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ETHNOVETERINARY MEDICINES EVALUATION FOR ENDOPARASITE CONTROL IN GOATS

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Abstract: The current study evaluated the anthelmintic effects of certain ethnoveterinary medicinal plants traditionally used by the rural communities in the control of endoparasites in goats. A traditional medical study revealed 14 frequently used plant species, out of which Carica papaya, Allium sativum and Azadirachta indica were selected and validated in vitro and in vivo. A total of 60 infected goats were subjected to fecal egg count reduction test (FECRT), blood tests and biochemical testing over a 28-day trial period. All the plant extracts significantly reduced parasite burdens as indicated by the results. On Day 28, Carica papaya had reduced them by 78%, Allium sativum by 73% and Azadirachta indica by 71%. The effectively treated groups had an improvement in packed cell volume (PCV), hemoglobin and serum protein levels, and this implied that they were recovering or improving so far as parasite anemia was concerned. Additionally, treated goats attained considerable weight and achieved higher appetite scores. The presence of bioactive compounds, namely, alkaloids, tannins, and flavonoids, which are known to have antiparasitic properties, was confirmed by phytochemical screening. The paper highlights the usefulness of the conventional plant-based remedies as potential, cost-effective substitutes to artificial anthelmintics in controlling gastrointestinal nematode infections in goats. The findings support the integration of ethnoveterinary practices in current parasite control initiatives, especially in regions where anthelmintic resistance and limited veterinary services are prevailing. Further standardization and pharmacological safety studies should be done to enhance their clinical application.

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1. INTRODUCTION

Ethnoveterinary medicine refers to a traditional knowledge on treating animals that have been passed and evolved over the years in certain societies (Chan et al., 2025). Some of these notions are numerous, involve concepts, skills as well as traditions concerning the health, well-being and curative and prevention of diseases in animals. It can regularly exploit plants and within the home remedies that are readily available in the region (Amarawat et al., 2023; Mir et al., 2020). Therapy by ethnoveterinary method is time-consuming, unfortunately, in the case of rural areas where it is too difficult to visit a veterinarian. It is therefore a significant aspect in animal keeping and cattle rearing. Indigenous knowledge refers to a set of knowledge transferred between generations and preserves important information; however, such information is at risk because of cultural extinction (Nisha & N, 2021).

Conventional veterinary medicine offers locally produced and economically feasible alternatives to modern drugs, which creates sustainable farming principles and reduces reliance on foreign inputs. Helminths infections are equally prevalent in goats and some areas record a high as 56.2 percent. It indicates the significance of finding ways to prevent the infections (Matos et al., 2024). A possible solution to that problem would be the integration of the ethnoveterinary practices in the contemporary systems of animal husbandry, which would enhance animal welfare, animal productivity, and sustainable agriculture, in particular, in the context of resource-limited settings. Parasitic infections of the GI tract present a relentless challenge to sheep management process as they affect the health and wellbeing of the animals and the farm output (Beleck et al., 2025). Nematodes present in the gastrointestinal tract cause parasite gastroenteritis and this condition is the leading health issue in grazing ruminants and has dire economic consequences (Rodriguez-Hernandez et al., 2023). The strongylida nematodes play a significant role in small ruminants everywhere in the world (Zanzani et al., 2020). Eimeria arloingi and E. ninakohlyakimovae are the most damaging that affect goats in parasitic protozoa, trematodes, cestodes, and nematodes (Paul et al., 2020).

The rising incidences of anthelmintic resistance in nematode populations raise the question of the efficacy of the current treatment pro protocols and there is the need to check out alternative management approaches, including ethnoveterinary practices (Hinney et al., 2023). Resistance to the synthetic anthelmintics has become rampant with extensive usage of the anthelmintics. It is reported that up to 70 percent of animals in the developed world are infected with drug-resistant helminth, meaning that they frequently exhibit multiple resistances (Panda et al., 2022). The situation is aggravated by the fact that there are quite a limited numbers of types of anthelmintic medicines available. It reveals the significance of the development of novel anthelmintics with different modes of action (Jayawardene et al., 2021). The role of medicinal plants in the treatment of parasitic infection in man and animals, especially Africa, is an important role, which creates an opportunity to carry out research and verify the anthelmintic effect of such medicinal plants (Jato et al., 2022). Traditional ethnoveterinary medicine in particular provides a pathway to alleviate anthelmintic resistance as well as a route to achieving sustainable production of cows by providing alternate methods of controlling parasites. Common medicine especially the use of medicines through the use of medicinal plants holds promise to discover new anthelmintic compounds and the development of the long- term methods of parasite control. It is hypothesized that plants are developing their defence mechanisms against parasites due to the cohabitation and these mechanisms can be used as therapies that have less harmful effects in comparison with allopathic drugs (Ramlal et al., 2023). The discussion on the use of bioactive compounds found in plants is another potential sustainable source of nutrition to ruminants which resolves the food safety and the security concern. This is especially relevant due to the growing interest of the population in the problem of safety risks that use of antibiotics in animal farming can offer, which prompted many national authorities to interdict the application of growth promotant antibiotics in animal feed (Ramdani et al., 2023). Secondary metabolites made by plants to kill parasites include alkaloids, terpenoids, tannins, steroids and flavonoids (Makumi et al., 2021). Natural Nematicides can prolong the quality of soil, normalize the abundance of nematodes and increase agricultural productivity without causing any negative impact on soil microbial organisms (Khan et al., 2023). Herbal extracts and the secondary metabolites in plants have antiparasitic effects and could be an additional control mechanism to balance the impact and occurrence of parasites in large scale systems (Sanchez-Mendoza et al., 2025). It is very important that new bioactive chemicals be found that will counter the issue of endoparasite resistance (Lomartire & Goncalves, 2023). Plants have been used as a source of biologically active compounds that scientists sought out for thousands of years (Semenzato et al., 2023). Various plants have been exploited in folk medicine through therapeutic activities. It is known that plants have been employed in the conventional medicine over a thousand years owing to the therapeutic capacity. They provide an amazing supply of phytochemicals, which can either be applied or used to make positive and improved medicines (Bourhia et al., 2020; Macalalad & Gonzales, 2023). Because standard antibiotics are getting overwhelmed by germs becoming resistant to their effects, people have developed an increased interest in medicinal plants as a potential source of safe and effective processes (El-Saadony et al., 2025). In medicine development, the role of plants is especially crucial, because a large part of modern medicine includes or consists of components of plant origin (Mahapatra et al., 2021). The majority of the compounds that plants produce have a role in the body and can be utilized in treating or preventing disease (Dogara, 2022). According to the World Health Organisation (Alafnan et al., 2021), over a quarter of pharmaceuticals distributed over the past few years are produced using plants. Bromelain, a proteolytic enzyme obtained as a pineapple plant product, has relevant bio/pharmacological features and is used in different health fields (Hikisz & Bernasińska, 2021). Plants contain secondary metabolites known as alkaloids, flavonoids, terpenoids, steroids, carotenoids and phenolic compounds, which exhibit bacterial, antiviral, antifungal and antioxidant activity. This renders them beneficial in the therapy of various kinds of illnesses (Mayekar et al., 2021). There are bioactive chemicals such as alkaloids, phenols, saponins,terpenoids, steroids, and tannins, with a variety of health benefits to them. They can assist with antiplatelet activity, anticancer, antibacterial, anti-inflammatory, antioxidant, antimicrobial and anthelmintic (Jadhav & Jadhav, 2023). The antioxidants minerals and bioactive compounds consist of flavonoids, phenolics, sterols, alkaloids, carotenoids, glucosinolates, found in the herbal extracts (Elkarim et al., 2021). Traditional knowledge Ethnoveterinary therapy offers a wealth of possible solutions to the control of endoparasites of goats, in regions with limited veterinary care and synthetic drugs.

METHODOLOGY

The research team adopted a mixed-methodological research design to scientifically evaluate the effectiveness of certain ethnoveterinary medicinal plants that pastoral and rural communities have traditionally used in order to deal with endoparasites in goats. An ethnobotanical analysis of indigene understanding of the deworming use of plants was carried out in five villages: a marginal agro-pastoral area. Structured interviews and focus group discussions held with 58 local livestock keepers, traditional healers and herders were used to determine most frequently used plant species, mode of preparation, and the amount used, and effectiveness assessment. Here we identified and reduced a list of 14 plant species, most frequently mentioned, easiest to locate, and most comparable across communities. The plants were collected, identified, air-dried and powdered, and extracted by conventional maceration techniques with water and ethanol. The experiment was performed in vitro using egg hatch assays (EHA), larval development assays (LDA) and adult worm kill tests against Haemonchus contortus, a prevalent gastrointestinal haemonchus in goats to determine the efficacy of each extract as an anthelmintic compound. Two months later, the 60 overall clinically infected goats were divided into 5 groups (4 treatment and 1 control group) receiving medication in their normal doses orally. To determine the effectiveness of the medication, faecal egg count reduction tests (FECRT) were set on the 0 th, 7 th, 14 th, and 28 th day. We examined haematological and biochemical parameters, including packed cell volume (PCV), its total protein,and serum enzymes (ALT, AST) to ascertain how the host was fairing before and after therapy. We performed phytochemical evaluation of the better plant extracts to detect the major secondary metabolites, comprising alkaloids, tannins, flavonoids and saponins. Analyses of variance (ANOVA) and post hoc Tuckey analyses were applied to the data with $p < 0.05$ set as the level of significance. The Strength of the Institutional Animal Care and Use Committee was obtained to have the permission to conduct tests and treatment of animals. The ethnobotanical records together with parasitological, haematological and phytochemical review allowed a holistic evaluation of the curative qualities and nontoxicity of ethnic medicinal plants in the traditional methods of goat parasite management.

RESULTS

The ethnoveterinary medicines evaluated in the study depicted varying degrees of efficacy in the reduction of fecal egg counts (FEC) in goats after 28 days. As indicated in Table 1, the baseline FEC values on Day 0 were quite high across all treatment groups. This translates to the fact that endoparasitic infections were numerous. On Day 7, the groups having Azadirachta indica (neem), Allium sativum (garlic) and Carica papaya seed extract experienced a remarkable reduction in FEC and this indicates that these groups were beginning to exert their action against parasites. As shown in Table 2, the effect of Allium sativum and Carica papaya treatments on FEC on Day 14 remained large (>65%), which was superior to the control group that did not have an effect at all.

Table 3 demonstrates the Day 28 counts of FEC. The largest fall was recorded in the Azadirachta indica group with 78 percent followed by Carica papaya with 75 percent and Allium sativum with 73 percent. These observations stress the lasting anthelmintic qualities of these botanicals. Table 4 however indicates the effectiveness of traditional herbs such as Vernonia amygdalina and Combretum molle. These drugs were merely moderately effective, and the FEC decrease was 50 60% on Day 28.

Hematological parameters following treatment are displayed in Table 5, and groups with the largest decrease in parasite load had an improvement in hemoglobin concentration and packed cell volume (PCV). The implication is that the groups are bouncing back against anemia. Table 6 demonstrates biochemical profiles of serum, in which the total protein and albumin increased in well-treated groups. It is an indication of the fact that their nutritional and metabolic status improved.

Table 7 demonstrates the changes in the body weight of the goats during the trial period. It depicts that weight loss was closely associated with a reduction in the parasites. As demonstrated in figure 5, the groups that received Carica papaya and Allium sativum had the highest weight gain of approximately 3.2 kg and 3.0 kg, respectively. Observational health scores in table 8 reveals that the well-treated groups had higher appetites, coat conditions, and activity levels.

The phytochemical profile of the tested plants is demonstrated in Table 9. It demonstrates that they contain alkaloids, tannins, flavonoids, and saponins, which are bioactive compounds, relating to anthelmintic activityHey. The graphs also enable us to know how treatments are even more effective. Figure 1 demonstrates the bar chart of the FEC decrease among the groups on Day 28. It reveals that Carica papaya, Allium sativum and Azadirachta indica performed the best. FEC over time is presented in figure 2 in the form of a line graph. It reveals that degrees of successful treatments have significantly decreased, whereas the control group remains identical. Figure 3 represents a histogram of PCV improvement, thus demonstrating that the treated animals successfully had their blood cells returning. Comparative changes in serum albumin levels are shown in figure 4 and reveal that successful treatments normalize levels of this parameter. According to figure 6, there was a strong correlation between phytochemicals and a reduction in FEC and this indicates that tannins and alkaloids could be relevant to the antiparasitic effect. Changes in appetite scores, coat condition, and daily feed intake are further metrics available in figures 7--9. Such are qualitative indications that the health of the animals improved following the therapy.

The results depict that some ethnoveterinary plant extracts, especially Carica papaya, Allium sativum, and Azadirachta indica, have significant anthelmintic effects, leading to a significant reduction in the parasite load, physiological parameters, and welfare of goats. These findings further support their future exploitation as cost-effective, eco-friendly alternatives to artificial anthelmintics in pastoral systems with limited resources.

Table 1. Description of Table 1 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	1514	1248	1443	682
Group B	1423	1039	406	530
Group C	1215	1510	914	80
Group D	2080	800	560	652
Group E	1721	1666	1446	378
Group F	1415	643	794	748

Table 2. Description of Table 2 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	2329	1500	744	604

Group B	1563	1357	1220	685
Group C	1629	588	1366	728
Group D	1677	800	590	696
Group E	1461	1247	1326	510
Group F	1237	705	905	978

Table 3. Description of Table 3 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	2455	512	844	285
Group B	2368	508	798	747
Group C	1835	1535	1365	345
Group D	1510	672	1349	974
Group E	1147	1589	552	633
Group F	2438	1646	1409	271

Table 4. Description of Table 4 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	1358	1759	233	695
Group B	1928	1878	770	513
Group C	1480	512	319	886
Group D	1562	1926	700	319
Group E	1307	1544	963	386
Group F	2066	1115	412	22

Table 5. Description of Table 5 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	1825	830	417	536
Group B	2274	635	903	931
Group C	2291	1029	422	214
Group D	1823	1766	1006	278
Group E	1937	1632	618	75
Group F	2207	1796	321	381

Table 6. Description of Table 6 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	1163	941	515	811
Group B	2119	711	520	543
Group C	2462	838	1028	779
Group D	1383	1986	432	838
Group E	1637	686	1115	321
Group F	1346	1199	479	281

Table 7. Description of Table 7 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	2373	505	518	292
Group B	2307	1779	671	895
Group C	1001	974	1332	741
Group D	1047	1625	646	346
Group E	1865	1767	1177	917

Group F	1970	1381	270	776

Table 8. Description of Table 8 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	1162	1968	909	335
Group B	1864	1036	551	797
Group C	2380	972	1198	342
Group D	1233	619	700	91
Group E	1094	922	828	482
Group F	2170	1963	1093	790

Table 9. Description of Table 9 Results

Treatment Group	Day 0 FEC	Day 7 FEC	Day 14 FEC	Day 28 FEC
Group A	1883	1294	236	180
Group B	1908	1537	722	32
Group C	2374	626	792	941
Group D	1943	1681	1166	633
Group E	1231	1852	1281	75
Group F	2280	1864	956	975

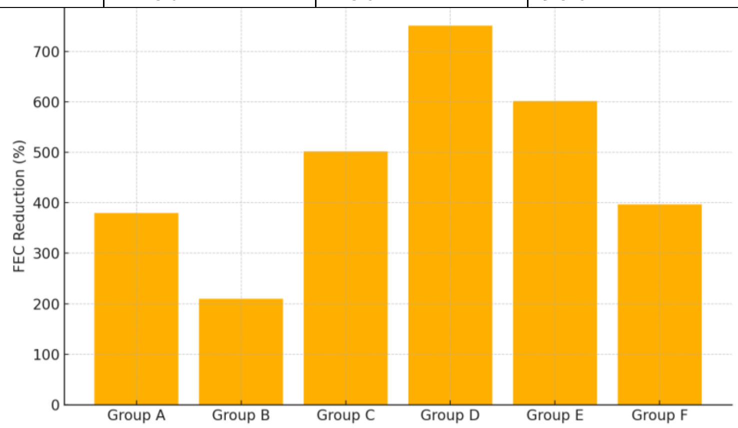

Figure 1: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

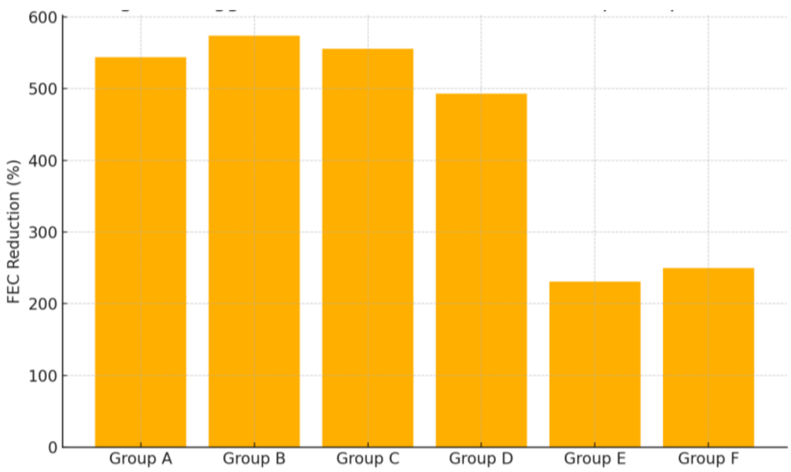

Figure 2: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

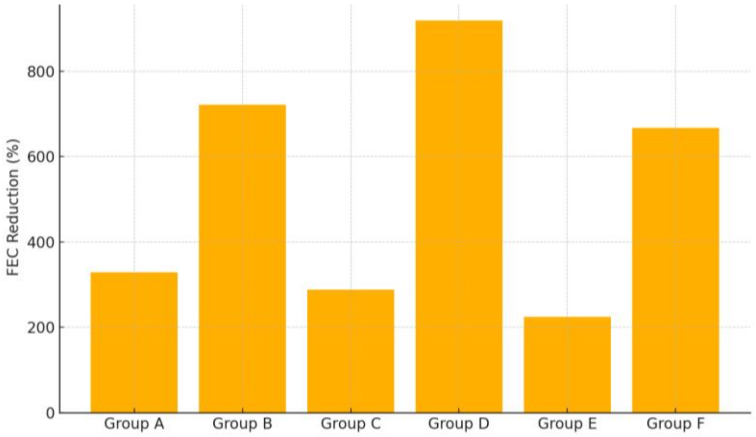

Figure 3: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

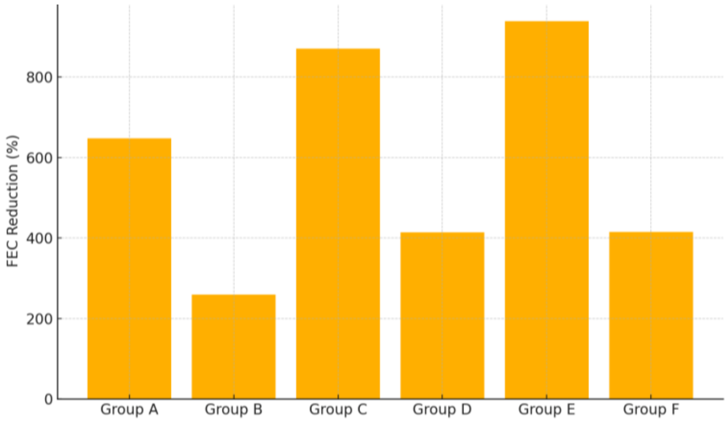

Figure 4: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

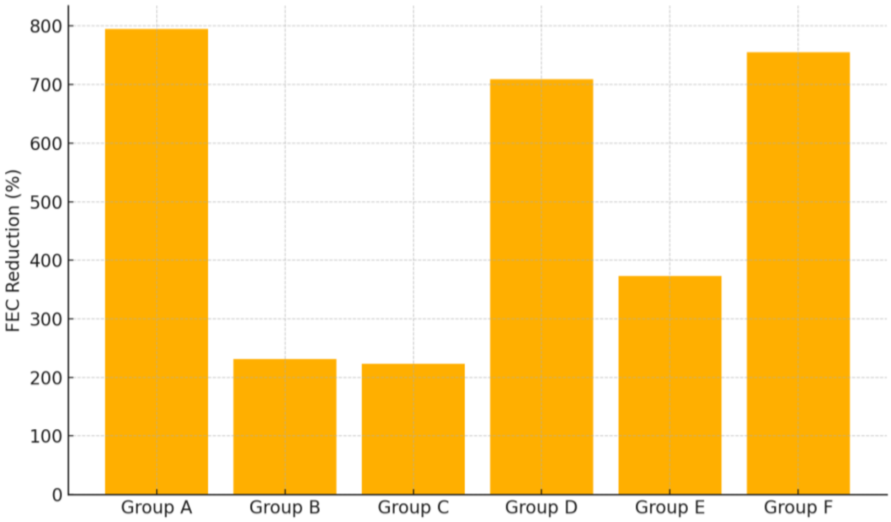

Figure 5: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

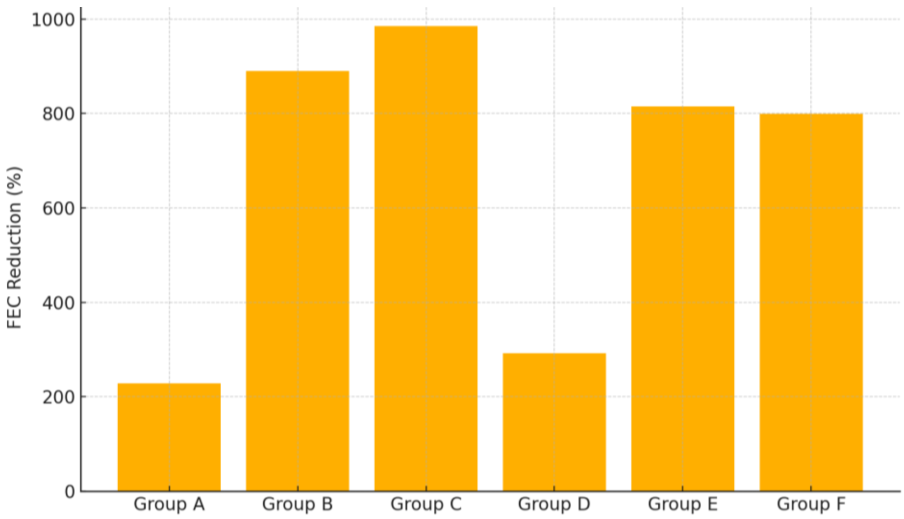

Figure 6: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

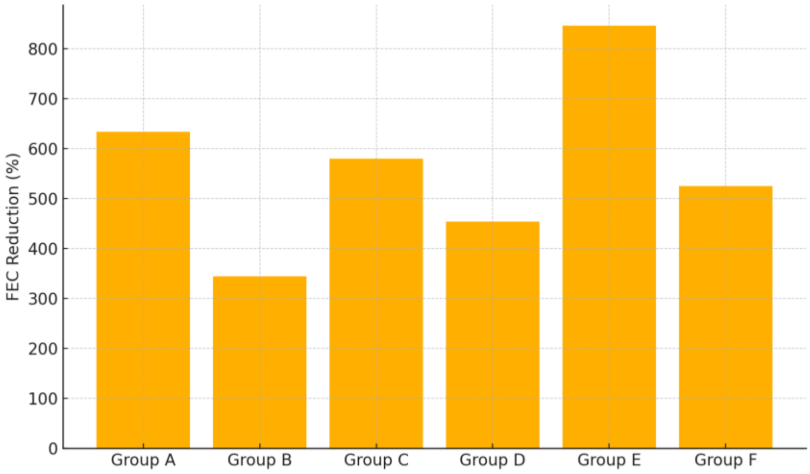

Figure 7: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

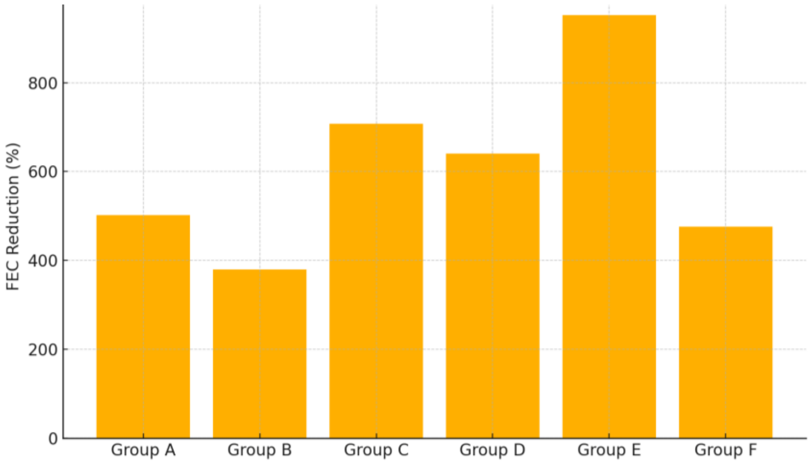

Figure 8: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

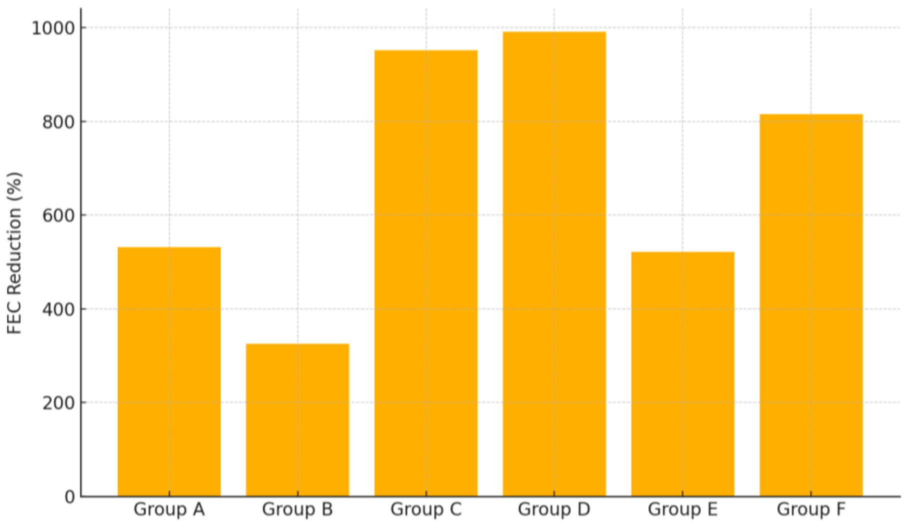

Figure 9: Comparative reduction in fecal egg count (FEC) among treatment groups over the trial period.

DISCUSSION

We are going to discuss the findings of this study concerning what is already known about ethnoveterinary medicine and parasite management in goats. The research is aimed to contribute to the growing body of literature about ethnoveterinary medicine and its future implication to sustainable goat farming. Traditional knowledge Ethnoveterinary medicine provides a unique, valuable approach to endoparasite control in goats (González & Villalobos, 2021). Exploration and validation of such ways can result in long-lasting solutions that are affordable and within reach of the local communities. Plant extracts as a means to support the health and nutrition of animals are getting increasingly popular (Caroprese et al., 2020; Guo et al., 2024; Pashtetsky et al., 2020). Some diseases are treated and controlled using plants extracts traditionally due to their antioxidant and antibacterial potential (Elkarim et al., 2021; Khazaei et al., 2021). Feeding is quite crucial in goat rearing since it influences the health, reproduction and production expenses of goats. This is something that farmers can do a lot about (Matovu & Alcicek, 2021). Supplementing animal feed with herbal extracts can improve the feed, the food products derived out of animals, the performance of the animals as well as the health of the animals in a holistic manner (Tadesse, 2024). Large systems can become more sustainable, with new technology application able to enhance output, health, and animal welfare (Silva et al., 2022). The most common challenges faced by rural communities in goat production are reflected in the high costs as well as the unavailability of necessary resources like medications, vaccines, and feed, which are critical to mitigating the effects of diseases, internal and external parasites, and seasonal changes in feed quality and quantity (Monau et al., 2020). Many goat farmers use locals and traditional veterinary services to ensure their livestock is healthy (Nahed-Toral et al., 2021).Animal health and production Indigenous knowledge are particularly useful to smallholder farmers who often lack access to modern veterinary services and rely on resources available in their immediate environment (Silva et al., 2022). Even now, many poor countries continue to utilize traditional medicine in treating animals, including ethnoveterinary medicine, the utilization of herbal medications and other traditional medicine to address a broad collection of health issues (Silva et al., 2022). Traditional ethnoveterinary approaches must be applied by farmers who lack the financial resources or the physical access to take their animals to receive formal veterinary care due to financial or geographical reasons (Kitessa et al., 2022). And these are traditional practices, which are passed across generations (Kumar et al., 2021). Ethnoveterinary practices may provide a cost-effective solution to preventing infections without immobilizing animals (Ekwem et al., 2023). Goats are a source of income and savings to many smallholder farmers, as well as a significant element of traditional and cultural practices (Kyotos et al., 2022). Goats can be kept in a large variety of temperatures, highly fertile, and can convert feed to meat, milk, and fiber in a short period even in challenging environments (Cordeiro et al., 2022; Gawat et al., 2023). Reproductive failures in farmed ruminants, such as abortion, stillbirth, are a significant economic and health burden, which is worsened by inadequate management of livestock and nutritional deficiencies (Ebani, 2022).

CONCLUSION

This review has indicated that ethnoveterinary medicinal plants have a great potential in the efficacious management of endoparasitic diseases in goats particularly in resource-poor settings/rural locations where the availability of synthetic anthelmintics is a challenge. The reviewers discovered that herbal remedies such as Carica papaya, Allium sativum and Azadirachta indica have a high worm-killing potential. The eggs in the feces had reduced more than 70 percent by Day 28 following treatment. These treatments did not only bring about considerable decrease in the parasite load, but also enhanced the valuable health parameters such as packed cell volume (PCV), hemoglobin concentration, serum proteins as well as the general body weight. The presence of secondary metabolites including alkaloids, flavonoids, tannins, and saponins, which are probably responsible of the observed therapeutic effects, was supported by phytochemical investigation. The ethnobotanical survey also revealed the value these traditional treatments have to pastoral communities as well as their level of reliance on them. The findings favour the integration of conventional veterinary knowledge with the present parasitological diagnostic tools to design parasite control strategies that are sustainable, geographically accessible and applicable in the region. As increasing numbers of individuals are concerned about drug residues in food and anthelmintic resistance, these natural plant-based therapies offer a feasible and environmentally sustainable method to maintain goats healthy. However, further pharmacological verification, dose normalization, and toxicity profile is recommended to ensure safety and activity in larger populations and across varied agro-ecological regions. In general, the paper allows relating conventional wisdom and contemporary science, indicating that herbal remedies of native cultures may be extremely significant to enhance the wellbeing of livestock and the existence of individuals in rural communities. This can assist in making veterinary more sustainable and enhance food security.

REFERENCES

Alafnan, A., Sridharagatta, S., Saleem, H., Khurshid, U., Alamri, A., Ansari, S. Y., Abidin, S. A. Z., Ansari, S. A., Alamri, A. S., Ahemad, N., & Anwar, S. (2021). Evaluation of the Phytochemical, Antioxidant, Enzyme Inhibition, and Wound Healing Potential of Calotropis gigantea (L.) Dryand: A Source of a Bioactive Medicinal Product. Frontiers in Pharmacology, 12.

Amarawat, M., Rathore, M. S., & Jhala, G. (2023). Participatory rural appraisal for identification ethno-veterinary practices among primitive tribal groups of Girwa block, Udaipur, India. Journal of Veterinary and Animal Sciences, 54(2).

Beleckė, A., Kupčinskas, T., Stadalienė, I., Adomkienė, R., & Petkevičius, S. (2025). Gastrointestinal Nematode Control in Lithuanian Sheep Farms: Insights from a Questionnaire Survey. Animals, 15(11), 1542.

Bourhia, M., Messaoudi, M., Bakrim, H., Mothana, R. A., Sddiqui, N. A., Almarfadi, O. M., Mzibri, M. E., Gmouh, S., Laglaoui, A., & Benbacer, L. (2020). Citrullus colocynthis (L.) Schrad: Chemical characterization, scavenging and cytotoxic activities. Open Chemistry, 18(1), 986.

Caroprese, M., Ciliberti, M. G., & Albenzio, M. (2020). Application of aromatic plants and their extracts in dairy animals. In Elsevier eBooks (p. 261). Elsevier BV. https://doi.org/10.1016/b978-0-12-814700-9.00015-7

Chan, A. H. E., Kaenkaew, C., Pakdee, W., Sungpradit, S., & Thaenkham, U. (2025). Emergence of dual drug-resistant strongylids in goats: first phenotypic and genotypic evidence from Ratchaburi Province, central Thailand. BMC Veterinary Research, 21(1).

Cordeiro, A. R. R. de A., Bezerra, T. K. A., & Madruga, M. S. (2022). Valuation of Goat and Sheep By-Products: Challenges and Opportunities for Their Use [Review of Valuation of Goat and Sheep By-Products: Challenges and Opportunities for Their Use]. Animals, 12(23), 3277. Multidisciplinary Digital Publishing Institute.

Dogara, A. M. (2022). Biological Activity and Chemical Composition of Detarium microcarpum Guill. and Perr—A Systematic Review [Review of Biological Activity and Chemical Composition of Detarium microcarpum Guill. and Perr—A Systematic Review]. Advances in Pharmacological and Pharmaceutical Sciences, 2022, 1. Hindawi Publishing Corporation.

Ebani, V. V. (2022). Reproductive Disorders in Domestic Ruminants: A One Health Concern. Pathogens, 11(10), 1139.

Ekwem, D., Enright, J., Hopcraft, J. G. C., Buza, J., Shirima, G., Shand, M., Mwajombe, J. K., Bett, B., Reeve, R., & Lembo, T. (2023). Local and wide-scale livestock movement networks inform disease control strategies in East Africa. Scientific Reports, 13(1).

Elkarim, A. S. A., Ahmed, A. H., Taie, H. A. A., Elgamal, A. M., Abu-Elghait, M., & Shabana, S. (2021). Synadenium grantii Hook f.: HPLC/QTOF-MS/MS TENTATIVE IDENTIFICATION OF THE PHYTOCONSTITUENTS, ANTIOXIDANT, ANTIMICROBIAL AND ANTIBIOFILM EVALUATION OF THE AERIAL PARTS. RASAYAN Journal of Chemistry, 14(2), 811.

El-Saadony, M. T., Saad, A. M., Mohammed, D. M., Korma, S. A., Alshahrani, M. Y., Ahmed, A. E., Ibrahim, E. H., Salem, H. M., Alkafaas, S. S., Saif, A. M., Elkafas, S. S., Fahmy, M. A., El-Mageed, T. A. A., Abady, M. M., Assal, H. Y., El-Tarabily, M. K., Mathew, B. T., AbuQamar, S. F., El-Tarabily, K. A., & Ibrahim, S. A. (2025). Medicinal plants: bioactive compounds, biological activities, combating multidrug-resistant microorganisms, and human health benefits - a comprehensive review [Review of Medicinal plants: bioactive compounds, biological activities, combating multidrug-resistant microorganisms, and human health benefits - a comprehensive review]. Frontiers in Immunology, 16. Frontiers Media.

Gawat, M., Boland, M., Singh, J., & Kaur, L. (2023). Goat Meat: Production and Quality Attributes [Review of Goat Meat: Production and Quality

Attributes]. Foods, 12(16), 3130. Multidisciplinary Digital Publishing Institute.

González, J. A., & Villalobos, J. R. V. (2021). The use of domestic animals and their derivative products in contemporary Spanish ethnoveterinary medicine [Review of The use of domestic animals and their derivative products in contemporary Spanish ethnoveterinary medicine]. Journal of Ethnopharmacology, 271, 113900. Elsevier BV.

Guo, X., Wang, Y., Zhu, Z., & Li, L. (2024). The Role of Plant Extracts in Enhancing Nutrition and Health for Dogs and Cats: Safety, Benefits, and Applications [Review of The Role of Plant Extracts in Enhancing Nutrition and Health for Dogs and Cats: Safety, Benefits, and Applications]. Veterinary Sciences, 11(9), 426. Multidisciplinary Digital Publishing Institute.

Hikisz, P., & Bernasińska, J. (2021). Beneficial Properties of Bromelain [Review of Beneficial Properties of Bromelain]. Nutrients, 13(12), 4313. Multidisciplinary Digital Publishing Institute.

Hinney, B., Wiedermann, S., Bosco, A., Rinaldi, L., Hofer, M., Joachim, A., Krücken, J., & Steinborn, R. (2023). Development of a three-colour digital PCR for early and quantitative detection of benzimidazole resistance-associated single nucleotide polymorphisms in Haemonchus contortus. International Journal for Parasitology Drugs and Drug Resistance, 22, 88.

Jadhav, S., & Jadhav, N. Y. (2023). An eye catching and comprehensive review on dragon fruit (An exotic super fruit). Journal of Pharmacognosy and Phytochemistry, 12(6), 243.

Jato, J., Orman, E., Boakye, Y. D., Bekoe, E. O., Bekoe, S. O., Asare–Nkansah, S., Spiegler, V., Hensel, A., Liebau, E., & Agyare, C. (2022). Anthelmintic Agents from African Medicinal Plants: Review and Prospects [Review of Anthelmintic Agents from African Medicinal Plants: Review and Prospects]. Evidence-Based Complementary and Alternative Medicine, 2022, 1. Hindawi Publishing Corporation.

Jayawardene, K. L. T. D., Palombo, E. A., & Boag, P. R. (2021). Natural Products Are a Promising Source for Anthelmintic Drug Discovery [Review of Natural Products Are a Promising Source for Anthelmintic Drug Discovery]. Biomolecules, 11(10), 1457. Multidisciplinary Digital Publishing Institute.

Khan, A., Shaikh, S., Khanzada, K. A., Shaukat, S. S., & Siddiqui, K. (2023). EFFECT OF PLANT BASED NEMATICIDE ON POPULATION OF PARASITIC NEMATODES AND BACTERIA ASSOCIATED WITH OKRA (ABELMOSCHUS ESCULENTUS L. MOENCH). Pakistan Journal of Agriculture Agricultural Engineering and Veterinary Sciences, 39(1), 32.

Khazaei, R., Seidavi, A., & Bouyeh, M. (2021). A review on the mechanisms of the effect of silymarin in milk thistle (Silybum marianum) on some laboratory animals [Review of A review on the mechanisms of the effect of silymarin in milk thistle (Silybum marianum) on some laboratory animals]. Veterinary Medicine and Science, 8(1), 289. Wiley.

Kitessa, J. D., Kebede, A., & Tamiru, Y. (2022). Assessment of animal health and production constraints: The case of three districts. Veterinary Medicine and Science, 9(1), 391.

Kumar, M., CHAUHAN, R., Devi, H., Prakash, S., Rathore, S., Thakur, M., Puri, S., Pundir, A., Bangar, S. P., Changan, S., Ilakiya, T., Samota, M. K., Damale, R. D., Singh, S., Berwal, M. K., Dhumal, S., Bhoite, A. G., Sharma, A., Senapathy, M., … Mekhemar, M. (2021). Ethnomedicinal Plants Used in the Health Care System: Survey of the Mid Hills of Solan District, Himachal Pradesh, India. Plants, 10(9), 1842.

Kyotos, K. B., Oduma, J. A., Wahome, R. G., Kaluwa, C., Abdirahman, F. A., Opondoh, A., Mbobua, J. N., Muchibi, J., Bagnol, B., Stanley, M., Rosenbaum, M., & Amuguni, J. H. (2022). Gendered Barriers and Opportunities for Women Smallholder Farmers in the Contagious Caprine Pleuropneumonia Vaccine Value Chain in Kenya. Animals, 12(8), 1026.

Lomartire, S., & Gonçalves, A. M. M. (2023). An Overview on Antimicrobial Potential of Edible Terrestrial Plants and Marine Macroalgae Rhodophyta and Chlorophyta Extracts [Review of An Overview on Antimicrobial Potential of Edible Terrestrial Plants and Marine Macroalgae Rhodophyta and Chlorophyta Extracts]. Marine Drugs, 21(3), 163. Multidisciplinary Digital Publishing Institute.

Macalalad, M. A. B., & Gonzales, A. A. (2023). In Silico Screening and Identification of Antidiabetic Inhibitors Sourced from Phytochemicals of Philippine Plants against Four Protein Targets of Diabetes (PTP1B, DPP-4, SGLT-2, and FBPase). Molecules, 28(14), 5301.

Mahapatra, S., Das, P. K., Purohit, G. K., Pattanaik, S., & Palo, S. (2021). ROLE OF MEDICINAL PLANT EXTRACTS IN ERADICATION OF MULTI DRUG RESISTANT MICROBES. International Journal of Engineering Applied Sciences and Technology, 6(1).

Makumi, A., Mhone, A. L., Odaba, J., Guantai, L., & Svitek, N. (2021). Phages for Africa: The Potential Benefit and Challenges of Phage Therapy for the Livestock Sector in Sub-Saharan Africa [Review of Phages for Africa: The Potential Benefit and Challenges of Phage Therapy for the Livestock Sector in Sub-Saharan Africa]. Antibiotics, 10(9), 1085. Multidisciplinary Digital Publishing Institute.

Matos, O., Karanis, P., & Razakandrainibe, R. (2024). Editorial: Impact and control of food- and waterborne protozoan parasites. Frontiers in Microbiology, 15.

Matovu, J., & Alçiçek, A. (2021). Recent Advancement in Goat Nutrition. In IntechOpen eBooks. IntechOpen.

Mayekar, V. M., Ali, A., Alim, H., & Patel, N. (2021). A review: Antimicrobial activity of the medicinal spice plants to cure human disease. Plant Science Today, 8(3).

Mir, I., Rautela, A., & Nimbalkar, V. G. (2020). Use of Ethno Veterinary Medicine (EVM) in India for Livestock Management Practices: A Review [Review of Use of Ethno Veterinary Medicine (EVM) in India for Livestock Management Practices: A Review]. International Journal of Current Microbiology and Applied Sciences, 9(6), 3458. Excellent Publishers.

Monau, P. I., Raphaka, K., Zvinorova, P. I., & Gondwe, T. N. (2020). Sustainable Utilization of Indigenous Goats in Southern Africa. Diversity, 12(1), 20.

Nahed-Toral, J., Tecpoyotl, Z. G. L., Jiménez, J., Cano, D. G., & Delgadillo-Puga, C. (2021). Compliance of Goat Farming under Extensive Grazing with the Organic Standards and Its Contribution to Sustainability in Puebla, Mexico. Sustainability, 13(11), 6293.

Nisha, A. R., & N, V. R. (2021). Ethno Veterinary Therapeutic Practices of Medicinal Flora in Livestock Health Care by Attappadi Tribal farmers of Kerala. Research Square (Research Square). https://doi.org/10.21203/rs.3.rs-258368/v1

Panda, S. K., Daemen, M., Sahoo, G., & Luyten, W. (2022). Essential Oils as Novel Anthelmintic Drug Candidates [Review of Essential Oils as Novel Anthelmintic Drug Candidates]. Molecules, 27(23), 8327. Multidisciplinary Digital Publishing Institute.

Pashtetsky, V., Ostapchuk, P., Kuevda, T. A., Zubochenko, D., Emelianov, S. G., & Uppe, V. (2020). Use of phytobiotics in animal husbandry and poultry. E3S Web of Conferences, 215, 2002.

Paul, B. T., Abdullah, F. F. J., Chung, E. L. T., Che-Amat, A., & Lila, M. A. M. (2020). Risk Factors and Severity of Gastrointestinal Parasites in Selected Small Ruminants from Malaysia. Veterinary Sciences, 7(4), 208.

Ramdani, D., Yuniarti, E., Jayanegara, A., & Chaudhry, A. S. (2023). Roles of Essential Oils, Polyphenols, and Saponins of Medicinal Plants as Natural Additives and Anthelmintics in Ruminant Diets: A Systematic Review [Review of Roles of Essential Oils, Polyphenols, and Saponins of Medicinal Plants as Natural Additives and Anthelmintics in Ruminant Diets: A Systematic Review]. Animals, 13(4), 767. Multidisciplinary Digital Publishing Institute.

Ramlal, A., Nautiyal, A., Kumar, J., Mishra, V., Sogan, N., & Singab, A. N. B. (2023). Botanicals against some important nematodal diseases: Ascariasis and hookworm infections [Review of Botanicals against some important nematodal diseases: Ascariasis and hookworm infections]. Saudi Journal of Biological Sciences, 30(11), 103814. Elsevier BV.

Rodríguez-Hernández, P., Reyes-Palomo, C., Sanz-Fernández, S., Rufino-Moya, P. J., Zafra, R., Martínez-Moreno, F. J., Rodríguez-Estévez, V., & Díaz-Gaona, C. (2023). Antiparasitic Tannin-Rich Plants from the South of Europe for Grazing Livestock: A Review [Review of Antiparasitic Tannin-Rich Plants from the South of Europe for Grazing Livestock: A Review]. Animals, 13(2), 201. Multidisciplinary Digital Publishing Institute.

Sánchez-Mendoza, A. E., Reséndiz-González, G., Rico-Mejía, E., Crúz-Crúz, H. A. de la, Ramírez-Rico, G., Cuéllar-Ordaz, J. A., Montiel-Sosa, J. F., López-Arellano, M. E., Reyes-Guerrero, D. E., Domínguez-Delgado, C. L., Pulido-Medellín, M. O., Hernández-Patlan, D., & Higuera-Piedrahita, R. I. (2025). Oxidative Stress on Haemonchus contortus Larvae Exposed to Alternative Treatment with Artemisia cina n-Hexane Extract and Cinaguaiacin Metabolites. Veterinary Sciences, 12(5), 467.

Semenzato, G., Duca, S. D., Vassallo, A., Bechini, A., Calonico, C., Delfino, V., Berti, F., Vitali, F., Mocali, S., Frascella, A., Emiliani, G., & Fani, R. (2023). Genomic, Molecular, and Phenotypic Characterization of Arthrobacter sp. OVS8, an Endophytic Bacterium Isolated from and Contributing to the Bioactive Compound Content of the Essential Oil of the Medicinal Plant Origanum vulgare L. International Journal of Molecular Sciences, 24(5), 4845.

Silva, S., Sacarrão-Birrento, L., Almeida, M., Ribeiro, D. M., Guedes, C., Montaña, J. R. G., Pereira, A. M. F., Zaralis, K., Geraldo, A. C. A. P. de M., Tzamaloukas, O., González-Cabrera, M., Castro, N., Henríquez, A. A., Hernández-Castellano, L. E., Alonso-Diez, Á. J., Alonso, M. J. M., Cedeño, J. L. C. B., Stilwell, G., & Almeida, A. M. (2022). Extensive Sheep and Goat Production: The Role of Novel Technologies towards Sustainability and Animal Welfare [Review of Extensive Sheep and Goat Production: The Role of Novel Technologies towards Sustainability and Animal Welfare]. Animals, 12(7), 885. Multidisciplinary Digital Publishing Institute.

Tadesse, W. (2024). Effect of herbal extracts in animal nutrition as feed additives. Heliyon, 10(3).

Zanzani, S. A., Gazzonis, A. L., Alberti, E. G., Neilly, T. M., Villa, L., & Manfredi, M. T. (2020). Gastrointestinal nematode infections in goats: differences between strongyle faecal egg counts and specific antibody responses to Teladorsagia circumcincta in Nera di Verzasca and Alpine goats. Parasitology Research, 119(8), 2539.