China, Spain, Asia and many other places of the world, but there have been no documentary evidence of study, systemic biological activities and adverse effects of these medicinal ferns been reported in Nigeria. Therefore, the present study was

designed to study the adverse effects and anthelmintic activities of powder extracts of *D. filix-mas* on dogs in the treatment of canine cestodosis in the study area.

MATERIALS AND METHODS

The study Area

The study was carried out in Jalingo metropolis, headquarters of Taraba State, Jalingo metropolis has the landmass of approximately 195 km² and is located between latitude 8°45' to 9°05' and Longitudes 11°15' to 11°35' E with an altitude of 180m above the sea level. Jalingo is bounded to the north by Lau Local Government Area, to the East by Yorro Local Government Area, to the south and West by Ardo-Kola Local Government Area (Musa et al., 2022). Jalingo metropolis consists of the entire Jalingo Local Government Area and some parts of Ardo-Kola Local Government Area such as ATC, Baba ya'u, Taraba State University and College of

Agriculture, Science and Technology, Jalingo are situated (Figure 1). The rainy season in Jalingo metropolis extends from April through October with mean precipitation amount between 750 mm to 880 mm (Adebayo, 2001). The ambient temperatures vary between 29 °C to 37 °C with an average mean of 32 °C in months of August and September. The coldest months are December and January due to the cold-dry wind from Sahara Desert while the warmest months are April and May. The climate of Jalingo metropolis is influenced by two dominant trade winds, namely the Southwest trade wind and the Northeast trade wind. (Bami, (2009).

Jalingo metropolis covers a Landmass of about 1,393 square Kilometers which includes Urban, Semi-Urban and Rural settlements with Jalingo metropolis serving as the administrative and commercial Centre (Taraba State Government, 2020).

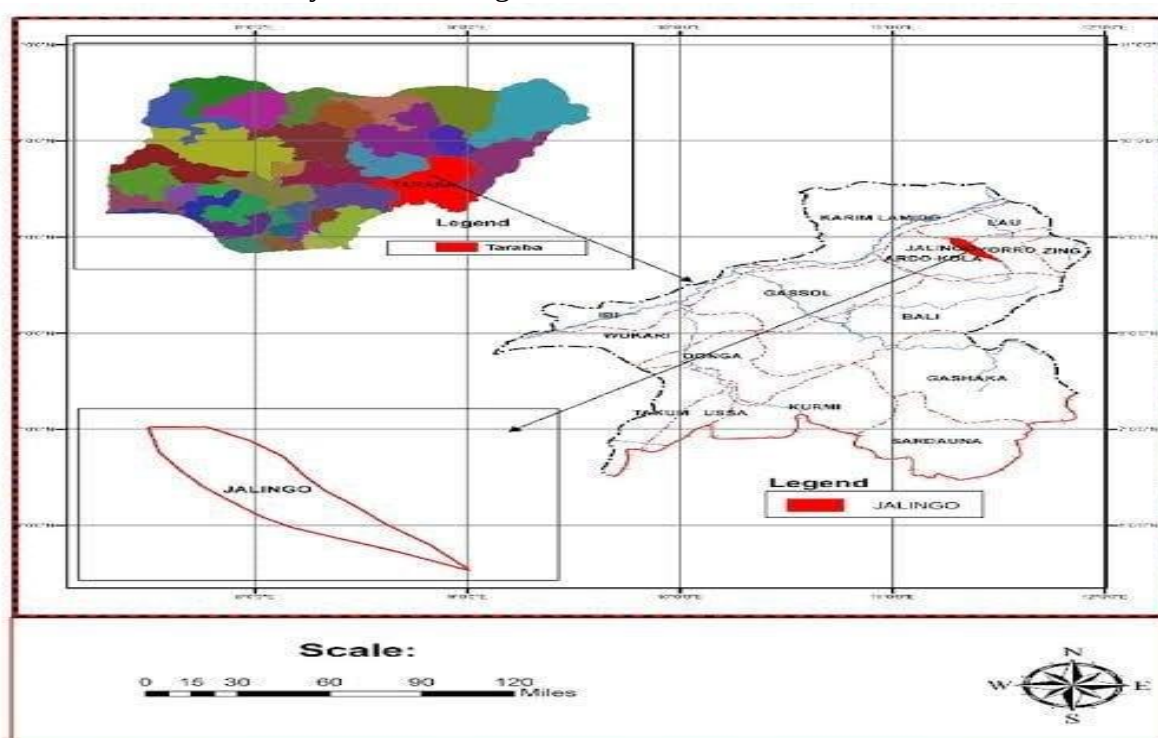


Figure 1: Map of Taraba State showing Jalingo Metropolis
Source: Ministry of Land and Survey (2021)

According to National Population Census, (2006), Jalingo Local Government Area has a population of approximately 184,000 people comprising of ethnically diverse groups such as Fulani, Mumuye, Jukun, Mambilla and Wurkun (NPC, 2006). According to National Bureau of Statistics (NBS) of Nigeria gave projection based on the 2006 Census that, population of Jalingo Local Government area is estimated to have grown to 300,000 to 320,000 people by 2023-2024 considering an average annual growth rate of 3% typical for Nigerian Urban Areas (NBS, 2023).

The economic activities of Jalingo Metropolis are primarily based on Agriculture, Trades and Services. The major agricultural activities include the cultivation of crops such as millet, sorghum, maize and rice as well as livestock rearing (cattle, sheep goats and poultry). (Adewale and Onu, 2017). Furthermore, Jalingo Metropolis serves as a commercial hub, with trading activities in markets and small-scale industries

contributing to the local economy (Taraba State Ministry of Commerce, 2019).

Source and Identification of the Medicinal Fern (*Dryopteris filix-mas*)

Dryopteris filix-mas was obtained from Chabbal Gudali Village, on the Mambilla Plateau in Sarduna Local Government Area of Taraba State, which lies on Longitude 6° 42' 50N and longitude 11°15E, with temperate climatic condition almost equivalent to that of Europe. (Bami, 2009). *Dryopteris filix-mas* was identified in the Department of Biological Sciences, University of Maiduguri.

Harvesting and Preparation of the Crude Powder Extract of *D. filix-mas*

The crude powder extracts were prepared as described by Sekendar *et al.*, (2017}. The Rhizomes of the *D. filix-mas* were harvested using a digger and removed by sharp knife. After harvesting the bunches were thoroughly washed and the minute spongy-like roots were carefully trimmed. The rhizomes were dismantled and thoroughly washed again. (Plates 1-3).



Plate 1: *D. filix-mas* leaves



Plate 2: *D. filix mas* bunches



Plate 3: *D. filix mas* rough parts

The outer most layers were peeled which revealed yellowish-gray substance. These substances were pounded in to rough particles in a dry sterile mortar and pestle. These rough particles were allowed to dry for 7 days at room temperature and further

grounded to fine powder. The powder was sieved in grade one sieve and the powder extract was weighed and package into 0.5g, 1g, 2g, 3g, and 4g. This crude powder extract was stored at dry cool place for sub-sequent use (Plates 4-6).



Plate 4: Rough powdered parts



Plate 5: Fine powdered particles



Plate 6: Finest sieved powder

Sample Size, Administration of the Extract and Monitoring of the Dogs

A total of sixteen (16) dogs of both sexes (8 male and 8 female) certainly seen with gravid segments of tapeworms at their anal region were identified within the study area and used for this study. Fifty grams (50g) of crude powder extract of *D. filix-mas* was dissolved in 50mls of fresh cow milk and administered orally at dose rate of 0.25mg/Kg body weight (0.25ml/Kg). The crude powder was administered between the early in the morning from 6:00 to 6:40 AM when the study-dogs were believed to have eaten nothing yet and kept off-feed for 5 hours (6:00 – 11:00 AM) to allow the worms absorb large quantities of the extract. The experimental dogs were confined in one place and strictly monitored for any adverse effects. These dogs were given heavy meal after four (5) hours post- treatment (PT). Their first faeces were checked for presence of expelled worms.

Post-Treatment Screening using Simple Floatation Method

Faecal samples were collected from the study-dogs 4 weeks post-treatment and screened for presence of cestodes eggs using simple floatation method in conjunction with McMaster's Techniques.

Statistical Analysis

Chi Square test was used to compare the rate of response to treatment between male and female dogs.

RESULTS AND DISCUSSION

Following oral administration of the crude powder extract of *D. filix-mas* to the test-dogs, five (5) different adverse effects (nausea, emesis, profuse salivation, restlessness and constipation) occurring in combination of two (2) or three (3) effects per dog were observed. Dogs with specimen numbers 16/M, 14/F, 07/F, 06/F, 02/M and 01/F initially salivated profusely and later had constipation while dog numbers 11/F, 10/M, and 08/F were restless, had profuse salivation and finally had constipation. One apparently normal dog with specimen number 09/M later had severe rectal obstruction (impaction) with twisted bunch of paralyzed worms and constipation. Dogs with specimen numbers 15/M, 13/F, 12/M, and 04/F initially had nausea which later resulted in emesis (vomition). However, dogs bearing specimen number 03/M and 05/M did not exhibit any adverse effect throughout the period under observation but at the end defaecated bunch of paralyzed-worms in their faeces.

At the end of it all, 10 dogs exhibited constipation, 9 dogs had salivation in addition to other adverse effects observed and 4 dogs had nausea which resulted in emesis. All the study dogs defaecated bunch of paralyzed adult tapeworms in their faeces (Table 1). About 300 species of ferns including *D. filix-mas* have been used as medicinal plant in Chinese

traditional medicine (Ding *et al.*, 2012). In this study, rhizome powder (extract) of *D. filix-mas* was administered to 16 dogs physically sighted with gravid segments of tapeworm at their anal region. Five (5) different adverse effects (constipation, profuse salivation, nausea, emesis, and restlessness) were observed with each dog showing 2 or 3 of these effects. This is in contrast with the findings of Njobdi *et al.*, (2018) who found 4 distinct adverse effects (nausea, profuse salivation restlessness and excitements) singly except for 2 sheep which showed combined adverse effects. Comparatively, the adverse effects were more severe in this study involving single-stomach animals (non-ruminants) than in the previous study involving complex-stomach animals (ruminants). This could be due to the simple fact that most of the extract constituents are wasted or neutralized in the bulk-complex ingesta of ruminants' than in the chyme of non-ruminants' stomach before biotransformation (Jirillo, .2014). However, this suggests that higher doses of the extract are recommended for oral administration in ruminants than non-ruminants.

Similarly, nausea, profuse salivation and restlessness were observed as common features in both mono-gastric and poly-gastric animals. The restlessness and nausea observed in both cases could be due to up and down movements of the adult worms along the gastro-intestinal tract (GIT) due to the toxic effects of the extracts. This could be also due to the presence of bioactive compounds such as saponins, tannins or alkaloids which can cause irritation of gastrointestinal tract and stimulation of central nervous system which may manifest as restlessness and excessive salivation. In the current study, constipation and salivation were the most consistent adverse effects observed as 62.50% and 56.25% were recorded. Each dog had constipation and salivation in

addition to other adverse effects respectively. The constipation could be attributed to the fact that most nutrients and about 90% water are absorbed from the ingesta / chyme with time while the remaining indigestible material solidifies into faeces and are stored in the distal colon which eventually pushed to the rectum and outside during defecation. Following delay of the faeces in the distal colon, more water / fluid absorbed and hence constipation (Ogobuiro *et al.*, 2019). The profuse salivation exhibited by 56.25% of the study-dogs 1 hour after oral administration of the extract could be due to presence of saponnins in the extract of *D. filix mas* which is known for its foaming properties (Nunomura *et al.*, 2006) and this finding is in agreement with the findings of Njobdi *et al.*, (2018). The constipation and impaction could be due to the presence of indigestible fiber content or secondary metabolites that can slow down gut motility leading to constipation (McRorie, 2015). Four (4) dogs initially had nausea but finally predisposed to emesis which was observed just once. However, this might be as a result of wandering of the adult worms in the gut which provokes anti-peristaltic movements as they perceive the bioactive substance (oleoresin, filicin, filmarone) of the extract (Sekendar *et al.*, 2012).

In this study, very severe rectal impaction was observed in one of the study dogs. The rectum was obstructed with twisted bunch of incapacitated worms. At this juncture, it is pertinent to note that combined effects of twisted bunch of incapacitated worms and constipated faeces will impose a detrimental obstructive effect on it host. Therefore, it is advisable that the administration of *D. filix-mas* extract be accompanied by light doses of non-oily laxatives such as Magnesium sulphate (M₂SO₄) to soften the faeces for easy evacuation. Although the oral therapeutic dose of *D. filix-mas* extract in single-

stomach animals is associated with the aforementioned adverse effects but all disappeared spontaneously. Two (12.5%) of the study-dogs did not exhibit any side effect throughout the period of this study and this may be due to individual's physiological difference. Six (6) hours post-treatment, paralyzed adult worms were defecated in the faeces of all the 16 dogs under consideration.

All the adverse effects observed in this study, are consistent with the reports from other studies examining the toxicity and side effect of *D. filix-mas* and other related fern species. Tiwari *et al.* (2011) reported that oral dose of *D. filix-mas* in rodents caused nausea, and vomition likely due to presence of filicin and other bioactive compounds that irritate the gastrointestinal

tract. Similarly, Singh and Kumar (2014) reported that oral dose of *D. filix-mas* extract induced restlessness and mild GIT upset in experimental animals. Furthermore, Patel *et al* (2015) reported that the emetic and constipating effects can be linked to the presence of phloroglucinol derivatives and tannins in *D. filix-mas* which have shown to affects Gut motility and that the restlessness can be attributed to Central Nervous System (CNS) stimulation and discomfort due to nausea. In contrast, some studies suggest that purified fractions or lower dose of *D. filix-mas* extracts have fewer adverse effects, suggesting that crude extract may contain irritating compounds responsible for these side effects (Gupta and Verma, 2017).

Table 1: Adverse Effects and State of Worms in Faeces of Dogs Treated with Oral Dose of 0.25mg/Kg of *D. filix-mas* Extract

Spécimen No/Gender	Weight (Kg)	Adverse-effects observed	State of worms in faeces
01/F	20	Salivation and constipation	Paralyzed
02/M	20	Salivation and constipation	Paralyzed
03/M	19	No adverse effect	Paralyzed
04/F	24	Nausea and Emesis	Paralyzed
05/M	23	No adverse effect	Paralyzed
06/F	23	Salivation and constipation	Paralyzed
07/F	26	Salivation and constipation	Paralyzed
08/F	18	Restlessness, salivation and constipation	Paralyzed
09/M	16	Impaction/ constipation	Paralyzed
10/M	19	Restlessness, salivation and constipation	Paralyzed
11/F	21	Restlessness, salivation and constipation	Paralyzed
12/M	24	Nausea and Emesis	Paralyzed
13/F	25	Nausea and Emesis	Paralyzed
14/F	17	Salivation and constipation	Paralyzed
15/M	21	Nausea and Emesis	Paralyzed
16/M	20	Salivation and constipation	Paralyzed

KEY: M = Male, F = Female.

Post-Treatment Screening Results of the Treated Dogs

Following the post-treatment screening after 4 weeks of treatment, all the study dogs tested negative for cestode egg. This confirms total response (100%) to treatment with crude extract of *D. filix-mas* by the study dogs (table 2). In a post-treatment screening, it was noticed that all the study-dogs were negative for cestode eggs thereby presenting for the first time in

the study area an overall Cure-Rate of 100%. The current study, revealed that the rhizome extract of *Dryopteris* fern work by paralyzing the voluntary and analogue muscles of Tape worms which leads to their detachment from the mucosa and passing out in faeces in a paralyzed state. The efficacy of this medicinal fern may be attributed to the fact that the vermifuge contains 6% aloeresin and 4% filicin which are reportedly known to have

paralyzing effects on voluntary and analogue muscles of tape worms and is believed to be responsible for the detachment of the worms from the intestinal mucosa thereby resulting in expulsion of such worms in faeces. (Zhao et al., 1992).

However, Njobdi et al, (2018) in their study titled “evaluation of invivo Nematocidal activity, adverse effects and cure-rate of *D. oreades* in sheep” reported that Nematode worms were expelled in the dead state in faeces which implies that other Dryopteris species kills nematodes instead of paralyzing. This wonderful difference may also be due to the anatomically distinct alimentary canal of Nematodes in which vital metabolic processes are inhibited by inherent pharmacokinetic properties of the

compound. This exposes the parasite to higher concentration of the anthelmintic which leads to starvation, dead and expulsion of the parasite (Palva et al., 1965; Takki, 1967). While cestodes do not have alimentary canal hence, food nutrients are absorbed through the body surface by diffusion (Bhaita et al., 2006). There is scanty information in literatures on the study or use of *D. filix-mas* for expulsion of worms in Nigeria because the fern was mostly used locally by private individuals without documentation. Therefore, more researches with wider scope, involving larger sample size, using different parts of this fern (leaves, stem, bark) are required to evaluate the anthelmintic activity of this vermifuge on Trematodes, Cestodes, and Nematodes.

Table 2: Post-Treatment Screening Results of the Dogs Treated with Oral Dose of Crude Powder Extract of *D. filix mas*

Specimen No/ Gender	Weight (Kg)	Remarks
01/F	20	No cestode egg seen
02/M	20	No cestode egg seen
03/M	19	No cestode egg seen
04/F	24	No cestode egg seen
05/M	23	No cestode egg seen
06/F	23	No cestode egg seen
07/F	26	No cestode egg seen
08/F	18	No cestode egg seen
09/M	16	No cestode egg seen
10/M	19	No cestode egg seen
11/F	21	No cestode egg seen
12/M	24	No cestode egg seen
13/F	25	No cestode egg seen
14/F	17	No cestode egg seen
15/M	21	No cestode egg seen
16/M	20	No cestode egg seen

Rate of Response to Treatment with the Oral Dose of the Extract in Relation to Gender

Following oral dose of crude powder extract of *D. filix-mas*, 50% (8) of the female dogs (bitches) and 50% (8) of the male dogs responded to the treatment hence defecated Paralyzed adult tapeworms in their faeces 5 - 6 hours post-treatment. This presented an overall Cure-Rate (CR) of 100% (Table 3). The uniform

positive response in both male and female in this study, suggests that gender does not significantly influence the extract's anthelmintic activity. This further indicates that the active compounds in *D. filix-mas* are broadly effective regardless of sex. Chi square test of sex versus response to treatment at 95% Confidence limit yielded no significant difference with regard to gender ($P>0.05$). This is important as pharmacodynamics can sometimes vary

between sexes due to hormonal or metabolic differences (Soldin and Mattison, 2009). The safety and tolerability although not explicitly stated, the positive results and spontaneous disappearance of all adverse effects in this study may imply tolerability at the administered dose. However, it is important to note that *D. filix-mas* extracts contain compounds such as filicin and aloeresin that can cause neurotoxicity and GIT irritation at higher doses (Hostetmann and Marston, 1995). So, dosing must be carefully controlled.

The 100% response to oral dose of *D. filix-mas* in this study, aligns well with several previously reported anthelmintic efficacies of *D. filix-mas* and other related fern species. For example, Nwafor et al (2018) reported that oral dose of *D. filix-mas*

extract resulted in complete elimination of *Taenia* species/ eggs in experimentally infected dogs within 4 weeks post-treatment. Similarly, Okoli et al. (2010) reported 100% reduction in cestodes egg-count in dogs treated with fern extracts, attributing this efficacy to bioactive compounds such as filicin which disrupt the metabolism and tegument integrity of tape worms. Moreover, the duration of four (4) weeks post-treatment is consistent with the life cycle and egg shedding patterns of cestodes, making this a reliable time frame for confirming treatment efficacy. The total absence of cestodee eggs post-treatment thus strongly indicates the anthelmintic potential of *D. filix-mas* crude rhizome powder extract (Tylor et al., 2016).

Table 3: Rate of Response to Treatment with Oral Dose of Crude Powder Extract of *D. Filix mas* Assessed in Relation to Gender

Gender	Rate of response to treatment in percentage		State of worms in faeces
	No. / % Positive	No. / % Negative	
Males	8 (50)	0 (0)	Paralyzed
Females	8(50)	0 (0)	Paralyzed
Total	16 (100)	0 (0)	

Chi Square Test (Gender Versus Response to Treatment). $X^2_1, 0.05 = 0.5342^{ns}$

CONCLUSION

In conclusion, it was noticed in this study that oral dose of *D. filix-mas* powder extract was associated with profuse salivation, restlessness, nausea, emesis and constipation in mono-gastric animal such as dogs however, these effects were found to have disappeared spontaneously. The current study also revealed that the rhizome extract of *Dryopteris* fern has paralyzing activities on voluntary and analogue muscles of Tape worms thereby leading to their detachment from the intestinal mucosa and passing out in faeces in a paralyzed state. Therefore, it is quite interesting to conclude that *D. filix-mas* was found to be very effective for expulsion of tape worms as cure rate of

100% cut across both sexes was recorded in this study.

RECOMMENDATIONS

Since, severe constipation and obstruction of the rectum was observed in dogs treated with oral dose of *D. filix-mas* powder extract, it is recommended that the oral doses be accompanied with light doses of non-oily laxatives (magnesium sulphate) to soften the faeces and ease the expulsion of the paralyzed worms. Administration of *D. filix-mas* extract in dogs should be followed by confinement and 3 to 4 hours off-feed to allow the worms in the gut to absorb enough quantities of the medicinal fern.

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REFERENCES

- Adebayo, A. A. (2001). Temperature variability and outbreak of meningitis and measles in Yola, Nigeria, *Global Journal of Pure and Applied Sciences*. 7(1): 133-135.
- Adewale, O. and Onu, J. (2017). Agricultural practice in Taraba State: A case study of Jalingo Local Government Area. *Journal of Agricultural Studies*, 12 (13), 45-52.
- Bami, Y. (2009). Urban Planning Land and Survey Geographer. Taraba State Diary 4-6.
- Bahadori, M. B., Mahmoodi, K. F., Aliahmadi, A., Bahadori, S. and Valizadeh, H. (2015). Antibacterial evaluation and preliminary phytochemical screening of selected ferns from Iranian. *Research Journal of Pharmacology*, 2:53-59.
- Bhatia, B. B. K., Pathak, M. L. and Banerjee, D. P. (2006). *Textbook of Veterinary Parasitology*. 140-207S
- Britto, J. D., Gracelin, H. S. and Kumar, P.B. (2012). Phytochemical studies on five medicinal ferns collected from Southern Western Ghats, Tamil-Nadu. *Asian Pharmacologic Journal of Tropical Biomedics* ;2:536-538.
- Ding, Z.T., Fang, Y.S., Tai, Z.G., Yang, M.H., Xu, Y.Q., Li, F. and Cao, Q.E. (2008). Phenolic content and radical scavenging capacity of 31 species of ferns. *Fitoterapian Journal of Natural Science*, 79:581–583.
- Dryon, R. M. and Vitale, G. (1997). Evidence for antheridiogen production and its mediation of a mating system in natural populations of fern gametophytes. *Botanical Journal of the Linnean Society*, 74:243-249
- Eskandari, M., Riazi, B., Shirzadian, S. and Mazooji, A. (2012). Investigation of fern species in Guilan province. *Rostaniha*.13:1-9.
- Gupta, R. and Verma S. (2017). Comparative studies on the safety profile of crude and purified extracts of *D. filix-mas* *Journal of Ethnopharmacology*, 198 150-156.
- Hostettmann, K. and Marston, A. (1995). Saponins, Cambridge University press. *Discusses the chemistry and biological chemistry*, 32-37.
- Idris, A. M., and Musa, H. (2021). Topographical influence on Microclimates of the Mambilla plateau region. *International Journal of Geography*, 9(1),102-117.
- Jirillo, E. (2014). Immuno-modulation by Parasitic Helminthes and its therapeutic exploitation erythrosora. *Iranian Journal of Pharmacological Research*, 11:991-997.
- Mahmoodi, K. F., Valizadeh, H., Hosseinzadeh, Z. and Bahadori, M. B. (2015). Furanocoumarins from *Heracleum rawianum* in Iran. *Iranian Chemo-Community*, 3:1-6.
- McRorie, J. W. (2015). Evidence-based approach to fiber supplements and

- clinically meaningful health benefits, part 1: what to look for and how to recommend.
- Musa, I. M., Adamu, S., Salau, W., Ayodeji, B. O. (2022). People's perception of land use changes along the flood plain of River Gwoi in Jalingo, Taraba State, Nigeria. *Gombe Journal of Geography and Environmental studies*, 2 (3), 2714-3201. <http://www.goigesjournal.com>
- Ministry of Land and Survey (2021). Map of Taraba State. Taraba State Ministry of Land and Survey, Jalingo.
- National Bureau of Statistics (NBS), Nigeria (2023). Estimated Population for Jalingo Local Government Area based on average annual growth rate of 3%, typical for Nigerian Urban Areas, National Bureau of Statistics, 67-78.
- National Population Commission (2006). Nigeria population Census Report 23-25.
- Njobdi, A. B., Umar, A., Bobbo, A. A., Zubairu, A., Abwage, S. A., Tukur, I. S., Ibrahim, H., Njobdi, M. W. and Sani, U. M. (2018). Evaluation of in vivo Nematocidal activity, Cure-Rate and adverse effects of crude extract of *D. oreades* in sheep in Ardo Kola Local Government Area of Taraba State, Nigeria. *Taraba Journal. of Agricultural Research*, 6 (2) 94-102.
- Nunomura, A., Castellani, R., Zhu, X. Moreira, P. Perry, G. and Smith, M. (2006). Involvement of oxidative stress in Alzheimer disease. *Journal of Neuropathological Experiment*, 65:631-41.
- Nwarfor, S. V., Okwuosa, C. N. and Ezeh, O. (2018). Anthelmintic effects of *D. filix-mas* extract on experimental canine cestodosis. *Veterinary Parasitology*, 254, 45-50
- Ogobuiro, I. Tuma, F. and Statpearls, M. (2019). Pathophysiology of Gastrointestinal tract Treasure Island (FL), *PubMed*. 11(4) 54-60.
- Okoli, I. C., Nwosu, C.O., & Eze, N. C. (2010). Efficacy of fern extracts against intestinal cestodes in dogs *Parasitology research*, 107(3), 589-594.
- Palva I. P. (1965). Expulsion of the fish tapeworm using aspidin and disaspidin. *Annual Medical International Journal*, 54 (3) 137-138
- Petal, S. Petal, T. & Petal, M. (2015). Effects of tannins and related compounds on gastrointestinal tract motility: An overview: Phytotherapy Research, 29(3), 321-338.
- Sekendar, M. A., Kawsarul, M., Obayed, M. R., Khalilur, M. R., Aslam, M. H. and Shah, M. A. (2012). Antioxidant and Cytotoxic activities of Methanolic extract of *Dryopteris filix-mas* (L.) Schott Leaves. *International Journal. of Drug Development and Research*, 4(2): 223-229.
- Singh, R. and Kumar, V. (2014). Toxicological evaluation of *D. filix-mas* extracts in experimental animals. *Journal of Herbal Medicine*, 4(2), 55-60
- Taraba State Ministry of Commerce (2019). Economic activities Reports, 43-44.

- Taraba State Government (2020). Taraba State Profile on Urban, Semi-Urban and Rural settlements of Jalingo Local Government Area, Taraba State, Nigeria, 37-38.
- Takki, S. (1967) Anthelmintic Effect of fern preparation and their action on some liver function test in man. *Annual Medical Experiment P Bid Fenn*, 45, 341-51.
- Taylor, M. A., Coop, R.I., & Wall, R.I (2016). *Veterinary Parasitology*. (4th ed) Wiley-Black Well. 123-134.
- Tiwari, R., Kumar, B. Kaur, M., Kaur, G. & Kaur, H. (2011). Phytochemical screening and extraction. A review *International Pharmaceutical Sciences*, 1 (1), 98-106.
- Uwumarongie, H.O., Enike, M. A. and Bafor, E.E. (2016). Pharmacognostic evaluation and gastrointestinal activity of *D. Filix mas* (L) schott. *Journal of herbal chemistry*, 2 (1) .19-25.
- Valko, M., Leibfritz, D., Moncol, J. Cronin, M. Mazur, M. and Telser, J. (2007). Free radicals and antioxidants in normal physiological functions and human disease. *International Journal of Biochemistry & Cell Biology*, 39: 44–84.
- Zhang M., Cao, J., Dai, X., Chen, X. and Wang, Q. (2012). Flavonoid Contents and Free Radical Scavenging Activity of Extracts from Leaves, Stems, Rachis and Roots of *Dryopteris*, *Iranian Journal of Medicinal Plants*, 13:35-41
- Zhao, G. Y., Hui, J. K., Rupprecht, J. L. M., McLaughlin, J. L. and Wood, K. V. (1992). Additional bioactive compounds and trilobacin, a novel highly cytotoxic acetogenin, from the bark of *Asimina triloba*. *Journal of Natural Products*, 55: 347-356.