

Review

Herbal remedies in animal parasitic diseases in Nigeria: a review

FAJIMI, A. K. and TAIWO, A. A.

Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, P. M. B. 5029, Ibadan, Nigeria.

Accepted November, 2004

This review of literature elucidates previous and current status of herbal remedies in animal parasitic diseases in Nigeria. It provides background information on the rationale behind ethnoveterinary research in general especially as it relates to the developing nations where cost of drugs majorly limit the full use of modern medicine. It presents in quantifiable terms the degree of efficacy of whole or plant parts and their extracts in percentages of efficacy. Dosages and concentrations were reported in certain instances especially in confirmatory research trials unlike in “surveys” where dosages were not recorded but presented only as “traditional practices among herdsman” for which scientific validation is necessary. Also, comparative inferences were drawn between the efficacy of tested herb and its counterpart in modern medicine. This review concludes that ethnoveterinary medicine should form a part of modern day animal health delivery system.

Keywords: Herb, efficacy, ethno-veterinary, parasite.

INTRODUCTION

The use of plant and animal parts for medicines has long been in existence and are widely documented in records kept in ancient China, India and Egypt. These ancient indigenous practices were discovered by a series of “trial and error” which then could not be substantiated by proven scientific theories. However, these practices have produced results of proven efficacies compared to conventional modern medicine (Chopra et al., 1956). In recent times, herbal medicines have become indispensable and are forming an integral part of the primary health care system of many nations.

A recent survey (1977) in the United States of America (USA) indicate an expected 20% annual growth in herbal medicine in the next 5 years (Saxena, 2001) with an estimated 80% of the world population living in the developing countries still relying on plants for health care. In the USA, the total number of visits to unconventional healers in 1988 was 425 million compared with 388

million visits to primary health care physicians, accounting for an estimated \$13.7 billion in the unconventional market (Eisenberg et al., 1993).

In view of this large dependence on traditional health practices, the World Health Organisation (WHO) recognized the implicit role of herbal medicine in the Alma Mata declaration of Health for All by the Year 2000 A.D. In 1978, WHO approved the use of these natural products. In 1996, the American Veterinary Medical Association officially recognized veterinary acupuncture and acutherapy, veterinary chiropractic, physical therapy, massage, homeopathic, botanical, nutraceutical and holistic veterinary medicine (Schillhorn, 1997).

In Nigeria, Fulani herdsman and others who keep animals as a means of livelihood have been involved in the treatment of animal diseases prior to the onset of modern medicine (Nwude, 1986), of which remedies against parasitism account for the highest means of intervention (Ibrahim et al., 1984). The primary aim of this work is to review literature on the current and previous works on ethno-veterinary research and development and enumerate factors to move the discipline forward.

*Corresponding author. E-mail: rocovo4@yahoo.com.

JUSTIFICATION FOR HERBAL REMEDIES IN ANIMAL PARASITIC DISEASES

The efficacies of conventional medicaments against both endo- and ecto-parasitic diseases have been reported with variable success (Meloney 1982; Basu and Haldar, 1994; Prichard 1978). However, the toxic effects of these chemicals on humans (Kaemmerer and Butenkotter, 1973; Murray et al., 1992), the development of resistance to it by target parasites (Maingi et al., 1996) as well as high cost of drugs (Chema et al., 1990) pave way for herbal remedies as reasonable alternative. Herbal therapies are natural products, environmentally friendly and cheap. Heifer Project International and other development organisations have given high priority and consideration to medicinal plants because it promotes biodiversity and conservation.

MEDICINAL PROPERTIES OF SOME INDIGENOUS PLANTS IN NIGERIA

Yohimbine, developed for use in traditional medicine, is employed for use in veterinary medicine as an aphrodisiac (Nwude and Ibrahim, 1980). The anti-inflammatory as well as the anti-pyretic activities of *Azadirachta indica* have been evaluated and documented (Okpanyi and Ezeukwu, 1981). Also, the anti-inflammatory and analgesic properties of the methanolic extract of *Ramalina farinacea* at a dose of 1600 mg/kg showed that signs associated with inflammation were suppressed by the drug, comparable to that of the standard drug, indomethacine (Udem et al., 2001). The hot water leaf extract of *Ocimum gratissimum* in dogs produced a significant reduction in the duration of emesis comparable to that of metaclopramide, a standard anti-emetic drug (Udem and Opara, 2001).

Leaves of *Cassia occidentalis* is used as a convulsant and as a purgative, *Andasonia digitala* as an antidiarrhoic in cattle, while *Erythrina senegalensis* has a potent diuretic property (Gefua, 2000). *Guleria senegalensis*, *Anogassus leocarpus* and *Selerocarya birrea* have been found useful in overcoming parturition difficulties in domestic animals (Hassan and Zalla, 2005).

The root extract of *Nauclea latifolia* was observed by Madubunyi (1995) to possess antihepatotoxic effect and inhibited the multiplication of *Trypanosoma brucei* infection. Alcohol extract of a combination of *Sorghum bicolor* and *Telfaria occidentalis* reconstituted at a concentration of 4 mg/100ml of distilled water proved a potent haematinic in the treatment of anaemic rabbits and better compared to commercial haematinic (Adedapo et al., 2002). The activities of *Carica papaya* extracts against *Salmonella aureus* and *Escherichia coli* have been documented in literature (Emekuwa, 1982; Ekpe et al., 1996). Other reports on the antimicrobial activities of certain Nigerian plants have been reported (Olukoya et

al., 1993; Sofowora, 1993; Irobi, 1992; Iwu, 1994 and Etkin et al., 1990).

An array of plant extracts native to northern Nigeria tested against poliovirus, astrovirus and parvovirus using the microtitre plate inhibition test and at a dose of between 100 µg/100 µl to 400 mg/100 µl produced significant antiviral effect (Kudi and Myint, 1999).

The anti-microbial properties of the crude extract of *Ageratum conyzoides* have been validated (Durodola, 1977). The aqueous extract of *Combretus padiculatum* was found to be bacteriocidal at 10% and bacteriostatic at 5% against *Salmonella pullorum* (Atawodi, 2000). The anti-bacterial properties of *Aegypti* was validated against *Staphylococcus aureus*, and methanol leaves extract of *Balanites aegypti* against *Staphylococcus albus* and *Shigella* using the zone inhibition method has been reported (Agaie and Usman, 2001).

ANTI-PARASITIC PROPERTIES OF SOME INDIGENOUS PLANTS IN NIGERIA

The kern oil of *B. aegyptica* proved highly efficacious against ectoparasite infestation of camels in Northern Nigeria (Oliver, 1960). Skin parasite infections of goats in Southern Nigeria have been successfully treated with leaves of *Sida carpinifolia* squeezed and rubbed on lesions (Dalziel, 1937). Burned leaves and twigs of *Guiera senegalensis* as well as burned whole plant of *Hyptis spicifigera* are used individually as insecticides in Nigeria (Nwude, 1997).

Sheabutter (*Vitellaria panadoxa*) plus salt at a ratio of 100:1 have been found efficacious in the treatment of localised psoroptic mange infection in rabbits with about 90% efficacy by the 14th day (Fajimi et al., 2002a). *Aloe variegata*, a green dogger shaped plant with a clear viscous gel applied as a gel-spread over mange lesions produced an efficacy of over 50% (Fajimi et al., 2002b). Okolo and Unaigwe (1984) reported that mange is treated by scrubbing the skin lesions with the fibrous palm kernel fruit waste with the addition of lime, kitchen salt, lime juice (*Citrus aurantium*) and palm oil, for a couple of weeks. Shittu and Bwala (1988) reported the proven efficacy of the seed oil of mahogany (*Kyaya ivoriensis*) against dermatitis associated with mange and dermatophilosis. Neem (*Azadirachta indica*) has been found useful as a pesticidal skin cream and when combined with a shampoo forms an excellent agent against lice (Birmah, 2000). Tobacco leaf + stem extract showed a 100% efficacy against lice by the 2nd day of application and maintained this efficacy for about 56 days post challenge in West African dwarf goats (Fajimi et al., 2003). *Annona squamosa* and *Tephrosia vogelli* through their powdered seeds effectively control lice in ruminants and poultry (Nwude, 1997). The rubbing of heated loose sand on the body of animals with lice has been found to effect a measure of control (Okolo and Unaigwe, 1984).

Table 1. Ethnoveterinary practices adopted for lice control.

Common Name	Scientific Name	Yoruba Name	Mode of Application
Sand paper leaves	<i>Ficus exasperate</i>	Eepin	Branches put in resting place. Replaced regularly.
Cassava	<i>Manihot esculenta</i>	Ege	Fermented water from (ii) and (iii) sprinkled in bird shed.
Maize	<i>Zea mays</i>	Ogi	
Palm Tree	<i>Elaeis guinensis</i>	Airan Ope	Male inflorescence of tree burnt in the shed. It gives a pungent odour.
Ash	<i>Carbon</i>	Eeru	Rubbed under the feathers and sprinkled on top.
Lime	<i>Citrus medica</i>	Osan Wewe	

Source: Eruvbetine and Abegunde, 1998.

Table 2. Plants used in the treatment of parasitic and protozoan diseases of poultry in Nigeria.

Botanical name	Vernacular name of plant	Disease treated for	Preparation and administration
<i>Khaya senegalensis</i>	<i>Madaci</i> (H)	a) i. Coccidiosis	i) Mix soap with dried powered mahogany bark and add to drinking water.
	Ghyaghya (G)	ii. helminthiasis	ii) Pound dried stem bark with red potash and give in drinking water.
<i>Terminalia avicennoides</i>	Baushe (H)	b) i. amoebic dysentery	Pound dried stem barks of <i>K. senegalensis</i> , 'bazana' and 'banohi' together, mix with potash and give in drinking water for 2 – 3 days.
<i>Citrus aurantifolia</i>	Lemon (E)	ii. diarrhoea	Pound dried stem bark with red potash and give in drinking water or cook the root with red potash and serve for drinking.
	Lemun sami (H)	Helminthiasis of poultry	Mix juice with drinking water and add small red potash.
<i>Boswellia dalzielli</i>	Ararrabi (H)	Worm infestation of poultry	
	andekehi (F)	Coccidiosis and amoebic dysentery.	Pound dried stem bark and add to drinking water for 2 – 3 days. Boil together. Stem barks of <i>B. dalzielli</i> and 'durmi ganji' and 'Kanmda' and give in drinking water. Pound the fresh leaves and squeeze into drinking water.
<i>Allium cepa</i>	Albasa (H)	Helminthiasis	For duck's lice, drop bulb in the bird's drinking water and for chickens use green leaves (spring onions) to be picked by the birds.
	Ghipa (G)		

Source: Gefu et al. (2000).

Pawpaw leaves when burnt into ashes and used as a topical agent control lice in poultry (Nwude and Ibrahim, 1980). The trypanocidal activity of *Allium sativum* (garlic) in rabbits as well as that of *Morinda lucida* leaf extract in mice against *Trypanosomes brucei* infection have been documented (Asuzu and Chineme, 1990; Ajagbona et al., 2003). Also, the trypanocidal potentials of *Azadirachta indica* as well as the *in vitro* activity of its leaf extract against *Trypanosoma brucei* have been assessed with reasonable success (Nok et al., 1993). Other ethnoveterinary practices adopted in the treatment of lice is highlighted in Table 1 (Eruvbetine and Abegunde, 1998).

Valkosen (2001) established that garlic fruits and bamboo shoots are effective in the treatment of pigs against *Ascaris suum* and that there is no significant difference between the treatment and that of piperazine. The confirmed efficacy of the aqueous extract of the seeds of *Carica papaya* against *Oesophagostomum*, *Trichuris* and *Trichostrongylus* have been validated to be over 90% in efficacy (Fajimi et al., 2001). *C. papaya*

leaves contain papain which is capable of digesting bacteria and parasitic cells hence its use as an anthelmintics and antibiotics (Saka, 2000). The leaves of *Amaranthus spinosus* have been found to elicit over 80% reduction in eggs per gram faeces of trichostrongylids in sheep and goats (Assiak et al., 2002). The ethanolic extract of *Khaya senegalensis*, *Amaranthus spinosus* and *Heliothropium indicum* produced a significant reduction in mean eggs per gram faeces of trichostrongylids comparable to the effect of ivermectin (Okpara et al., 2004).

In vitro efficacy study of *Nauclea latifolia* showed high anthelmintic efficacy against strongyle nematodes of small ruminants by its ability to prevent parasite eggs from hatching. The extract at the concentration of 100 mg/ml was observed to have comparable anthelmintic efficacy with commercial anthelmintic drug, levamisole and albendazole (Onyeyli et al., 2001). Resins, bitter principles, tannins, flavonoids and indolquinolizidine alkaloids have been isolated from *Nauclea Latifolia*

(Hotellier and Delaveau). Ethanol extract of *Amaranthus spinosus* as a vermifuge against *Hyostromylus rubidus* and *Trichuris trichuria* is pronounced and validated (Assiak et al., 2001). *Khaya senegalensis* and *Vernonia amygdalina* showed moderate to high efficacy against *Haemonchus*, *Cooperia*, *Oesophagostomum* and *Trichostrongylus* species of helminths (Chiezey et al., 2000; Alawa et al., 2000). *In vitro* evaluation of seeds of *Anogeissus leiocarpus* and leaf of *Cassia occidentalis* have shown high anthelmintic efficacy against *Nippostrongylus brasiliensis* in rats (Ibrahim, 1984). Screenings of ethanolic extract of *Pilostigma thonningi* bark against helminths have confirmed its efficacy against *Ascaridia galli* infected chickens. (Asuzu and Onu, 1994). Plants used for the management of helminthosis in ruminants in Sokoto State Nigeria is highlighted by Agaie et al. (2004). The Anthelmintic efficacy of *Carica papaya* latex against *Ascaridia galli* and *cappilaria spp.* was found to be as high as 77.7% reduction in eggs per gram faeces (Adu and Akingboye, 2002). Table 2 shows plants used in the treatment of parasitic and protozoan diseases of poultry in Nigeria.

CONCLUSIONS

Numerous plants indigenous to Nigeria and to Africa in general have been found with amazing medicinal properties. Some are well-evaluated vis-à-vis their content of specific active principles against the target parasites while others are not. It is therefore highly essential that medicinal plants whose properties have not been fully characterized should form a top agenda of top management in developing nations whose citizens are sometimes unable to afford expensive orthodox medicine. This policy if pursued will not only preserve the scarce foreign exchange but also promote the spirit of plant conservation. This can be accelerated by including ethno-veterinary medicine as part of curriculum in veterinary school and as an integral part in veterinary delivery systems.

REFERENCES

- Achan MR, Ndaalio G, Nkunga MHH, Weevers H, Sawhey AN (1980). Studies on African Medicinal plants for antibacterial activity. *Plant Med. (Suppl.)*:91–97.
- Adedapo AA, Dina OA, Saba AB, Oladipo OD (2002). Evaluation of *Telfaria occidentalis* and *Sorghum bicolor* extracts as potent haematinics in domestic rabbits. *Nig. J. Anim. Prod.* 29(1):88–93.
- Agaie BM, Usman ID (2001). Antibacterial activity of the leaf extract of *Balanites aegypti*. *Nig. Vet. J.* 22(2):42–46.
- Adu OA, Akingboye KA (2002). Anthelmintic efficacy of Pawpaw (*Carica papaya*) latex in Pcoc.7th Ann. Conf. Anim. Sci. Assoc. of Nig. (ASAN) held sept. 16-19, 2002.
- Ajagbona OP, Mikahil HG, Muhammed BY, Onyeyili PA (2003). Trypanocidal efficacy of *Allium sativum* (Garlic) in Rabbits infected with *Trypanosoma brucei*. *Proc. 28th Annu. Conference of the Nig. Soc. Anim. Prod.* held at IAR&T, Ibadan, Nigeria pp.11-12.
- Alawa CBI, Gefu JO, Chiezey PN, Abdu PA, Magaji SO, Eduvie LO, Adeyinka IA Screening of *Vernonia amygdalina* for anthelmintic properties. Proceedings of an international workshop on ethnovet. practices held between 14 – 18 August, 2000, Kaduna. Published by the National Animal Production Research Institute, Ahmadu Bello University, Zaria, Nigeria.
- Assiak IE, Onigemo MA, Olufemi BE, Tijani LA (2001). *Amaranthus spinosus* as a vermifuge: A Preliminary investigation in Pigs. *Proc.26th Annu. Conference of the Nig. Soc. of Anim. Prod.* held at NAPRI,Zaria ,Nigeria. pp. 60-62.
- Assiak IE, Olufemi BE, Ayoade GO, Onigemo MA (2002). Preliminary studies on the effects of *Amaranthus spinosus* leaves extracts as an anthelmintic in growing pigs. *Tropical Vet.* 20(2):126–129.
- Atawodi (2000). Antibacteria leffects of *Combretus glutinosum* and *Trapinasthus dodoneifolius* on *Salmonella gallinarium* and *Salmonella pullorum*. In: *Ethnovet. Res. Dev. Proc. Int. workshop on Ethnovet. Practices held on 14–18th August, 2000, Kaduna, Nig.* pp. 72-77.
- Azuzu IU, Chineme CN (1990). Effects of *Morinda lucida* leaf extract on *Trypanosomes brucei* infection in mice. *J. Ethnopharm.* 30:307–313.
- Basu AK, Aaldar DP (1994). An *in-vitro* study of the efficacy of Sevin (I naphthyl-methyl carbamate) on ectoparasites of livestock. *Bull. Anim. Health Prod. Afr.* 42:303–305.
- Birmah AK (2000). Efficacy and commercialization of Neem products. African Books Collective. p. 78.
- Chema S, Ward D (1990). Cost effective disease control routines and animal health management in animal agriculture. *Proc.FAO Expert Consultation held in Rome, Italy between 10–14 December, 1990.*
- Chiezey NP, Gefu JO, Jagun AG, Abdu PA, Alawa CBI, Magaji SO, Adeyinka IA, Eduvie L O Evaluation of some Nigerian plants for anthelmintic activity in young cattle. Proceedings of an international workshop on Ethnovet. Practices held between 14 – 18 August, 2000, Kaduna. Published by the National Animal Production Research Institute, Ahmadu Bello University, Zaria, Nigeria.
- Chopra RN, Naygar SL, Chopra IC (1956). *Glossary of Indian Medicinal Plants.* Council of Sci. Industrial Res. New Delhi, p. 160.
- Dalziel M (1937). *The useful plants of West Tropical Africa.* Crown Agents, Lond. p. 612.
- Durodola JI (1977). Antimicrobial property of crude extracts from herbal wound remedy – *Ageratum conyzoides*. *Plant Med.* 32:388.
- Eisenberg DN, Kessler RC, Foster C, Norlock EE, Calkins DR, Delbano TL (1993). Unconventional medicine in the United States: Prevalence, costs and patterns or use. *New Engl. Med. J.* 328:246–252.
- Ekpe JE, Ebenso EE, Antia BS (1996). *West African J. Biol. and App. Chem.* 41(1):16–20.
- Emekuwa AC (1982). *J. Nat. Prdts.* 54(2):41–45.
- Eruvbetine, Abegunde (1998). Ethnoveterinary practices in the treatment of diseases of indigenous chicken. *Nig. Vet. J.* 19:21–26.
- Etkin NL, Ross PJ, Muazzami I (1990). The indigenization of pharmaceutical therapeutic transitions in natural Hausaland. *Soc. Sci. Med.* 30(8):919–928.
- Fajimi AK, Taiwo AA, Ayodeji IO, Adebowale EA, Ogundola FI (2001). Therapeutic trials on gastrointestinal helminth parasite of goats using pawpaw seeds as a drench. Proceedings of the international conference on sustainable crop. Livestock prod. for improved livelihoods and nat. res. Managt. West Afr. held at the International Livestock Research Institute (ILRI) in partnership with International Institute of Tropical Agriculture between Nov. 9–23, 2001 (In Press).
- Fajimi AK, Taiwo AA, Adebowale EA, Ogundola FI (2002a). Evaluation of sheabutter plus salt against naturally acquired psoroptic mange in rabbits. *Tropical Vet.* 20(1):11–16.
- Fajimi AK, Ayodeji IO, Ajayi FT, Ogundola FI (2002b). Efficacy studies of topically administered aloe-vera in rabbits naturally infested with psoroptic mange mites. *Moor J. Agric. Res.* 3(2):199–202.
- Gefu JO, Abdu PA, Alawa CB (eds) (2000). *Ethnovet. practices res. Dev. Proc. Of the workshop on ethnovet practices held 14-18 August, 2000, Kaduna, Nig.* Published by the National Anim. Prod. Res. Inst, ABU, Zaria, Nig.
- Hassan WA, Zalla IL. Overcoming parturition difficulties in domestic animals through ethno- veterinary practices in Zamfara state, Nigeria. *Proc. of the 8th Ann. Conf. Anim. Sci. of Nigr.* Held at the Univ. of Tech. Minna, Nigr. 16-18 Sept. 2003.

- Hotellier FP, Delaveau P (1975). *Nauclefine* and *Naucleatine* constituents of *Nauclea latifolia*. *Phytochem* 14:1407-1411.
- Ibrahim MA, Nwude N, Ogunsusi RA, Aliu YO (1984). Screening of West African plants for anthelmintic activity. *ILCA Bull.* 17:19-23.
- Irobi ON (1992). Activities of *Chromolaena odorata* (composite) leaf extract against *Sendomonas aeruginosa* and *Streptococcus faecalis*. *J. Ethnopharmacol.* 37(1):51-53.
- Iwu MM (1994). African medicinal plants in the search for new drugs based on ethnobotanical. *Ciba Found. Symp.* 185:116-126.
- Kaemmerer K, Butenkotter S (1973). The problem of residues in meat of edible domestic animals after application or intake of organophosphate esters. *Residue Rev.* 46:1.
- Kudi AC, Myint SH (1999). Antiviral activity of some Nigerian Medicinal Plant Extracts. *J. Ethnopharmacol.* 68:289-294.
- Madubuinyi II (1995). Antihepatotoxic and trypanocidal activities of the ethanolic extract of *Nauclea latifolia* root bark. *J. Herbs,spices, med. Plts.* 3:23-35.
- Maingi NH, Bjorn SM, Tharmsborg HO, Bogh P, Nansen (1996). A survey of anthelmintic resistance in nematode parasites of goats in Denmark. *Vet. Parasitol.* 66:53-66.
- Meleney WP (1982). Control of Psoroptic Scabies on calves with ivermectin. *Am. J. Vet. Res.* 43:329-331.
- Murray VS, Wiseman HH, Dawlings S, Morgan I, Houseman IM (1992). Health effects of organophosphate sheep dips. *Brit. Vet. J.* 305:1090.
- Nok AJ, Eseivo KAN, Longdet I, Arowosafe S, Onyenekure P, Gimba CE, Kagbu DA (1993). Trypanocidal potentials of *Azadirachta indica* *in vivo* activity of leaf extract against *Trypanosoma brucei*. *J. Clin. Biochem. Nutr.* 15:113-118.
- Nwude N (1986). Veterinary aspects of medicinal plant research in Nigeria. In: state of medicinal plant Res. Nig. Ed. Sofowora A .p. 197.
- *Nwude N (1997). Ethnoveterinary pharmacology practices in Nigeria. An overview. Paper presented at the Inaugural Review and Planning Workshop on Nationally Coordinated Research Programme on Livestock Diseases NVRI, Vom. 24th-28th March.
- Nwude N, Ibrahim MA (1980). Plants used in traditional veterinary medical practice in Nigeria. *J. Vet. Pharmacol. Therap.* 3:261.
- Okolo MIO, Unaigwe JE (1984). Studies on traditional veterinary practice in Anambra State of Nigeria. *Diseases and treatment. Nig. Vet. J.* 13(2):14-22.
- Okpanyi SN, Ezeukwu GC (1981). Anti-inflationary and antipyretic activities of *Azadirachta indica*. *Plant Med.*41:34.
- Okpara JO, Anagor PO, Okpalia EJ, Abdullahi A, Ahmed MS (2004). The anthelmintic efficacy of medicinal herb extracts against Gastrointestinal helminths of sheep. Proceedings of the 9th Annual Conference of Animal Science Association of Nig. (ASAN) Sept. 13th-16th 2004. Ebonyi State University, Nigeria.
- Oliver B (1960). Medicinal plants in Nigeria. Private ed. Nig. Coll. Arts, Sci. Technol. Ibadan.
- Olukoya DK, Idika N, Odugbemi T (1993). Antibacterial activity of some medicinal plants from Nigeria. *J. Ethnopharmacol.* 39(1):69-72.
- Onyeyili PA, Amin JD, Gambo HI, Nwosu CO, Jibike GI (2001). Toxicity and Anthelmintic Efficacy of Ethanolic Stem Bark Extract of *Nauclea latifolia*. *Nig. Vet. J.* 22(1):74-82.
- Prichard RK (1978). Epidemiology and control of gastrointestinal parasites of sheep (C.S.I.R.O.). Australia.
- Saxena MJ (2001). Relevance of Herbs in improving health index of livestock animals. An invited paper for the 38th Annual Congress of the Nigerian Veterinary Medical Association held in Topo, Badagry, Lagos State, Nigeria between 9 - 13th October, 2001.
- Schillhorn Van, Veen TW (1997). Sense or nonsense? Traditional methods of animal parasitic disease control. *Vet. Parasitol.* 71:177-194.
- Shittu M, Bwala H (1988). Traditional veterinary care among the nomadic herdsmen of southern Borno State. *Nig. Livestock Farmer* 8(2-4):27-34.
- Sofowora A (1982). Medicinal Plants and Traditional Medicine in Africa. Pub. John Wiley and Sons Limited.
- Udem SC, Opara IC. (2001). Proceedings of the 38th Annual Congress of the Nigerian Vet. Medical Association held in Topo, Badagry, Lagos State, Nigeria on 9 - 13th October, 2001.
- Udem SC, Esimone CO, Obinwa OC, Akah PA (2001). Proceedings of the 38th Annual Congress of the Nigerian Vet. Medical Association held in Topo, Badagry, Lagos State, Nigeria on 9 - 13th October, 2001.
- Valkosen (2001). Efficacy of garlic fruits and bamboo shoots in deworming swine. Proc. of the 26th Annu. Conference of the Nigerian Soc. for Anim. Prod. held at NAPRI, Zaria ,Nigeria p. 50-51.