ONLINE JOURNAL OF ANIMAL AND FEED RESEARCH

An International Peer-Reviewed Journal which Publishes in Electronic Format

Volume 8, Issue 1, January 2018

Online J. Anim. Feed Res., 8 (1): January 25, 2018

Editorial Team

Editorial Review Board

Join OJAFR Team

As an international journal we are always striving to add diversity to our editorial board and operations staff. Applicants who have previous experience relevant to the position may be considered for more senior positions (Section Editor, SE) within OJAFR. All other members must begin as Deputy Section Editors (DSE) before progressing on to more senior roles. Editor and editorial board members do not receive any remuneration. These positions are voluntary.
If you are currently an undergraduate, M.Sc. or Ph.D. student at university and interested in working for OJAFR, please fill out the application form below. Once your filled application form is submitted, the board will review your credentials and notify you within a week of an opportunity to membership in editorial board.
If you are Ph.D., assistant or associate editors, distinguished professor, scholars or publisher of a reputed university, please rank the mentioned positions in order of your preference. Please send us a copy of your CV or ORCID ID or briefly discuss any leadership positions and other experiences you have had that are relevant to applied Animal and Feed Researches or publications. This includes courses you have taken, editing, publishing, web design, layout design, and event planning.
If you would like to represent the OJAFR at your university, join our volunteer staff today! OJAFR representatives assist students at their university to submit their work to the OJAFR. You can also, registered as a member of OJAFR for subsequent contacts by email and or invitation for a honorary reviewing articles.

Download OJAFR Application Form

Archive

Volume 8 (1); 25 January 2018

Case Report

Prevalence of black quarter (BQ) disease in private dairy farm in Hyderabad, Sindh province of Pakistan.

Yousaf A, Rais M-ul-N, Mushtaq A, Jamil T.

Online J. Anim. Feed Res., 8(1): 01-04, 201; pii: S222877011800001-8

Abstract

A sporadic incident of Clostridial disease that affected Holstein Friesian (HF) cross bred cows (n=8) at an organized dairy farm was investigated. Detailed clinical investigations and treatment were carried out on all the affected animals. Complete blood count (CBC) and plasma biochemistry were performed on survived animals (n=6). The needle biopsy samples were subjected to culture and identification of the organism by Gram staining. Two cows were died before instituting the treatment in this clinical incident. The carcasses were seen with typicalbloated appearance immediately after death, laying one side with affected leg stuck out. Postmortem of the carcasses were not been carried out. Pertinent findings of the CBC were a relative neutrophilia whilst a normal total leucocyte count and lowered Hb. Plasma biochemical parameters revealed significant increase in the mean activity of a separate amino transferase while alanine amino transferase levels were within limits. Gram's staining of the inoculated culture revealed the presence of small gram positive rods with sub terminal spores. Clinical treatment of the cases was performed with administration of heavy dose of crystalline penicillin and non-steroidal anti-inflammatory drugs (NSAIDS). Clinical recoveries of the cases were good and cessation of spread within the herd confining itself as a sporadic clinical incident. Sporadic Clostridiosis (BQ) of eight cross bred dairy cows was dealt in the present case study by including the details of its alterations in hematological parameters, Plasma biochemical parameters, observation of characteristic clinical signs of the disease and employment of empirical treatment with Penicillin.

Keywords: Black Quarter, Clostridium, Clostridium chauvoei, Dairy, HF Crossbred Dairy Cattle, Sporadic Clostridiosis

[Full text-PDF]

Research Paper

Effect of seed proportions on morphological characteristics of forage mixture in North Gondar, Ethiopia. Online J. Anim. Feed Res., 8(1): 05-11. www.ojafr.ir

Birhan M.

Online J. Anim. Feed Res., 8(1): 05-11, 2018; pii: S222877011800002-8

Triticale x Triticosecale Wittmack Vicia villosa

Birhan M. (2018). Effect of seed proportions on morphological characteristics of forage mixture in North Gondar, Ethiopia. *Online J. Anim. Feed Res.*, 8(1): 05-11. www.ojafr.ir

Abstract

The experiment was carried out on forage mixture triticale (X Triticosecale wittmack) and vetch (Vicia vilosa R.) under rain fed condition of Dembya district. Forage mixture grown under different seeding rates during 2016 cropping season in the study area. The objectives of the research were; to evaluate the optimum seeding rates for maximum forage biomass yield of the mixture and to assess the morphological and phenological efficiency of forage biomass yield in the mixture. The experimental design employed during the research was a randomized complete block design (RCBD) with five treatments and replicated five times with the total of 25 treatments/plots. The forage treatment include with five different proportions of seeding rates (SP) in the ratio of (triticale /vetch) 100:0 (SP1), 75:25 (SP2) 50:50 (SP3) 25:75 (SP4) and 0:100 (SP5) and the plot size was 2m x 5m width and length. Data was subjected to analysis as variance using MSTATC statistical procedure for morphological characteristics of forage yield and quality parameters. Higher forage DMY of the mixture (11.85t/ha) was observed at SP3. The research depicted that, SP3 for triticale was found to have highly significant at ($P < 0.01$) in leaf area, leaf length and leaf to stem ratio than any other SPs in the forage mixture. With all these findings the experiment result of this study was found the combination of SP3 could be considered as the best association of triticale/vetch for better forage mixture as it resulted in highest, leaf area, leaf length and leaf to stem ratio and better DMY would be a benefit for forage biomass production in the mixture.

Keywords: Effect, Seed Proportions, Morphology, Mixture, Ethiopia

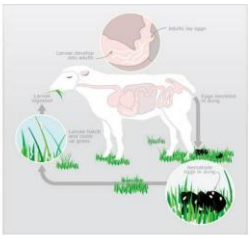
[Full text-PDF] [XML]

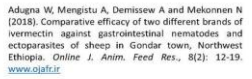
Research Paper

Comparative efficacy of two different brands of ivermectin against gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwest Ethiopia.

Adugna W, Mengistu A, Demissew A and Mekonnen N.

Online J. Anim. Feed Res., 8(1): 12-19, 2018; pii: S222877011800003-8





Abstract

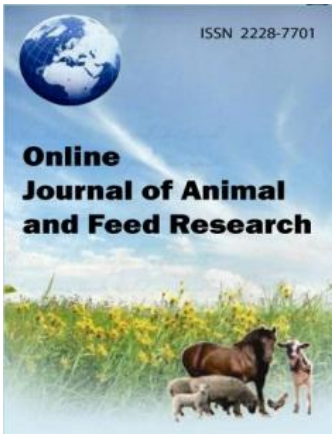
Gastrointestinal nematodes and ectoparasites are endemic in Ethiopia. Giving appropriate treatment for these infestations will reduce the damage that could occur from them. The current experimental study aimed to see the efficacy of two Ivermectin formulations for the purpose of this parasite in Gondar town. For the study 58 local sheep aged from 6 months to 2 years from small holder farmers were selected and randomly allocated as two treatment and one control groups. Ivermectin bolus and injection formulations were used for this efficacy assessment. For assessment of efficacy against gastrointestinal nematodes, 45 sheep were used and divided into three groups; for ectoparasite evaluation, 13 sheep were involved. Feces from each sheep were taken before and after each drug administration and egg per gram of feces were determined and larval cultures were done on day zero before treatment and on day 14 post-treatment. Ivermectin efficacy was investigated by the Fecal Egg Count Reduction Test (FECRT). Ivermectin injection and bolus were reduced FEC by 95.06% (95%CI: 87.8, 98.5%) and 98.8% (95%CI: 90.3, 100%), respectively. The therapeutic efficacies of both ivermectin formulations against ticks and lice infestations were 100% after 7 days of treatment and remained effective up to 28th days of post treatment. To the contrary, these parasites were increased gradually on 7th, 14th, 21st and 28th days of post treatment in the control group. Coproculture revealed four GIN genera which were *Haemonchus, Trichostrongylus, Oesophagostomum* and *Trichuris.* The identified genera of ticks and louse were *Bophilus* and *Linognathus*, respectively. The bolus form of ivermectin showed better efficacy against nematodes than the injectable and ectoparasites were cleared totally by the drug. Detailed studies are suggested to verify the efficacy of the formulations and searching optional drugs for those developing resistance.

Keywords: Ectoparasite, Efficacy, Gastrointestinal nematode, Ivermectin

[Full text-PDF] [XML]

Archive

Online Journal of Animal and Feed Research



ISSN: 2228-7701

Frequency: Bimonthly

Current Issue: 2018, Vol: 8, Issue: 1 (January)

Publisher: SCIENCELINE

Online Journal of Animal and Feed Research is an international peer-reviewed journal, publishes the full text of original scientific researches, reviews, and case reports in all fields of animal and feed sciences, bimonthly and freely on the ınternet ...view full aims and scope

www.ojafr.ir

» OJAFR indexed/covered by NLM/PubMed, CABI, CAS, AGRICOLA, DOAJ, Ulrich's™, GALE, ICV 2015 = 71.65), Worldcat, EZB, TOCs ...details

» Open access full-text articles is available beginning with Volume 1, Issue 1.

» Full texts and XML articles are available in ISC-RICeST and DOAJ.

» This journal is in compliance with Budapest Open Access Initiative and International Committee of Medical Journal Editors' Recommendations.

» High visibility of articles over the internet.

Editorial Offices:
Atatürk University, Erzurum 25100, Turkey
University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada
University of Maragheh, East Azerbaijan, Maragheh 55136, Iran
Homepage: www.science-line.com
Phone: +98 914 420 7713 (Iran); +90 538 770 8824 (Turkey); +1 204 8982464 (Canada)
Emails:
administrator@science-line.com
saeid.azar@atauni.edu.tr

2018 SCIENCELINE

Online Journal of Animal and Feed Research

Volume 8, Issue 1: 01-04; Jan 25, 2018

ISSN 2228-7701

PREVALENCE OF BLACK QUARTER (BQ) DISEASE IN PRIVATE DAIRY FARM IN HYDERABAD, SINDH PROVINCE OF PAKISTAN

Adnan YOUSAF[1]✉, Mehar-ul-Nissa RAIS[2], Aamerzish MUSHTAQ[3], Tahseen JAMIL[4]

[1]*Salman Poultry (Pvt) Limited, Rawalpindi, Pakistan*
[2]*Department of Agriculture Economics, Sindh Agriculture Univeristy Tandojam, Pakistan*
[3]*Faculty of Veterinary and Animals Sciences, PMAS-Arid Agriculture University Rawalpindi, Pakistan*
[4]*Department of veterinary Physiology and Bio chemistry, Sindh Agriculture University Tandojam, Pakistan*
✉Email: dr.adnan011@gmail.com

ABSTRACT: A sporadic incident of Clostridial disease that affected Holstein Friesian (HF) cross bred cows (n=8) at an organized dairy farm was investigated. Detailed clinical investigations and treatment were carried out on all the affected animals. Complete blood count (CBC) and plasma biochemistry were performed on survived animals (n=6). The needle biopsy samples were subjected to culture and identification of the organism by Gram staining. Two cows were died before instituting the treatment in this clinical incident. The carcasses were seen with typicalbloated appearance immediately after death, laying one side with affected leg stuck out. Postmortem of the carcasses were not been carried out. Pertinent findings of the CBC were a relative neutrophilia whilst a normal total leucocyte count and lowered Hb. Plasma biochemical parameters revealed significant increase in the mean activity of a separate amino transferase while alanine amino transferase levels were within limits. Gram's staining of the inoculated culture revealed the presence of small gram positive rods with sub terminal spores. Clinical treatment of the cases was performed with administration of heavy dose of crystalline penicillin and non-steroidal anti-inflammatory drugs (NSAIDS). Clinical recoveries of the cases were good and cessation of spread within the herd confining itself as a sporadic clinical incident. Sporadic Clostridiosis (BQ) of eight cross bred dairy cows was dealt in the present case study by including the details of its alterations in hematological parameters, Plasma biochemical parameters, observation of characteristic clinical signs of the disease and employment of empirical treatment with Penicillin.

Keywords: Black Quarter, Clostridium, Clostridium chauvoei, Dairy, HF Crossbred Dairy Cattle, Sporadic Clostridiosis

CASE REPORT
pii: S222877011800001-8
Received 23 Aug. 2017
Accepted 26 Dec. 2017

INTRODUCTION

Clostridium spp are the group of anaerobic bacteria that are of considerable medical and veterinary importance. Clostridiosis commonly referred to a variety of diseases of economic importance caused by the bacteria of this genus (Divers et al., 2008). Clostridium chauvoei, the causative agent of blackleg and malignant edema in cattle, sheep and other ruminants isa gram positive, spore forming, rod shaped bacterium (Sultana et al., 2008). The clostridial myositis of skeletal muscles is characterized by the appearance of crepitating sounds with fluctuating swelling causing myonecrosis in of one or more limb quarters, severe toxemia and followed by rapid death (Radostits et al., 2000). The spores of which survive for several years without losing their pathogenicity. It is a soil borne infection, portal of entry is through alimentary tract after ingestion of contaminated feed, fodder and soil (Robson et al., 2012). It is an economically important disease among the marginal dairy farmers of India though preventable by vaccination but occurs sporadically.

CASE DESCRIPTION

A sporadic outbreak of Clostridial disease (black quarter, BQ) was investigated in HF cross bred cows (n=8) maintained at an organized dairy farm unit in the Distract Hyderabad, Sindh. All the affected were of aged 3 years and in their first lactation. The unit herd was having a populationof seventy five cows at the time of this sporadic

To cite this paper: Yousaf A, Rais M-ul-N, Mushtaq A, Jamil T (2018). Prevalence of black quarter (BQ) disease in private dairy farm in Hyderabad, Sindh province of Pakistan. *Online J. Anim. Feed Res.*, 8(1): 01-04. http://www.ojafr.ir

incident. The farm population has been purchased from the Karachi as mid to late term pregnant heifers and been transferred to acclimatize prior to calving. All the animals at the time of purchase were immunized against foot and mouth disease (FMD), black quarter (BQ) and hemorrhagic septicemia (HS). This combine vaccine formulation contains BQ component as formaldehyde inactivated clostridium chauvoei culture. The cows were housed at tie stall barns and are intensively managed. The animals were fed with concentrate mash, chopped green fodder and mixed fodder silage. The unit herd had a history of foot and mouth disease affection a month back. Among the herd, eight cows were observed with sudden onset of lameness and swelling in the gluteal and lumbar muscles. On clinical examination the cows were found depressed, febrile, lame (on one limb) with acute swelling of gluteal muscles, anorectic, with complete rumen stasis, high fever (>104°F) and a pulse rate of above 110/min. Palpation of the swollen area emitted crackling/crepitating sounds. All the animals were clinically affected with in a period of two days indicating the sudden onset and loss of two cows on the first day. Herd check and isolation of the affected was performed. The laboratory clinical investigations were performed and intensive clinical therapy was instituted on the survived cows. The unit herd was observed carefully for any other inclusion of herd mates with similar signs over a period of few weeks.

MATERIALS AND METHODS

Ethical approval

This experiment was performed according to all ethics and animal rights (Sindh Agriculture University Tandojam-Pakistan).

From a total of eight affected cows two were died exhibiting clinical signs on the first day of this sporadic incident before even the treatment instituted. Post-mortem of the carcasses were not been carried out with the fear of spread of bacteria. The clinical investigation further continued with collection of blood samples from the six cows. To perform CBC and smears blood samples were collected using disodium salt of ethylene diaminetetraacetic acid (EDTA) as anticoagulant for estimation of hematological parameters (Coles, 1980) and to check for any haemoprotozoan infection. Blood samples were also collected in heparinized vials for estimation of plasma biochemical parameters of clinical importance by utilizing DT60IIR Dry chemistry analyzer (Johnson and Johnson, USA). Needle biopsy samples were obtained for microbiological identification to identify the suspected cause of organism. Such samples were taken from the swollen muscles of gluteal and lumbar region inoculated into Robertson's cooked meat media. The culture was incubated in the anaerobic chamber for 48 hours. Upon completion of the tenured time, Gram's staining of the culture was performed to identify the microbe involved in this sporadic clinical incident.

RESULTS AND DISCUSSION

The acute onset of the clinical signs and loss of two cows on the initial day were predictably suggesting the involvement of any acute/per acute clinical causes/ disease of cattle. As mentioned above the characteristic clinical signs are consistent with the descriptions by (Radostits et al., 2000, Coles, 1980) for the blackleg disease such as occurrence of sudden lameness, reluctance to move, swelling on the one or more quarters involving major group of muscles, anorectic, with complete rumen stasis, high fever (>104°F), pulse rate of above 110/min and culminating fatally. In addition, upon palpation of the swollen muscles emitted crackling/crepitating sounds. A presumptive clinical diagnosis of Clostridiosis (BQ) was made, based on the acute onset and characteristic clinical signs suggesting the etiological involvement of Clostridium chauvoei in these sporadic Clostridiosis. The two dead carcasses were observed with the bloated appearance, with the limbs spread apart and pointing upwards, due to the rapid accumulation of gas under the skin/body cavity. Postmortem examination (PM) of the carcasses were not been carried with the fear of bacterial spread and consequent contamination of the environment by formation of spores. It is suggested, performing PM of carcasses is considered optional or should not be performed and the decision weighed on the husbandry/clinical situation in BQ (Robson, 2012). The portal of entry of this organism in cattle is through ingestion of bacterial spores originating from contaminated feed or soil. The ingested spores enter the circulation upon essential anaerobic situations these spores germinate and multiply. The bacteria produce toxins, which in turn actively circulates in blood and causes damage such as severe necrotizing myositis locally in the skeletal muscle and systemic toxemia (Sultana et al., 2008, Radostits, 2010). The organism invariably causes lesions other than the skeletal muscles were the base of tongue, heart muscle, diaphragm, psoas muscles, on brisket and udder. Among the other possible conditions that are considered in the list of differentials are as abcess, seroma and hematoma, all are possibly ruled out by the characteristic clinical sign.

To cite this paper: Yousaf A, Rais M-ul-N, Mushtaq A, Jamil T (2018). Prevalence of black quarter (BQ) disease in private dairy farm in Hyderabad, Sindh province of Pakistan. *Online J. Anim. Feed Res.*, 8(1): 01-04. http://www.ojafr.ir

The results of the complete blood count of the six cows as follows, Hemoglobin (Hb) 7.40±0.20 gm. % and Total leucocyte content (TLC) 8783±1356 cells/ mm3. Results of the differential count of the WBC's were noted as neutrophil count (N) 56.67±3.25%, Lymphocytes (L) 42.33±3.7%, and eosinophil (E) 1.00±0.68%. The results indicate presence of a relative neutrophilia whilst with normal range of TLC, anemia and an absence of any haemoprotozoan disease among the survived cows. Plasma biochemical concentrations of aspartate amino-transferase (AST) was 238±25 U/L and alanine amino-transferase (ALT) levels were found to be 8±3 U/L. The present study results are in agreement with the hematological changes that are been observed with two to three days post infection experimentally on the hill bulls of two to three year olds except the lowered Hb in this study (Singh *et al.,* 1993) The present study results recorded a moderate anemia among the survived and those are in the treatment could be attributed due to the fact, that the cows were also suffered with an incident of FMD a month back whilst the unit herd which was duly immunized against both of these diseases at the time of purchase. The reasons behind this occurrence of both the diseases could possibly be due to the failure of vaccine that arise out of poor handling and administration of the vaccine by field staff. Microbial identification out of the gram staining of the inoculated culture revealed the presence of small gram-positive rods with sub terminal spores. This finding had clearly supported the empirical decision to employ heavy doses (44,000 U/kg body weight IM) of crystalline penicillin twice daily for seven days. The agent was also injected locally in to the affected muscles for enhanced efficacy, added the cows were given NSAIDs to aid in pain relief from the lameness and febrile. Occurrence of BQ is predominant in warmer months (Robson, 2012). Usually the disease culminates fatally without the possible chances to employ treatment and see the recovery of the affected. This sporadic clostridiosis occurred in the winter month such as December equating to an atypical BQ where in the temperature of the location of the unite herd are around 10^{o}C and within the herd of seventy five it affected only eight cows among which two were died. It is important to know that the unit herd operates under intensive system with zero grazing and predictably the level of spore's contamination in to their feed/ fodder.

CONCLUSION

Clostridiosis in dairy cattle can cause considerable losses in terms of loss of herd and loss of production. Sporadic Clostridiosis (BQ) of eight cross bred dairy cows was dealt in the present case study by including the details of its alterations in hematological parameters, plasma biochemical parameters, observation of characteristic clinical signs of the disease and employment of empirical treatment with Penicillin. Microbial identification should be among the top tool of clinical investigations of any clinical disease situation to a herd. The present study emphasizes the need of proper vaccine handling and administration to the herd by the veterinary team in the field against such important diseases.

DECLARATIONS

Authors' contribution

Dr. Adnan Yousaf was the main researcher, Madam Mehar- ul-Nissa Rais was research supervisor, Dr. Tahseen Jamil revised the article and Dr. Aamerzish Mushtaq contributions in statistics, and other activities related to the research.

Acknowledgments

The author is thankful to owner and staff of Private dairy farm for their support and cooperation during the whole period of research work.

Conflict of interests

The authors declare that they have no conflict of interest with respect to the research, authorship, and/or publications of this article.

REFERENCES

Divers TJ and Peek SF (2008). Rebhun's Diseases of Dairy Cattle.2nd Edition, W.B.Saunders Co. Ltd., Philadelphia, USA.

Sultana M, Ahad A, Biswas PK, Rahman MA, Barua H (2008). Black Quarter (BQ) Disease in Cattle and Diagnosis of BQ Septicemia Based on Gross Lesions and Microscopic Examination. Bangladesh J Microbiol.25 (1): 13-16.

Radostits OM, Gay CC, Blood DC and Hinchcliff KW (2000).Veterinary Medicine.9th Edition W.B. Saunders Co. Ltd., Philadelphia, USA.Edition, W.B.Saunders Co. Ltd., Edition, Philadelphia, USA.

To cite this paper: Yousaf A, Rais M-ul-N, Mushtaq A, Jamil T (2018). Prevalence of black quarter (BQ) disease in private dairy farm in Hyderabad, Sindh province of Pakistan. *Online J. Anim. Feed Res*., 8(1): 01-04. http://www.ojafr.ir

Robson S (2012). Blacklegincattle.Availableat:http://www.thedairysite.com/articles/843/blacklegin-cattle. Accessed on: 24 Apr 2012.

Coles EH (1980). Veterinary Clinical Pathology 3rd Edition, W.B. Saunders Co.Ltd., London.

Singh KP, Parihar NS, Charan K and Tripathi BN (1993). Hematological and biochemical alterations in Hill bulls infected with Clostridium Chauvoei. Acta Vet. 62: 89-94.

To cite this paper: Yousaf A, Rais M-ul-N, Mushtaq A, Jamil T (2018). Prevalence of black quarter (BQ) disease in private dairy farm in Hyderabad, Sindh province of Pakistan. *Online J. Anim. Feed Res*., 8(1): 01-04. http://www.ojafr.ir

2018 SCIENCELINE

Online Journal of Animal and Feed Research

Volume 8, Issue 1: 05-11; Jan 25, 2018

ISSN 2228-7701

EFFECT OF SEED PROPORTIONS ON MORPHOLOGICAL CHARACTERISTICS OF FORAGE MIXTURE IN NORTH GONDAR, ETHIOPIA

Malede BIRHAN

University of Gondar, Collage of Veterinary Medicine and Animal Sciences, Department of Animal Production and Extension, P.O.Box, 196, Gondar, Ethiopia

Email: birhan1975@gmail.com; maledeb@yahoo.com

ABSTRACT: The experiment was carried out on forage mixture triticale (X Triticosecale wittmack) and vetch (Vicia vilosa R.) under rain fed condition of Dembya district. Forage mixture grown under different seeding rates during 2016 cropping season in the study area. The objectives of the research were; to evaluate the optimum seeding rates for maximum forage biomass yield of the mixture and to assess the morphological and phenological efficiency of forage biomass yield in the mixture. The experimental design employed during the research was a randomized complete block design (RCBD) with five treatments and replicated five times with the total of 25 treatments/plots. The forage treatment include with five different proportions of seeding rates (SP) in the ratio of (triticale /vetch) 100:0 (SP1), 75:25 (SP2) 50:50 (SP3) 25:75 (SP4) and 0:100 (SP5) and the plot size was 2m x 5m width and length. Data was subjected to analysis as variance using MSTATC statistical procedure for morphological characteristics of forage yield and quality parameters. Higher forage DMY of the mixture (11.85t/ha) was observed at SP3. The research depicted that, SP3 for triticale was found to have highly significant at (P<0.01) in leaf area, leaf length and leaf to stem ratio than any other SPs in the forage mixture. With all these findings the experiment result of this study was found the combination of SP3 could be considered as the best association of triticale/vetch for better forage mixture as it resulted in highest, leaf area, leaf length and leaf to stem ratio and better DMY would be a benefit for forage biomass production in the mixture.

Keywords: Effect, Seed Proportions, Morphology, Mixture, Ethiopia

ORIGINAL ARTICLE

pii: S2228770118000002-8

Received 04 Aug. 2017

Accepted 05 Jan. 2018

INTRODUCTION

Land resource stress in the tropics and sub-tropical countries has increased as the number of people supported by the land has risen. Thus, cultivation of uplands, which are marginally suited to annual crops, has led to diminishing of soil fertility and crop yields (Bimrew, 2008). Continuous cultivation of the same types of crop has led to the development of intransigent problems of diseases, pest and weed infestation (Dawit, 2013). Tropical forages are playing a vital role in the development of sustainable cropping system, and a best methods of forage improvement has arisen by using intercropping of annuals crops and perennial legumes in sole cropping patterns makes it possible to manipulate the outcome of competition (Humphrey, 1994).

Livestock production in the tropics can be increased through increasing the productivity per animal and per unit of area land. A major factor in increasing livestock productivity will be the improvement of animal nutrition and feed supplies, especially in case of ruminant animals that must provide better nutrition (Whitman et al., 1980). Natural grazing land of the area consists of largely wide range of grasses, legumes and other herbaceous species. According to Daniel (1990) the existing feed stuffs in Ethiopia, native pasture and crop residues are poor in quality and provide insufficient protein, energy, vitamins and minerals. Animals' thrive predominantly on high-fiber feeds,

To cite this paper: Birhan M. (2018). Effect of seed proportions on morphological characteristics of forage mixture in North Gondar, Ethiopia. *Online J. Anim. Feed Res.*, 8(1): 05-11. www.ojafr.ir

which are incomplete in nutrients (nitrogen, sulfur, phosphorus, etc) necessary for microbial fermentation (Osuji et al., 1993).

If the price of animal products rises, farmers may adjust their planting schedules in favor of forage crops and commercial livestock production could be only achieved through the feeding of quality forage (FAO, 2011). Moreover, the important feature of the mixture is enhancement of seasonal distribution of forages, because legumes remain green long in the dry season (Prasad and Singh, 1991). The performance of the mixture depends on their compatibility and initial seed rate proportions of grass and legume species (Willey and Rao, 1980). Low seed rate results in a poor stand and prolonged time required for development of satisfactory grass-legume mixed pasture and high seed rates are in conspicuous because it incurs higher cost (Prasad and Singh, 1991).

Even thought, information on their agronomic management of optimum level of seeding rate for maximum biomass production for mixed pastures to improve yield and quality of forage is generally inadequate. In addition, the ministry of agriculture for adoption by dairy cattle owners is testing the different legume species (Charles et al., 2012). The mixture has been identified to have a promising potential for pasture improvement. Therefore, this study was designed with the following specific objectives:

1-To study the optimum seeding rates for maximum biomass yield of forages in the mixture.

2-To assess the morphological and phonological efficiency of forage yield and quality in the mixture.

MATERIALS AND METHODS

Description of the study area

The investigation was conducted at Dembia district of North Western part of Ethiopia, 736 km North of Addis Ababa, and 36 km from Gondar to Gorgora Tana road. The area experiences one main rainy (unimodal) with long rainy season extending from half of March to the mid October, but the effective rainfall is from May to half October. The mean annual rainfall was 1150 mm with a peak in June and July having an average of 105 rainy days. The area lies at an altitude of 2004 m.a.s.l. between. The major criteria used for the selection of the experimental area were the proportion of livestock especially local dairy cows and crossbred dairy cattle are more available in the study area at the radius of 5km from the farming area to the town, in addition there is a shortage of improved forage species and due to grazing land has been shifting of in to crop land as human population increased as geometric rate. Topography of the site was gentle slope and well drained in which the farmer used the area to frequently cultivated for crop alternatively in year round (CSA, 2011).

Land preparation and sowing

The varieties of forages were triticale (x *Tritico secale witt mack*): Vetch (*Vicia vilosa* r.) using 120 kg and 25 kg seed rate for triticale and vetch correspondingly. In both varieties the plot size was 2m x 5m for the treatments. The seed was purified; select the weed, and other dead, irregular in shape for to increased germination percentage. Therefore, the seed was mixed according to their respective seed proportion treatment combination and broadcasted on a well-prepared seedbed on the experimental site.

Experimental design and treatments

The experiment was conducted with five seed rate proportions on well prepared plots of mixed soil type and replicated five times with the total of 25 treatments were put in randomized complete block design (RCBD) in the study area.

Treatments of the seed proportion

Triticale alone which were; 100% (SP1), Triticale 75% + 25% Vetch which was (SP2), Triticale 50% + 50% Vetch (SP3), Triticale 25% + 75%Vetch (SP4) and Vetch alone 100% (SP5).

Seedling and tiller counts

Seedling counts for both species were done one week after emergence from the quadrants having (0.5 m x 0.5 m) area from each plot. It was carried out initial plant stand after seven days of growth by measuring quadrants and summarized the mean value at the different seed proportion treatments taken from each plot for both triticale and vetch mixture. Tillering count for triticale was measured at 45 days of growth by taking 0.5m x 0.5m sample area from each the entire plots and count the number of tillers found from individual plants.

Plant height, dry matter accumulations and heading date

Ten plants of triticale and ten plants of vetch were harvested every 20 days from ground level, to measure the height, fresh and dry matter weight and measured to assess the rate of change of height and dry matter

To cite this paper: Birhan M. (2018). Effect of seed proportions on morphological characteristics of forage mixture in North Gondar, Ethiopia. *Online J. Anim. Feed Res.*, 8(1): 05-11. www.ojafr.ir

accumulation over the growing period and height was expressed in centimeters by every 20 days of interval of plant growth. Dry matter accumulation was also determined every 20 days of plant growth and measured the changes in g/10 plants. For dry matter yield determination, the fresh weight of each plot was measured in the field using 20 kg measuring capacity balance in the field just after cutting. Sub-samples of each treatment were dried in the oven at 65 ^{0}C for 72 hours to determine the dry matter contents of the forages at Holeta Animal Nutrition Laboratory Tilahun (2002).

RESULTS AND DISCUSSION

Number of leaves for Triticale and branches for Vetch

The number of leaf for triticale significantly affected (P<0.01) by the different seed proportion (Table 1). SP1 with seed proportion two did not showed significant variations (P>0.05) in the number of leaves for triticale. The number of branches for vetch was significant different (P<0.01) in the different seed proportion and the highest and the lowest number of branches of vetch were measured SP5 and SP2 respectively. As the seed proportion of triticale decreased the numbers of branches of vetch become increased (Melese et al., 2014).

Seedling count for both forages and tiller counts in the mixture

Seedling counts after one week of emergency for both forage species showed significant variation (P<0.01) at the different seed proportions combination in Table 2. Higher seedling counts for triticale was obtained at SP1 and the lower seedling count at SP4 with values ranging from 135 to 44 seedlings /m^2 with a difference of 91 seedlings. The highest seedling count of vetch was measured at SP5 with the value of 55 seedling / m^2 but SP2 and SP3 did not indicate statistically significant variation at (P>0.05) in the seedling count of legume species. Analysis of variance data indicated that, tillering capacity of triticale in the growing period was significantly affected (P<0.01) by the different seed proportion treatments. The tillering capacity of triticale increased as the proportion of vetch increased and the maximum number of tiller was recorded at SP4 and the lower number of tiller at SP1 with the values of 210 and 135 tillers / m^2 respectively (Yeshitila et al., 2008).

Ground cover and Vigor Scores for Triticale and Vetch

Analysis of variance of data indicated that, the ground cover decreased with the decrease in the relative proportions of the seeds of each crop in the forage mixture and similar findings with Zewdie (2010).

The ground cover for different seed proportions of triticale were significantly affected by one to the other and higher at SP1 than SP3 and SP3 were also higher than SP4. The ground cover of vetch was also significantly affected (P<0.01) by the various seed proportion, however, SP5 was higher than that of SP2, SP3 and SP4. But seed proportion one with seed proportion two and seed proportion two with seed proportion three did not indicate statistically significant effect (P>0.05) on the vigorousity of triticale in the growing period.

Height, heading and Flowering Days of Triticale and Vetch

Data revealed that, heading days for triticale significantly affected (P<0.01) by the different seed proportion. Significantly higher result was obtained at SP3 with the value of 70.06 days. But SP1 and SP2 did not showed significant variation (P<0.01).

Flowering days for vetch also showed significantly influenced at (P<0.01) by the different seed proportions. However, SP3 and SP4 did not showed significant different at (P>0.05) one to the other and SP2 obtained higher flowering days as compare to the other SP. The lower days for flowering of vetches components at SP5 might be the higher proportion of vetch inclusion with triticale may enhance the growth and the plant could attain early maturing of its full development. Analysis of variance indicated that the height of triticale at the 20th days of cutting showed significant variation at (P<0.01) at the various seed proportions. The highest and the lowest height of triticale were observed at SP1 and SP2 with the values of 26.33 and 22.11cm correspondingly, this finding had a similar output with Malede (2013).

At the 40th days of plant growth plant height also significantly affected by the different seed proportion and the highest height of triticale was recorded at SP1 and the lowest at SP2 which measured 44.45 and 40.33 cm respectively. Analysis of variance data revealed that, there was statistically significant variation (P<0.01) in the height of triticale at the 60th days of plant growth. The highest height was also found at SP1and the lowest at SP3 measuring with the value of 75.89 and 68.67 cm indicated with the different of 7.22 (Chinedum and Evans, 2001).

Analysis of variance data at the 20th days measurement, the height of vetch indicated that, there was significantly affected at (P<0.01) in the different SP and the highest height was measured at SP5 and the lowest at SP2. Seed proportion three, seed proportion four and five indicated statistically non-significant different (P>0.05) from each other.

To cite this paper: Birhan M. (2018). Effect of seed proportions on morphological characteristics of forage mixture in North Gondar, Ethiopia. *Online J. Anim. Feed Res.*, 8(1): 05-11. www.ojafr.ir

At the 40th days of plant height measurement statistically significant variation (P<0.01) was found at the different seed proportion and the highest and the lowest plant height were measured at SP5 and SP4 with the value of 43.33 and 38.89 cm correspondingly. In the 60th days of plant growth height indicated significant different (P<0.01) in the various seed proportion.

Significantly higher leaf area was obtained at seed proportion three as compared to the other seed proportions. Leaf area showed an increasing tendency from seed proportions one to seed proportion three with the value of 18.44 to 26.54 cm^2. Analysis of variance data discovered that leaf length significantly influenced (P<0.01) by the different seed proportions. The highest leaf length was measured at seed proportion two and the lowest at seed proportion one measuring with the value of 45.64 and 38.60 cm respectively (Tsige, 2000).

Table 1 - Number of leaves for triticale and vetch as affected by seed proportion

Seeding rates (SP)	Number of leaf for triticale	Number of branches for vetch
SP1	3.03^{c}	-
SP2	3.0^{c}	11.04^{c}
SP3	4.03^{a}	13.00^{b}
SP4	3.65^{b}	13.64 ^{b}
SP5	-	14.62^{a}
Mean	3.43	13.10
SE(±)	0.03	0.01
LSD	0.03	1.07
CV (%)	3.17	5.34

SE = standard error, LSD = Least significant Different CV = Coefficient of Variations, Seed Proportion from 1 to 5, means with different letter within the columns are indicated significant different, whereas means with the same letter showed no significant variation.

Table 2 - Seedling counts (m^2) for both crops and tillering for triticale

Seeding rates (SP)	Emergency		Tillering
	Triticale /m^2	Vetch /m^2	Triticale /m2
SP1	135^{a}	-	135^{c}
SP2	115^{a}	18^{c}	195^{b}
SP3	91^{b}	25^{c}	210^{ab}
SP4	44^{c}	40^{b}	231^{a}
SP5	-	55^{a}	-
Mean	96.25	34.5	192.75
SE(±)	0.123	0.824	2.451
LSD	23.561	6.586	28.661
CV (%)	11.36	9.6	8.6

Table 3 - Ground cover and the vigorous of after one month of seed proportion

Seeding rates (SP)	Ground cover		Vigor	
	Triticale	Vetch	Triticale	Vetch
SP1	4.5^{a}	-	4.5^{a}	-
SP2	4.2^{b}	2.5^{c}	4.1^{ab}	3.4^{a}
SP3	3.8^{c}	3.8^{b}	3.8^{bc}	3.1^{a}
SP4	3.0^{d}	3.8^{b}	3.5^{cd}	3.6^{a}
SP5	-	4.2^{a}	-	4.0^{a}
Mean	3.88	3.58	3.98	3.53
SE(±)	0.354	0.417	0.1254	0.834
LSD	0.201	0.102	0.585	NS
CV (%)	13.51	13.51	13.51	13.51

SE = standard error, LSD = Least significant Different CV = Coefficient of Variations, Seed Proportion from 1 to 5, means with different letter within the columns are indicated significant different, whereas means with the same letter showed no significant variation.

To cite this paper: Birhan M. (2018). Effect of seed proportions on morphological characteristics of forage mixture in North Gondar, Ethiopia. *Online J. Anim. Feed Res.*, 8(1): 05-11. www.ojafr.ir

Table 4 - Days to heading for triticale and days to flowering for vetch

Seeding rates (SP)	Heading days Triticale	Flowering days Vetch
SP1	60.22^{c}	-
SP2	62.56^{c}	95.66^{a}
SP3	70.06^{a}	91.84^{b}
SP4	67.00^{b}	90.88^{c}
SP5	-	88.86^{c}
Mean	65	91.81
SE(±)	1.03	0.86
LSD	3.52	2.552
CV (%)	11.99	5.365

SE = standard error, LSD = Least significant Different CV = Coefficient of Variations, Seed Proportion from 1 to 5, means with different letter within the columns are indicated significant different, whereas means with the same letter showed no significant variation.

Table 5 - Plant height (cm) for triticale as affected by seed proportions

Seeding rates (SP)	Harvesting days			
	20	40	60	80
SP1	26.33^{a}	44.45^{a}	75.89^{a}	-
SP2	22.11^{b}	40.33^{b}	70.35^{b}	-
SP3	25.34^{a}	41.00^{ab}	68.67^{b}	110.27^{a}
SP4	23.33^{b}	44.22^{a}	69.22^{b}	123.00^{a}
SP5	-	-	-	-
Mean	24.3	42.5	71.03	120.1
SE(±)	0.243	0.786	0.66	3.546
LSD	1.270	3.821	3.721	NS
CV (%)	3.45	6.56	3.88	12.12

Table 6 - Plant height (cm) of vetch as affected by seed proportions

Seeding rates (SP)	Harvesting date			
	20	40	60	80
SP1	-	-	-	-
SP2	20.56^{b}	39.56^{b}	67.22^{b}	114.22^{a}
SP3	21.86^{ab}	41.11^{ab}	66.33^{b}	118.67^{a}
SP4	22.22^{ab}	38.89^{b}	72.11^{a}	116.86^{a}
SP5	24.56^{a}	43.33^{a}	72.33^{a}	112.78^{a}
Mean	22.3	40.72	69.5	115.63
SE(±)	1.85	0.86	1.46	3.52
LSD	3.31	3.34	4.62	NS
CV (%)	10.58	8.52	4.99	11.64

Table 7 - Leaf area, leaf length and leaf to stem ratio of triticale

Seeding rates (SP)	Leaf area (cm)	Leaf length (cm)	Leaf to stem ratio
SP1	18.44^{d}	38.60^{d}	0.84^{b}
SP2	24.21^{c}	45.64^{a}	1.04^{b}
SP3	26.54^{a}	42.64^{b}	1.44^{a}
SP4	25.04^{b}	40.20^{c}	1.01^{b}
SP5	-	-	-
Mean	23.60	41.80	1.08
SE(±)	1.06	1.04	0.44
LSD	0.82	0.55	0.26
CV (%)	4.84	12.00	7.12

To cite this paper: Birhan M. (2018). Effect of seed proportions on morphological characteristics of forage mixture in North Gondar, Ethiopia. *Online J. Anim. Feed Res.*, 8(1): 05-11. www.ojafr.ir

Conflict of interests

The authors have not declared any conflict of interests.

REFERENCES

Central Statistics Authority (2011). Agricultural sample survey report: Private peasant holding (Statistical Bulletin), Addis Ababa, Ethiopia.

Bimrew A (2008). Supplementation of different levels of rice bran and noug seed (Guizatia abissynica) cake mixtures on Nutrient utilization of Farta sheep fed natural grass hay. An MSc Thesis Presented to the School of Graduate studies of Haramaya University, Pp. 125

Food and Agriculture Organization (2011). Draft guidelines on phenotypic characterization of Animal genetic Resource. On Genetic Resources for Food and Agriculture Rome, 18-22 July, 2011, Pp. 6

Charles S, Wortmann and Charles, A. Shapiro (2012). Harvesting Crop Residues: University of Nebraska-Extension, Institute of Agriculture and Natural resources.

Chinedum N and Evans N (2001). Comparative analysis of the economics of conventional and non-onventional feed use by poultry enterprises. Journal of Agriculture in the Tropics and Subtropics Volume 102 (2): 153 - 160.

Conservation and utilization of natural pasture hay for feeding dairy cattle in the greater Addis milkshed, central highlands of Ethiopia. Journal of Agricultural Research and Development, 3(6): 082-093.

Daneil K (1990). Effects of management practice on Rhodes grass and Lucerne pasture with special reference to developmental stages of cutting and associated changes in nutritional quality. PANESA/ARNAB (Pasture network for Eastern and Southern Africa/Africa Research Network for Agricultural By-product). Utilization of research results on forage and Agriculture product materials as animal feed resource in Africa. Proceedings of the first joint Workshop, held in Lilongwe, Malawi. 5-8 December 1988. PANESA/ARNAB, Addis Ababa, Ethiopia pp.635-639.

Dawit A, Ajebu N and Sandip B (2013). Assessment of feed resource availability and livestock production constraints in selected Kebeles of Adami Tullu Jiddo Kombolcha District, Ethiopia. African Journal of Agricultural Research, 8(29): 467-473.

Humphrey L (1994). Tropical forage; their role in sustainable agriculture. Longman Ltd New York. 157p.

Malede B (2013). Evaluation of Barley Green Forage as Animal Feed Intercropping with Vetch in North Gondar Zone, Ethiopia. European Journal of Biological Sciences 5 (2): 50-54, 2013. ISSN 2079-2085. © IDOSI Publications, 2013. DOI: 10.5829/idosi.ejbs.2013.5.2.7320.

Melese G, Berhan T and Mengistu U (2014). Effect of Supplementation with Non-Conventional Feeds on Feed Intake and Body Weight Change of Washera Sheep Fed Urea Treated Finger Millet Straw. Greener Journal of Agricultural Sciences, 4(2): 071- 074. Osuji, P.O., Sahlai I.V.N, and Khalili H. 1993. Feed evaluation ILCA Manual.

International Livestock Research Center for Africa (ILCA) 208. Addi Ababa, Eth. 26p. planning agricultural water management investments.

Prasad, N. K. and P. A. Singh (1991). Biological Potential and Economic Visibility of Wheat/Lucerne Intercropping System. Indian Journal of Agri. Science. 61: 835-840.

Tilahun T (2002). Effect of Planting Density and Arrangement Component Crops on Productivity of Maize/Faba Bean Intercropping Systems. An MSc Thesis Presnted to the School of Graduate Studies of Alemaya University of Agriculture. 125p.

Tsige, Y (2000). Livestock feed security and associated impacts on sustainable agricultural development. In: Proceedings of the 7th Annual Conference of Ethiopian Society of Animal Production (ESAP), Addis Ababa, Ethiopia, 26-27 May 1999.

Whiteman, P. C., S. S. Awarding, E. C. Wallis and R. Brucc (1980). Tropical Pasture Science. Oxford University, London, 425p.

Willey R.W. and Rao M.R. (1980). Competitive Ratio for Quantifying Competition between Intercrops. Experimental Agriculture, 16: 117-12

Yeshitila A, Tessema Z and Azage T (2008). Availability of livestock feed resources in Alaba district, Southern Ethiopia. In: Proceedings of the 16th annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, October 8 to 10, 2008.

Zewdie W (2010). Livestock production systems in relation with feed availability in the Highlands and Central Rift valley of Ethiopia. A MSc thesis submitted to the School of Animal and Range Sciences, School of Graduate studies Haramaya University. Pp. 61.

To cite this paper: Birhan M. (2018). Effect of seed proportions on morphological characteristics of forage mixture in North Gondar, Ethiopia. *Online J. Anim. Feed Res.*, 8(1): 05-11. www.ojafr.ir

2018 SCIENCELINE

Online Journal of Animal and Feed Research

Volume 8, Issue 1: 12-19; Jan 25, 2018

ISSN 2228-7701

COMPARATIVE EFFICACY OF TWO DIFFERENT BRANDS OF IVERMECTIN AGAINST GASTROINTESTINAL NEMATODES AND ECTOPARASITES OF SHEEP IN GONDAR TOWN, NORTHWEST ETHIOPIA

Worku ADUGNA[1], Araya MENGISTU[1]✉, Yitayew DEMESSIE[1] and Natnael MEKONNEN[2]

[1]*College of Veterinary Medicine and Animal Sciences, University of Gondar, Ethiopia*
[2]*Private Pharmaceurticals Importers, Bahir Dar, Ethiopia*

✉Email: armen.kassa@gmail.com

ABSTRACT: Gastrointestinal nematodes and ectoparasites are endemic in Ethiopia. Giving appropriate treatment for these infestations will reduce the damage that could occur from them. The current experimental study aimed to see the efficacy of two Ivermectin formulations for the purpose of this parasite in Gondar town. For the study 58 local sheep aged from 6 months to 2 years from small holder farmers were selected and randomly allocated as two treatment and one control groups. Ivermectin bolus and injection formulations were used for this efficacy assessment. For assessment of efficacy against gastrointestinal nematodes, 45 sheep were used and divided into three groups; for ectoparasite evaluation, 13 sheep were involved. Feces from each sheep were taken before and after each drug administration and egg per gram of feces were determined and larval cultures were done on day zero before treatment and on day 14 post-treatment. Ivermectin efficacy was investigated by the Fecal Egg Count Reduction Test (FECRT). Ivermectin injection and bolus were reduced FEC by 95.06% (95%CI: 87.8, 98.5%) and 98.8% (95%CI: 90.3, 100%), respectively. The therapeutic efficacies of both ivermectin formulations against ticks and lice infestations were 100% after 7 days of treatment and remained effective up to 28th days of post treatment. To the contrary, these parasites were increased gradually on 7th, 14th, 21st and 28th days of post treatment in the control group. Coproculture revealed four GIN genera which were *Haemonchus, Trichostrongylus, Oesophagostomum* and *Trichuris.* The identified genera of ticks and louse were *Bophilus* and *Linognathus*, respectively. The bolus form of ivermectin showed better efficacy against nematodes than the injectable and ectoparasites were cleared totally by the drug. Detailed studies are suggested to verify the efficacy of the formulations and searching optional drugs for those developing resistance.

Keywords: Ectoparasite, Efficacy, Gastrointestinal nematode, Ivermectin

ORIGINAL ARTICLE
pii: S2228770118000003-8
Received 10 Aug. 2017
Accepted 12 Jan. 2018

INTRODUCTION

In Ethiopia, small ruminants are important sources of income for the rural communities, however they are affected by many factors (Abebe and Esayas, 2001; Biffa et al., 2006; Sisay et al., 2006). Studies in different parts of the country have shown that ovine gastrointestinal parasites are found to be major problems that are causing considerable losses (Abebe and Esayas, 2001; Biffa et al., 2006; Tembely et al., 1997). There are over 20 different species of gastrointestinal nematodes (GINs) of sheep that can cause clinical or subclinical disease with reduced growth rate, body condition and milk production. Of these, *Haemonchus*, *Strongyloides*, *Trichostrongylus, Nematodirus*, and *Trichuris* are the major gastrointestinal nematode species reported in sheep (Razzaq et al., 2013). Besides, GINs, ectoparasites are very common and widely distributed in all agro-ecological zones of Ethiopia (Kumssa and Mekonnen, 2011; Kumssa et al., 2012), causing a wide range of health problems that confront sheep productivity. It is reported that 35% of sheep and 56% of goat skin rejections in Ethiopia are attributed to ectoparasites (Kassa, 2006).

Several anthelmintic preparations imported and distributed in the country; majority of them have been utilized frequently for two or more decades; possible cause of drug resistance (George et al., 2011) and the increase in the prevalence of GIN infections could also be attributed to the development of anthelmintic resistance (AR) (Martínez-Valladares et al., 2015). In small ruminants, GINs can generally be controlled using broad-spectrum

To cite this paper: Adugna W, Mengistu A, Demessie Y and Mekonnen N (2018). Comparative efficacy of two different brands of ivermectin against gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwest Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 12-19. www.ojafr.ir

anthelmintics. Macrocyclic lactones (avermectin and milbemycins), benzimidazole, and imidazothiazoles levamisole and hydropyrimidines (pyrantel/morantel) are some of the commonly used anthelmintics in Ethiopia. Among these anthelmintics ivermectin is the one that display a novel mode of action against nematode and arthropod parasites of animals. Its broad spectrum activity against GINs (Egerton et al., 1997) and ectoparasites (Cambell et al., 1983); with a wide safety of margin has made it the drug of choice in cattle, sheep, goat, swine and horses (Ademola et al., 2003). However, in Ethiopia, there are limited reports on the efficacy of these anthelmintics against economically important parasites (Bersissa and Abebe, 2006) and there is no published report on the comparative efficacy of two different brands of ivermectin to control GINs as well as ectoparasites of sheep in North Gondar as well as in Ethiopia. Therefore, the study aimed to evaluate the efficacy of Ivermectin formulations for the treatment of gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwestern parts of Amhara regional state, Ethiopia.

MATERIALS AND METHODS

Study area

The study was conducted in Gondar town; Amhara region, northwest Ethiopia from January 2016 to April 2016. Gondar town is located on 35°7' N and 13°8' E and lies at an altitude of 2,200 meter above sea level. It is found 748km north of Addis Ababa. The area receives mean annual rain fall of 1,172 mm mainly in rainy season with average temperature of 19.7°C. Being a highland area, the city is spread on different mountains, slopes and in valleys and has three small rivers, many streams and a lake. According to Zone Office of Agriculture and Rural Development, the population size of Gondar town in 2008 is about 112,249 out of which 60,883 are males and 51,366 are females [17-18]. The livestock population in North Gondar zone comprises of cattle (2, 771, 7 0 1), sheep (815, 7 1 6), goats (1,251,867), horses (27,248), mules (9, 695) and donkeys (376,841) (CSA, 2013).

Study animals and management

A total of 58 local breed sheep, kept under semi intensive management system sourced from private smallholder farmers with the age between six month and two years were used for the study. The sheep were purposively selected, which have not been treated in the previous 8 to 12 weeks were considered for the study. A young lamb that was not weaned and did not begin feeding on pasture was totally excluded from ivermectin efficacy trial. Sheep allocated for the study were identified by ear tags. Altogether those animals were shepherded together for the most part and grazed on permanent communal pastures. The animals also shared the same watering point during day time and housed in pens during night on their respective farms. The production system was based on traditional practices and no controlled mating (Eda, 2012), breeding occurring year round with two lambing cycles a year for many ewes. Feed supplements were not known except hay, crop residues which were available after harvesting season and a rare supply of common salts (NaCl) for selected animals. The ethical clearance was obtained from the ethical review committee of the college of Veterinary Medicine and Animal Sciences, University of Gondar and permission was obtained from the sheep owners.

Study design and treatment of animals

An experimental study design was conducted from January 2016 to April 2016 to investigate the efficacy of different brands of ivermectin against gastrointestinal nematodes and ectoparasites through fecal egg count reduction test and ectoparasite number with direct physical or visual examination, respectively in naturally infected sheep in Gondar town. Before the experiment fecal samples were collected from all sheep and examined for nematode infestations. The positive sheep were randomly allocated into three experimental groups. The first group was treated with ivermectin of china (1ml/50kg BW) subcutaneously; the second with ivermectin of India in the form of bolus (200mcg/kg BW) orally and the third was left untreated (control). The randomization also holds true for the purpose of the drug efficacy trail for ectoparasites. A control (untreated) group should be used to allow for natural changes in egg/ectoparasite counts during the test.

Sampling procedures and laboratory investigation

Fecal samples were collected from each animal for pre-screening of animals for sufficient egg counts. Feces were collected from each animal directly from the rectum using rubber gloves. The same procedure was followed at the post-treatment sampling. Samples were placed in individually sealed containers and labeled with specific identification mark, then return rapidly to the University of Gondar parasitological laboratory for egg counts. Fecal specimen was also subjected to coprological examination using standard fecal examination techniques (Shah-Fischer and Say, 1989; Hansen and Perry, 1994). Positive samples for parasite eggs was subjected to eggs per gram (EPG) determination using Modified McMaster egg counting method described by Coles et al. (1992).

To cite this paper: Adugna W, Mengistu A, Demessie Y and Mekonnen N (2018). Comparative efficacy of two different brands of ivermectin against gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwest Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 12-19. www.ojafr.ir

Many nematode eggs are alike and species differentiations for the genera of *Haemonchus, Ostertagia, Trichostrongylus, Cooperia, Bunostomum,* and *Oesophagostomum* cannot be clearly differentiated from the eggs in fecal samples. These parasites, differentiation can be achieved by the use of fecal cultures. Fecal samples from each sheep were collected on each sampling day (before and after treatment) and composite fecal cultures were made for each group. Small amount of water was added to moisten, and the samples left for 14 days at room temperature in sampling bottle by adding small amounts of water as necessary. Third stage larvae (L3) were recovered from the cultures by the Wide- mouthed Jar (Bayou, 2005), differentiated to the generic level, and identified under a compound microscope (at magnification 40x) using morphological keys (MAFF, 1971; Van Wyk et al., 2004).

The ectoparasites (ticks and lice) were detected by physical examination of the animals and the presences of the ectoparasites were visualized and recorded. Tick and lice infestations were examined physically on individual animals. These parasites were counted on different body regions (abdominal and thigh region) and an area of 5×4 i.e. 20 square cm was selected. The selected areas were marked with a permanent color and ticks and lice within this area were counted before treatment (day 0) and post-treatment (7th, 14th, 21st and 28th day) periods. The severity of infestation of ectoparasites (ticks and lice) was observed by counting the number of ectoparasites in a selected area of the individual sheep. Ectoparasites including ticks and lice were collected by hand from their attachment sites, put in universal bottle containing 70% methanol (Soulsby, 1982). Samples were then transported to University of Gondar, Veterinary parasitological laboratory for further identification of the parasites. Tick and lice specimens were placed on Petri-dish and examined under stereomicroscope for morphological species classifications (Walker et al., 2003; Wall and shearer, 2001).

Fecal egg count reduction test

Fecal egg count reduction test (FECRT) was used for the evaluation of the effects of the drug. The most commonly used field detection methods for anthelmintic resistance or efficacy is the fecal egg count reduction test (FECRT). This method can be adapted for use as a screening agent for Veterinarians and producers to identify less than desired clearance of the parasites after anthelmintic treatment (Gasbarre et al., 2009). The procedure compares the pre-treatment parasite level with the parasite levels after treatment. The efficacy of two brands of ivermectin was determined by comparing the FECRT from a group of animals before and after treatment (Coles et al., 2006).

Arithmetic means of pre and post treatment FECs were used to calculate the percentage efficacy of ivermectin using a formula; FECR% = 100 (1- T2/C2) where T2 and C2 are arithmetic mean egg per gram of feces (EPG) in the treated and untreated groups, respectively at day 14 post treatment. The efficacy of each ivermectin formulation was tested and interpreted according to the World Association for the Advancement of Veterinary Parasitology (WAAVP) recommendations for efficacy evaluations of anthelmintics. Similarly anthelmintic effectiveness was based on the FECR (%) and the lower 95% confidence limits. Reduction in the efficacy and presence of anthelmintic resistance is considered to exist, if the FECRT percentage of an anthelmintic treatment is < 95% and the lower confidence limit for the reductions is <90% (Coles et al., 1992). If only one of the two criteria is met, reduction in efficacy is suspected.

Efficacy of ivermectin against ectoparasite

In this study the efficacy of ivermectin is assessed by the comparison of ectoparasite numbers on groups of treated and untreated sheep. Ectoparasite (tick and louse) counts should be conducted on day 1 or day 0 prior to treatment, on day 7 and at 7-day intervals thereafter until study termination period. Geometric means of pre and post treatment ectoparasite counts were used to calculate the percentage efficacy of ivermectin using a formula as described by Abbott's formula: 100 [(C- T)/C] where parasite mean counts of the treated (T) and control (C) occur (Abott, 1925). In contrast to endoparasites, where an accurate measure of present populations can be made at necropsy, the assessment of louse and tick burdens by examination of selected areas of skin surface is less precise. Therefore, a measurement of response to treatment requires the repeated examination of parasitized areas or previously parasitized areas of the skin surface.

Data management and analysis

While collecting fecal samples from study animals, all data was recorded with pre-designed format and entered into computer using Microsoft excel spread sheet. Mean, standard deviation and reduction percentages were calculated through descriptive statistics. Means of egg count reduction were compared among groups through analysis of variance (One-Way ANOVA) and the difference between treatments was compared using least square method of multiple comparisons. Differences considered significant when $P<0.05$. Statistical Package for Social Sciences (SPSS) version 20 was used to analyze the data.

To cite this paper: Adugna W, Mengistu A, Demessie Y and Mekonnen N (2018). Comparative efficacy of two different brands of ivermectin against gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwest Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 12-19. www.ojafr.ir

RESULTS

Ivermectin efficacy against gastrointestinal nematodes

Mean fecal egg counts and percent reduction. The reduction in mean fecal EPG, after 14 days of post treatment, for ivermectin bolus and injection were 98.8% and 95.06%, respectively. The pre-treatment and post-treatment egg count means, standard deviation and the per cent reduction in the fecal egg counts are presented in (Table 1). There was no statistically significant difference (P>0.05) between the egg count of control and treated groups as well as between the two treated groups, ivermectin bolus treated and ivermectin injection treated, before treatment. Statistically post-treatment egg counts and percentage reduction of the drugs were significant (P=0.04) between treatment groups as well as there were strict differences (P=0.00) in net egg count between treatment and control groups on the post-treatment (Table 2).

Survivor parasites after treatment. Fecal culture was conducted parallel to fecal egg count to differentiate strongly type of eggs both in before and after treatments in each group.

Ivermectin efficacy against ectoparasites

Ivermectin recommended oral dose (200mcg/kg, BW and 0.02ml/kg, BW subcutaneous injection were found 100% effective against tick and lice infestation in sheep. No tick and lice were found within the selected area of sheep on 7, 14, 21, and 28 days after the treatment in both the ivermectin bolus and injection. On the other hand, in the control group, the number of tick and lice increased gradually on 7, 14, 21, and 28 day of treatment (Table 3). The adult ectoparasites (tick and lice) from the control groups were identified at the genus level (Table 4).

Table 1 - Mean fecal egg count and egg count percent reduction by Ivermectin (n=15)

Ivemectin formulations	Mean FEC±STDEV		Reduction (%)	95% Confidence interval	
	Pre treatment	Post treatment	Mean	Lower	Upper
Bolus	573.3±284.02	6.67±25.82	98.8	90.3	100
Injection	620±298.09	26.67±59.4	95.06	87.8	98.5
Control	420±169.87	540±206.33	NA	NA	NA

FEC: Fecal Egg Count, NA: Not Applicable, n: Number of sheep in each group, STDEV: Standard Deviation

Table 2 - Parasites (GINs) identified in control and treatment groups after ivermectin treatment (N=15)

Group	Ivermectin	Parasite
1	Bolus	*NL*
2	Injection	*Trichuris, Haemonchus,*
3	Untreated control	*Haemonchus, Trichuris, Oesophagostomum, Trichostrongylus, Strongyloides*

N: Number of sheep in each group, NL: No Larvae

Table 3 - Efficacy of Ivermectin (bolus and injection) against ectoparasitic infestation in sheep

Ivemectin	Ectoparasites	Number of ectoparasites (mean± STDEV) (n=5/3)				
		Pre-treatment	Post-treatment period			
		day 0	Day 7	Day 14	Day 21	Day 28
Bolus	Tick	3.4±1.14	Nil	Nil	Nil	Nil
	Lice	5.3±2.1	Nil	Nil	Nil	Nil
Injection	Tick	4.6±2.3	Nil	Nil	Nil	Nil
	Lice	4.8±1.3	Nil	Nil	Nil	Nil
Control	Tick	3.3±1.5	4.3±1.2	6±2.7	6.8±2.9	8.3±4.1
	Lice	4.1±1.16	5.5±2.2	5.8±2.3	7.2±3.5	10±4.9

N: Number of sheep; STDEV: Standard Deviation; Nil: zero (0)

To cite this paper: Adugna W, Mengistu A, Demessie Y and Mekonnen N (2018). Comparative efficacy of two different brands of ivermectin against gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwest Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 12-19. www.ojafr.ir

Table 4 - Ectoparasites identified on the control groups of sheep		
Group	**Ivermectin**	**Survived ectoparasites**
1	Bolus	0
2	Injection	0
3	Untreated control	*Bophilus* and *Linognathus*

DISCUSSION

The result showed that the mean fecal egg count reduction test value of ivermectin bolus and injection were 98.8 and 95.06%, respectively. The FECR test indicated that based on World Association for the Advancement of Veterinary Parasitology guidelines of Coles et al. (1992), the ivermectin bolus was effective against GINs of sheep whereas ivermectin injection was suspected reduction in efficacy. This guideline states, Resistance is considered if the percentage reduction in egg counts is less than 95% and the lower 95% confidence level is less than 90%. If only one of the two criteria is met, resistance is suspected. In this study the suspected resistance in the case of ivermectin injection may be due to prior under dosing, lack of anthelmintic class rotation and a high treatment frequency, alone or in combination as it was reported to increase the risk of anthelmintic resistance in Ethiopia, Uganda and in South Africa, and it was evidenced by Macro-cyclic lactones resistance in South Africa (Kumssa and Abebe, 2009; Byaruhanga and Okwee-Acai, 2013; Tsotetsi et al., 2013; Carmichael et al., 1987).

The reason for better efficacy in ivermectin bolus in the present study was probably due to recent introduction and low frequency of treatment. Therefore, majority of nematode parasite populations in sheep remained unexposed to anthelmintic selection, thus remaining susceptible. This is in agreement with work done by Domke et al. (2012) said that limited use of ivermectin seemed to have prevented the development of anthelmintics resistance in GINs of small ruminant in Norway. However, macrocyclic lactone resistance in *Haemonchus* was reported in South Africa (Tsotetsi et al., 2013) and Australia (Jabbar et al., 2013) due to extensive and prolonged use of macrocyclic lactones.

The effectiveness of ivermectin bolus (200µg/kg BW) and injection (0.02ml/kg BW) against ticks and lice were found to be 100% effective at 7th post treatment day and remained effective up to 28th day of post treatment. This result was in agreement with the earlier record made by different authors (Hanif et al., 2005; Aziz et al., 2012; Hassan et al., 2012; Fahima, 2003; Yazwinski et al., 1997; Sangwan et al., 1995; Vizzio and Caro, 1995; Pedroso et al., 1994; Thompson et al., 1994). However, some studies have shown 86.6% (Umur et al., 1993) and 90% (Imrul, 1997) efficacy of ivermectin in sheep and goat, respectively. The intensive use of anthelmintics has led to the development of anthelmintic resistance in small ruminants (Kaplan, 2004; Wolstenholme et al., 2004). Generally, the most likely explanation for the variation in efficacy of ivermectin was probably due to variation in ingredients, prolonged use without rotation, frequent dosing, and incorrect weight calculation which gives a risk of under-dosing that in turn results resistance.

CONCLUSION AND RECOMMENDATIONS

The study revealed that Ivermectin bolus was effective to treat GINs compared to the injectable formulation; whereas both were effective against ectoparasites. Apart from its effectiveness resistant parasites were also recorded, which might contribute for the dynamics of parasites epidemiology and this could urge seeking of optional drugs. Therefore, based on the above concise conclusion newly produced and/or introduced anthelmintics, regular monitoring for anthelmintic resistance, proper use of effective anthelmintics, awareness creation to the farming communities and further studies regarding the drug efficacies are suggested.

DECLARATIONS

Acknowledgement

We acknowledge Dr. Berhanu Moges and Dr. Natnael Mekonnen as well as their organization for providing us the ivermectin preparations for the study. We also highly appreciate the contribution of Dr Shashitu Birhan where her contribution was so immense.

Authors' Contributions

W.A. and A.M. prepared the proposal. W.A. conduct the research and collect the data while W.A., A.M. and A.D. participated in the data analsyis and writing of the manuscript. N.M. donated the drugs for the efficacy trial.

To cite this paper: Adugna W, Mengistu A, Demessie Y and Mekonnen N (2018). Comparative efficacy of two different brands of ivermectin against gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwest Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 12-19. www.ojafr.ir

Competing interests

The authors declare that they have no competing interests.

REFERENCES

Abbott WS (1925). A method of computing the effectiveness of an insecticide. *J. Econ. Entomol,* 18: 265–267.

Abebe W, Esayas G (2001). Survey of ovine and caprine gastrointestinal helminthosis in eastern part of Ethiopia during the dry season of the year. *Rev. Med. Vet*, 152: 379-384.

Ademola O, Benjamin F, Fagbemi O, Olakunle S (2003). Comparative in-vitro studies on the efficacy of ivermectin against gastrointestinal sheep nematode. *Tropical Journal of Pharmaceutical Research,* 2 (2): 235-238.

Aziz FB, Awal MA, Hasan Q, Rahman MM (2012). Comparative Efficacy of Ivermectin and Diazinon against Ectoparasites in Sheep. *J Anim Vet Adv,* 37: 398-46.

Bayou K (2005). Standard Veterinary Laboratory Diagnostic manual: Parasitology. Ethiopian agricultural Research Organization: National Animal Health Research Center, Addis Ababa. 3: 1-8.

Bersissa K, Abebe W (2006). Efficacy of Albendazole and Tetramisole anthelmintics against *Haemonchus contortus* in experimentally infected Lambs. *Intern J Appl Res Vet Med,* No.4, p.2.

Biffa D, Jobre Y, Chaka H (2006). Ovine helminthosis, a major health constraint to productivity of sheep in Ethiopia. *Anim. Health Res. Rev.***7**: 107-118.

Byaruhanga C, Okwee-Acai J (2013). Efficacy of albendazole, levamisole and ivermectin against gastro-intestinal nematodes in naturally infected goats at the National Semi-arid Resources. Research Institute, Serere, Uganda. *Veterinary Parasitology,* 195: 183-186.

Campbell WC, Fisher MH, Stapley EO, Albers-Schonberg G, Jacob TA (1983). Ivermectin: A potent new antiparasitic agent. *Science* 221(4513): 823–828.

Carmichael I, Visser R, Schneider D, Soll M (1987). *Haemonchus contortus* resistance to ivermectin. *J. S. Afr. Vet. Assoc,* 58, p. 93.

Central Statistical Agency (CSA) (2013) Agricultural Sample Survey, 2012/13 (2005 E.C.), Volume II: Report on Livestock and livestock characteristics (Private peasant holdings). Statistical Bulletin 570. Federal Democratic Republic of Ethiopia, Addis Ababa.

Coles GC, Bauer C, Borgsteede FH, Geerts S, Klei TR, *et al* (1992). World Association for the Advancement of Veterinary Parasitology (WAAVP) methods for the detection of anthelmintic resistance in nematodes of veterinary importance. *Veterinary Parasitoogy*, 44: 35-44.

Coles GC, Jackson F, Pomroy W E, Prichard KR, Von Samson-Himmelstjerna G *et al* (2006).The detection of anthelmintic resistance in nematodes of veterinary importance. *Veterinary parasitology*, 136: 167-185.

Domke AV, Chartier C, Gjerde B, Höglund J, Leine N, et al (2012). Prevalence of anthelmintic resistance in gastrointestinal nematodes of sheep and goats in Norway. *Parasitology Research*, 111: 185-193.

Edea Z, Haile A, Tibbo M, Sharma AK, Sölkner J, et al (2012). Sheep production systems and breeding practices of smallholders in western and south-western Ethiopia: Implications for designing community-based breeding strategies. Livest. Res. Rural dev. 24(7).

Egerton JR, Ostlind DA, Blair LS, Eary CH, Suhayda D, (1979). Avermectins, new family of potent anthelmintic agents: Efficacy of the B1a component. *Antimicrobial Agents and Chemotherapy,* 15(3): 372–378.

Fahima BA (2003). Comparative efficacy of Ivermectin and Diazenon against ectoparasite in sheep. MSc thesis Submitted to department of Pharmacology, BAU, Mymensingh, p. 48-80.

Gasbarre CL, Smith LL, Lichtenfels RJ, Pilit AP (2009). The identification of cattle nematode parasites resistant to multiple classes of anthelmintics in a commercial cattle population in the US. *Veterinary Parasitology*, 166: 281-285.

George N, Persad K, Sagam R, Offiah VN, Adesiyun AA, et al (2011). Efficacy of commonly used anthelmintics: First report of multiple drug resistance in gastrointestinal nematodes of sheep in Trinidad. *Veterinary Parasitology,* 183, p. 194–197.

Hanif MA, Mostofa M, Choudhury EM, Awal AM, Rahman MM, et al (2005). Efficacy of ivermectin (pour on formulation) against ectoparasites in sheep. *Bangladesh Journal of Veterinary Medicine*, 3, p. 140-143.

Hassan MM, Ahasanul MD, Hoque MA, Islam SK, Khan SA, et al (2012). Efficacy of anthelmintics against parasitic infections and their treatment effect on the production and blood indices in Black Bengal goats in Bangladesh. *Turkish Journal of Veterinary Science,* 36(4): 400-408.

Imrul M (1997). Efficacy of ivermectin (pour on formulation) against gastro-intestinal nematodiasis and ectoparasites in cattle. MS (Vet. science) Thesis, submitted to the Department of Pharmacology, Bangladesh Agricultural University, Mymensingh.

Jabbar A, Campbell AJD, Charles JA, Gasser RB (2013). First report of anthelmintics resistance in *Haemonchus contortus*in alpacas in Australia. *Parasites & Vectors*, 6: 243.

Kaplan RM (2004). Drug resistance in nematodes of veterinary importance. *A status report. Trends Parasitol*, 20, P. 477–481.

Kassa B (2006). 'Cockle, manage and pox: Major threats to the leather industry in Ethiopia. Ethiopian leather industry: Perseverance towards value addition', *Proceedings of the National Workshop*, Addis Ababa, Ethiopia, December 14–15, 2006, p. 71–92.

Kumsa B, Abebe G (2009). Multiple anthelmintic resistances on a goat farm in Hawassa, southern Ethiopia. *Trop. Anim. Health Prod*, 41(4): 655-662.

Kumsa B, Mekonnen S (2011). 'Ixodid ticks, fleas and lice infesting dogs and cats in Hawassa, southern Ethiopia', *Onderstepoort Journal of Veterinary Research* 78, Art. #326 4 pages. Available at: http://dx.doi.org/10.4102/ojvr.v78i1.326 (accessed 19 April 2016).

Kumsa B, Tamirat H, Tadesse G, Aklilu N, Cassani R (2012). 'Prevalence and species composition of ixodid ticks infesting horses in three agroecologies in central Oromia, Ethiopia', *Tropical Animal Health and Production,* 44, p. 119–124. Available at: http://dx.doi.org/10.1007/s11250-011-9897-y, PMid: 21656133 (accessed 22 April 2016).

Martínez-Valladares M, Geurden T, Bartram DJ, Martínez-Pérez JM, Robles-Pérez D (2015). Resistance of gastrointestinal nematodes to the most commonly used anthelmintics in sheep, cattle and horses in Spain. *Veterinary Parasitology*, 211: 228-233.

Ministry of Agriculture Fisheries and Food (MAFF) (1971). *Manual of Veterinary Parasitological Laboratory Techniques*. Technical Bulletin, Her Majesty's stationery office, London, 18: 5-19.

Pedroso PD, Moya BG, Borja GE, Paiva D, Pedroso DE (1994). Ivermectin for the control of Sarcopromuscapruna (Shannon and Del Ponte, 1926). (Diptera, Muscidae), carrier of Dermatobia Hominis, L.Jr. (1781). (Deptera, Cuterebridae). *Revista Barsileira de Parasitologia Veterinaria*, 3: 61-64.

Razzaq AK, Ashraf A, Maqbool MA, Khan Islam M, Khan H (2013). Epidemiology, sero-diagnosis and therapeutic studies on ovine nematodes at district loralai, Baluchistan, Pakistan. *J. Anim. Plant. Sci*, 23(6): 1559-1565.

Sangwan RP, Langholef WK, Cramer LG, Eagleson JS (1995) An ivermectin tablet for sheep, efficacy against gastrointestinal nematodes and a bioavilability comparison with a liquid ivermectin formulation. *Vet Parasitol*, 60: 297-302

Sissay M, Asefa A, Uggla A, Waller P J (2006). Anthelmintic resistance of nematode parasites of small ruminants in eastern Ethiopia: exploitation of refugia to restore anthelmintic efficacy. *Vet. Parasitol*, 135, p. 337-346.

Soulby EC (1982). *Helminths, Arthropods, and Protozoa of domestic animals*, 7th ed. Philadelphia: Lea and Faebiger. p. 375-502.

Tembely S, Lahlou-kassi A, Rege J, Sovani S, Diedhiou ML, et al (1997). Epidemiology of nematode infections in sheep in a cool tropical environment. *Vet. Parasitol*, 70: 129-141.

Thompson DR, Kugg D, Scott PG, Cramer LG, Barrick RA (1994). Rainfall and breed effects on the efficacy of ivermectin jetting fluit for the prevention of fly strike and treatment of infestation of lice in long wooled sheep. *Austr Vet J*, 71: 161-164.

Tsotetsi AM, Njiro S, Katsande TC, Mayo G, Baloyi F, *et al.,*(2013). Prevalence of gastrointestinal helminths and anthelmintic resistance on small-scale farms in Gauteng Province, South Africa. *TropicalAnimal Health and Production,* 45: 751-761.

Umur S, Irmak K (1993). Treatment of natural sarcoptic mange in calves with Ivermectin and phoxin. Veteriner Fakultesi Dergisi. Ankara, Universitesis, 40: 301-310

Van Wyk JA, Cabaret J, Michael LM (2004). Morphological identification of nematode larvae of small ruminants and cattle simplified. *Veterinary Parasitology* 119: 277-306.

Vizzio EA, Caro RR (1995) Use of Ivermectin and lufenuron in the treatment of dog fleas. *Veterinaria Argentina*, 12: 406-408.

Walker AR, Bouattour A, Camicas JL, Estrada-Pena IG Horak, AA, et al (2003). Ticks of domestic animals in Africa: A guide to identification of species. Bioscience and Reports. Edinburgh, London, p. 262.

Wall R, Shearer D (2001). *Veterinary Ectoparasites: Biology, Pathology and Control*. 2nd ed. Black well science.

To cite this paper: Adugna W, Mengistu A, Demessie Y and Mekonnen N (2018). Comparative efficacy of two different brands of ivermectin against gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwest Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 12-19. www.ojafr.ir

Wolstenholme JA, Fairweather I, Prichard R, Samson-Himmelstjerna G, Sangster CN (2004). Drug resistance in veterinary helminths. Trends in Parasitology, 20: 10- 12.

Yazwinski TA, Tucker CA, Featherston HE, Walstrom DJ (1997). Comparative therapeutic efficacy of doramectin and ivermectin against naturally acquired nematode infection in cattle. *Vet Record*, 140: 343- 344.

To cite this paper: Adugna W, Mengistu A, Demessie Y and Mekonnen N (2018). Comparative efficacy of two different brands of ivermectin against gastrointestinal nematodes and ectoparasites of sheep in Gondar town, Northwest Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 12-19. www.ojafr.ir

Instructions for Authors

OJAFR EndNote Style | Manuscript Template | Sample Articles | Declaration form

Manuscripts as Original Research Paper, Review, Short Communication and Case Reports and are invited for rapid peer-review publishing in the *Online Journal of Animal and Feed Research (ISSN 2228-7701)*.
Papers can be in any relevant fields of Animal Sciences (Animal Nutrition, Physiology, Reproduction, Genetics and Breeding, Behavior, Health, Husbandry and its economic, Animal products and Veterinary medicines of domestic animals) and relative topics. The journal does encourage papers with emphasis on the nutritive value and utilization of feeds that is depended to methods of Improvement, Assessment, Conserving and Processing feeds, Agronomic and climatic factors, Metabolic, Production, Reproduction and Health responses to dietary inputs (e.g., Feeds, Feed Additives, Specific Feed Components, Mycotoxins). Also, Mathematical models relating directly to animal-feed interactions, Analytical and experimental methods for Feed Evaluation as well as Animal Production studies with a focus on Animal Nutrition that do have link to a feed (Food Science and Technology) are acceptable relative topics for OJAFR**.**

Submission

The manuscripts should be submitted using our online submission system. For facile submission, please embed all figures and tables at the end of the manuscript to become one single file for submission. Once submission is complete, the system will generate a manuscript ID and password sent to author's contact email. If you have any difficulty in submitting the manuscript, kindly send via email: editors@ojafr.ir. All manuscripts must be checked (by English native speaker) and submitted in English for evaluation in totally confidential and impartial way.

Supplementary information:

Author guidelines are specific for each journal. Our MS Word template can assist you by modifying your page layout, text formatting, headings, title page, image placement, and citations/references such that they agree with the guidelines of journal. If you believe your article is fully edited per journal style, please use our Word template before submission. Supplementary materials may include figures, tables, methods, videos, and other materials. They are available online linked to the original published article. Supplementary tables and figures should be labeled with a "S", e.g. "Table S1" and "Figure S1". The maximum file size for supplementary materials is 10MB each. Please keep the files as small as possible to avoid the frustrations experienced by readers with downloading large files.

Submission to the Journal is on the understanding that:

1.The article has not been previously published in any other form and is not under consideration for publication elsewhere;
2.All authors have approved the submission and have obtained permission for publish work.
3.Researchers have proper regard for conservation and animal welfare considerations. Attention is drawn to the *'Guidelines for the Treatment of Animals in Research and Teaching'*. Any possible adverse consequences of the work for populations or individual organisms must be weighed against the possible gains in knowledge and its practical applications. If the approval of an ethics committee is required, please provide the name of the committee and the approval number obtained.

Ethics Committee Approval

Experimental research involving human or animals should have been approved by author's institutional review board or ethics committee. This information can be mentioned in the manuscript including the name of the board/committee that gave the approval. Investigations involving humans will have been performed in accordance with the principles of *Declaration of Helsinki*. And the use of animals in experiments will have observed the *Interdisciplinary Principles and Guidelines for the Use of Animals in Research, Testing, and Education* by the New York Academy of Sciences, Ad Hoc Animal Research Committee. If the manuscript contains photos or parts of photos of patients, informed consent from each patient should be obtained. Patient's identities and privacy should be carefully protected in the manuscript.

Presentation of the article

Main Format:

First page of the manuscripts must be properly identified by the title and the name(s) of the author(s). It should be typed in Times New Roman (font sizes: 12pt in capitalization for the title and the main text, double spaced, in A4 format with 2cm margins. All pages and lines of the main text should be numbered consecutively throughout the manuscript. The manuscript must be saved in a .doc format, (not .docx files). Abbreviations in the article title are not allowed except the well-known ones.

Manuscripts should be arranged in the following order:

a. TITLE (brief, attractive and targeted);
b. Name(s) and Affiliation(s) of author(s) (including post code) and corresponding E-mail;
c. ABSTRACT;
d. Key words (separate by semicolons; or comma,);
e. Abbreviations (used in the manuscript);
f. INTRODUCTION;
g. MATERIALS AND METHODS;
h. RESULTS;
i. DISCUSSION;
j. CONCLUSION;
k. Acknowledgements (if there are any);
1. REFERENCES;
m. Tables;
n. Figure captions;
o. Figures;

The sections "RESULTS AND DISCUSSION" can be presented jointly.
The sections "DISCUSSION AND DISCUSSION" can be presented jointly.

Article Sections Format:

Title should be a brief phrase describing the contents of the paper. Title Page should include full names and affiliations of the author(s), the name of the corresponding author along with phone and e-mail information. Present address(es) of author(s) should appear as a footnote.

Abstract should be informative and completely self-explanatory, briefly present the topic, state the scope of the experiments, indicate significant data, and point out major findings and conclusions. The abstract should be 150 to 300 words in length. Complete sentences, active verbs, and the third person should be used, and the abstract should be written in the past tense. Standard nomenclature should be used and abbreviations should be avoided. No literature should be cited.

Following the abstract, about 3 to 7 **key words** should be listed.

Introduction should provide a clear statement of the problem, the relevant literature on the subject, and the proposed approach or solution. It should be understandable to colleagues from a broad range of scientific disciplines.

Materials and Methods should be complete enough to allow experiments to be reproduced. However, only truly new procedures should be described in detail; previously published procedures should be cited, and important modifications of published procedures should be mentioned briefly. Capitalize trade names and include the manufacturer's name and address. Subheadings should be used. Methods in general use need not be described in detail.

Results should be presented with clarity and precision. The results should be written in the past tense when describing findings in the author(s)'s experiments. Previously published findings should be written in the present tense. Results should be explained, but largely without referring to the literature. Discussion, speculation and detailed interpretation of data should not be included in the results but should be put into the discussion section.

Discussion should interpret the findings in view of the results obtained in this and in past studies on this topic. State the conclusions in a few sentences at the end of the paper. The Results and Discussion sections can include subheadings, and when appropriate, both sections can be combined.

Conclusion should be brief and tight, providing a few specific tasks to accomplish: 1-Re-assert/Reinforce the Thesis; 2-Review the Main Points; 3- Close Effectively. The Conclusion section should not be similar to the Abstract content.

Declarations including Ethics, Consent to publish, Competing interests, Authors' contributions, and Availability of data and materials are necessary.

Acknowledgments of persons, grants, funds, etc should be brief.

Tables should be kept to a minimum and be designed to be as simple as possible. Tables are to be typed double-spaced throughout, including headings and footnotes. Each table should be on a separate page, numbered consecutively in Arabic numerals and supplied with a heading and a legend. Tables should be self-explanatory without reference to the text. The details of the methods used in the experiments should preferably be described in the legend instead of in the text. The same data should not be presented in both table and graph forms or repeated in the text.

The Figure legends should be typed in numerical order on a separate sheet. Graphics should be prepared using applications capable of generating high resolution GIF, TIFF, JPEG or PowerPoint before pasting in the Microsoft Word manuscript file. Use Arabic numerals to designate figures and upper case letters for their parts (Figure 1). Begin each legend with a title and include sufficient description so that the figure is understandable without reading the text of the manuscript. Information given in legends should not be repeated in the text.

Declarations section - Please include declarations heading

Please ensure that the sections: Ethics (and consent to participate), Consent to publish, Competing interests, Authors' contributions, and Availability of data and materials are included at the end of your manuscript in a Declarations section.

Consent to Publish

Please include a 'Consent for publication' section in your manuscript. If your manuscript contains any individual person's data in any form (including individual details, images or videos), consent to publish must be obtained from that person, or in the case of children, their parent or legal guardian. All presentations of case reports must have consent to publish. You can use your institutional consent form or our consent form if you prefer. You should not send the form to us on submission, but we may request to see a copy at any stage (including after publication). If your manuscript does not contain any individual person's data, please state "Not applicable" in this section.

Authors' Contributions

For manuscripts with more than one author, OJAFR require an Authors' Contributions section to be placed after the Competing Interests section. An 'author' is generally considered to be someone who has made substantive intellectual contributions to a published study. To qualify as an author one should 1) have made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) have been involved in drafting the manuscript or revising it critically for important intellectual content; and 3) have given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. Acquisition of funding, collection of data, or general supervision of the research group, alone, does not justify authorship.

We suggest the following format (please use initials to refer to each author's contribution): AB carried out the molecular genetic studies, participated in the sequence alignment and drafted the manuscript. JY carried out the immunoassays. MT participated in the sequence alignment. ES participated in the design of the study and performed the statistical analysis. FG conceived of the study, and participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript. For authors that equally participated in a study please write '**All/Both authors contributed equally to this work**.' Contributors who do not meet the criteria for authorship should be listed in an acknowledgements section.

Competing Interests

Competing interests that might interfere with the objective presentation of the research findings contained in the manuscript should be declared in a paragraph heading "Competing interests" (after Acknowledgment section and before References). Examples of competing interests are ownership of stock in a company, commercial grants, board membership, etc. If there is no competing interest, please use the statement "The authors declare that they have no competing interests.". *Online Journal of Animal and Feed Research* adheres to the definition of authorship set up by the International Committee of Medical Journal Editors (ICMJE). According to the ICMJE authorship criteria should be based on 1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, 2) drafting the article or revising it critically for important intellectual content and 3) final approval of the version to be published. Authors should meet conditions 1, 2 and 3. It is a requirement that all authors have been accredited as appropriate upon submission of the manuscript. Contributors who do not qualify as authors should be mentioned under Acknowledgements.

Change in authorship

We do not allow any change in authorship after provisional acceptance. We cannot allow any addition, deletion or change in sequence of author name. We have this policy to prevent the fraud.

Acknowledgements

We strongly encourage you to include an Acknowledgements section between the Authors' contributions section and Reference list. Please acknowledge anyone who contributed towards the study by making substantial contributions to conception, design,

acquisition of data, or analysis and interpretation of data, or who was involved in drafting the manuscript or revising it critically for important intellectual content, but who does not meet the criteria for authorship. Please also include their source(s) of funding. Please also acknowledge anyone who contributed materials essential for the study.
Authors should obtain permission to acknowledge from all those mentioned in the Acknowledgements. Please list the source(s) of funding for the study, for each author, and for the manuscript preparation in the acknowledgements section. Authors must describe the role of the funding body, if any, in study design; in the collection, analysis, and interpretation of data; in the writing of the manuscript; and in the decision to submit the manuscript for publication.

Data Deposition

Nucleic acid sequences, protein sequences, and atomic coordinates should be deposited in an appropriate database in time for the accession number to be included in the published article. In computational studies where the sequence information is unacceptable for inclusion in databases because of lack of experimental validation, the sequences must be published as an additional file with the article.

References

An OJAFR reference style for **EndNote** may be found **here**.

1. All references to publications made in the text should be presented in a list with their full bibliographical description.
2. In the text, a reference identified by means of an author‘s name should be followed by the date of the reference in parentheses. When there are more than two authors, only the first author‘s surname should be mentioned, followed by ’et al‘. In the event that an author cited has had two or more works published during the same year, the reference, both in the text and in the reference list, should be identified by a lower case letter like ’a‘ and ’b‘ after the date to distinguish the works.
3. References in the text should be arranged chronologically (e.g. Kelebeni, 1983; Usman and Smith, 1992 and Agindotan et al., 2003). 'et al.' should not be italic. The list of references should be arranged alphabetically on author's surnames, and chronologically per author. If an author's name in the list is also mentioned with co-authors, the following order should be used: Publications of the single author, arranged according to publication dates - publications of the same author with one co-author - publications of the author with more than one co-author. Publications by the same author(s) in the same year should be listed as 1992a, l992b, etc.
4. Names of authors and title of journals, published in non-Latin alphabets should be transliterated in English.
5. A sample of standard reference is "1th Author surname A, 2th Author surname B and 3th Author surname C (2013). Article title should be regular, in sentence case form, and 9 pt. Online Journal of Animal and Feed Research, Volume No. (Issue No.): 00-00." (Journal titles should be full and not italic.)
6. If available please add DOI numbers or the link of articles at the end of each reference.

Examples (at the text):

Abayomi (2000), Agindotan et al. (2003), (Kelebeni, 1983), (Usman and Smith, 1992), (Chege, 1998; Chukwura, 1987a,b; Tijani, 1993,1995), (Kumasi et al., 2001).

Examples (at References section):

a) For journal:

Lucy MC (2000). Regulation of ovarian follicular growth by somatotropin and insulin- like growth factors in cattle. Journal of Dairy Science, 83: 1635-1647.

Kareem SK (2001). Response of albino rats to dietary level of mango cake. Journal of Agricultural Research and Development, Pp. 31-38.

Chikere CB, Omoni VT and Chikere BO (2008). Distribution of potential nosocomial pathogens in a hospital environment. African Journal of Biotechnology, 7: 3535-3539.

b) For symposia reports and abstracts:

Cruz EM, Almatar S, Aludul EK and Al-Yaqout A (2000). Preliminary Studies on the Performance and Feeding Behaviour of Silver Pomfret (Pampus argentens euphrasen) Fingerlings fed with Commercial Feed and Reared in Fibreglass Tanks. Asian Fisheries Society Manila, Philippine, 13: 191-199.

c) For edited symposia, special issues, etc., published in a journal:

Korevaar, H., 1992. The nitrogen balance on intensive Dutch dairy farms: a review. In: A. A. Jongebreur et al. (Editors), Effects of Cattle and Pig Production Systems on the Environment: Livestock Production Science, 31: 17-27.

d) For books:

AOAC (1990). Association of Official Analytical Chemists. Official Methods of Analysis, 15th Edition. Washington D.C. pp. 69-88. Pelczar JR, Harley JP, Klein DA (1993). Microbiology: Concepts and Applications. McGraw-Hill Inc., New York, pp. 591-603.

e) Books, containing sections written by different authors:

Kunev, M., 1979. Pig Fattening. In: A. Alexiev (Editor), Farm Animal Feeding. Vol. III. Feeding of Different Animal Species, Zemizdat, Sofia, p. 233-243 (Bg).

In referring to a personal communication the two words are followed by the year, e.g. (Brown, J. M., personal communication, 1982). In this case initials are given in the text. Where available, URLs for the references should be provided.

Formulae, numbers and symbols

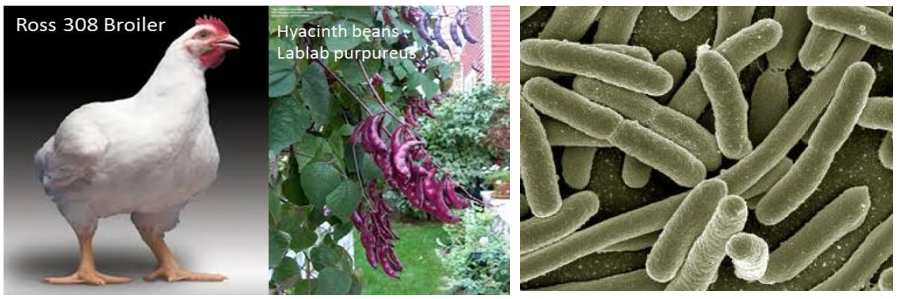
1. Typewritten formulae are preferred. Subscripts and superscripts are important. Check disparities between zero (0) and the letter 0, and between one (1) and the letter I.
2. Describe all symbols immediately after the equation in which they are first used.
3. For simple fractions, use the solidus (/), e.g. 10 /38.
4. Equations should be presented into parentheses on the right-hand side, in tandem.
5. Levels of statistical significance which can be used without further explanations are *P < 0.05, **P < 0.01, and ***P<0.001.
6. In the English articles, a decimal point should be used instead of a decimal comma.
7. Use Symbol fonts for "±"; "≤" and "≥" (avoid underline).
8. In chemical formulae, valence of ions should be given, e.g. Ca2+ and CO32-, not as Ca++ or CO3.
9. Numbers up to 10 should be written in the text by words. Numbers above 1000 are recommended to be given as 10 powered x.
10. Greek letters should be explained in the margins with their names as follows: Aα - alpha, Bβ - beta, Γγ - gamma, Δδ - delta, Eε - epsilon, Zζ - zeta, Hη - eta, Θθ - theta, Iι - iota, Kκ - kappa, Λλ - lambda, Mμ - mu, Nν - nu, Ξξ - xi, Oo - omicron, Ππ - pi, Pρ - rho, Σσ - sigma, Tτ - tau, Yυ - ipsilon, Φφ - phi, Xχ - chi, Ψψ - psi, Ωω - omega. Please avoid using math equations in Word whenever possible, as they have to be replaced by images in xml full text.

Abbreviations

Abbreviations should be presented in one paragraph, in the format: "term: definition". Please separate the items by ";".
E.g. ANN: artificial neural network; CFS: closed form solution; ....

Graphical Abstract:

Authors of accepted articles should provide a graphical abstract (a beautifully designed feature figure) to represent the paper aiming to catch the attention and interest of readers. Graphical abstract will be published online in the table of content. The graphical abstract should be colored, and kept within an area of 12 cm (width) x 6 cm (height) or with similar format. Image should have a minimum resolution of 300 dpi and line art 1200dpi.



Note: Height of the image should be no more than the width. Please avoid putting too much information into the graphical abstract as it occupies only a small space. Authors can provide the graphical abstract in the format of PDF, Word, PowerPoint, jpg, or png, after a manuscript is accepted for publication.
If you have decided to provide a Professional Graphical Abstract, please click **here**.

Review/Decisions/Processing

Firstly, all manuscripts will be checked by Docol©c, a plagiarism finding tool. The received papers with plagiarism rate of more than 40% will be rejected. Manuscripts that are judged to be of insufficient quality or unlikely to be competitive enough for publication will be returned to the authors at the initial stage. The remaining manuscripts go through a double-blind review process by two reviewers selected by section editor (SE) or deputy SE of OJAFR, who are research workers specializing in the relevant field of study. One unfavorable review means that the paper will not be published and possible decisions are: accept as is, minor revision, major revision, or reject. The corresponding authors should submit back their revisions within 14 days in the case of minor revision, or 30 days in the case of major revision. Manuscripts with significant results are typically reviewed and published at the highest priority. The editor who received the final revisions from the corresponding authors shall not be hold responsible for any mistakes shown in the final publication.

Plagiarism: There is an instant policy towards plagiarism (including self-plagiarism) in our journals. Manuscripts are screened for plagiarism by Docol©c, before or during publication, and if found they will be rejected at any stage of processing.

Date of issue

All accepted articles are published bimonthly around 25th of January, March, May, July, September and November, each year in full text on the Internet.

Publication charges

Articles of *Online Journal of Animal and Feed Research (ISSN 2228-7701)* are freely accessible. No peer-reviewing charges are required. Publication of short reports and letter are free of charge; however, a negligible editor fee will be applied for long research and review papers (more than 10 pages) before copyediting and publication, if accepted.

The Waiver policy

The submission fee will be waived for invited authors, authors of hot papers, and corresponding authors who are editorial board members of the *Online Journal of Animal and Feed Research*. The Journal will consider requests to waive the fee for cases of financial hardship (for high quality manuscripts and upon acceptance for publication). Requests for waiver of the submission fee must be submitted via individual cover letter by the corresponding author and cosigned by an appropriate institutional official to verify that no institutional or grant funds are available for the payment of the fee. Letters including the manuscript title and manuscript ID number should be sent to: editors@ojafr.ir. It is expected that waiver requests will be processed and authors will be notified within two business day.

The OA policy

Online Journal of Animal and Feed Research is an Open Access journal which means that all content is freely available without charge to the user or his/her institution. Users are allowed to read, download, copy, distribute, print, search, or link to the full texts of the articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author. This is in accordance with the *BOAI definition of Open Access*.

Submission Preparation Checklist

Authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to the following guidelines:

- The submission has not been previously published, nor is it before another journal for consideration (or an explanation has been provided in -Comments to the Editor).
- The submission file is in Microsoft Word, RTF, or PDF document file format.
- Where available, URLs for the references have been provided.
- The text is double-spaced; uses a 12-point font; and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.
- The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.

Editorial Offices:
Atatürk University, Erzurum 25100, Turkey
University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada
University of Maragheh, East Azerbaijan, Maragheh 55136, Iran
Homepage: www.science-line.com
Phone: +98 914 420 7713 (Iran); +90 538 770 8824 (Turkey); +1 204 8982464 (Canada)
Emails: administrator@science-line.com ; saeid.azar@atauni.edu.tr

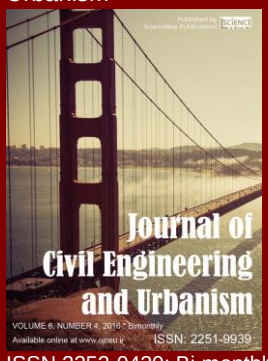
SCIENCELINE PUBLISHING CORPORATION

Scienceline Publication Ltd is a limited liability non-profit non-stock corporation incorporated in Turkey, and also is registered in Iran. Scienceline journals that concurrently belong to many societies, universities and research institutes, publishes internationally peer-reviewed open access articles and believe in sharing of new scientific knowledge and vital research in the fields of life and natural sciences, animal sciences, engineering, art, linguistic, management, social and economic sciences all over the world. Scienceline journals include:

Online Journal of Animal and Feed Research

ISSN 2228-7701; Bi-monthly
View Journal | Editorial Board
Email: editors@ojafr.ir
Submit Online >>

Journal of Civil Engineering and Urbanism



ISSN 2252-0430; Bi-monthly
View Journal | Editorial Board
Email: ojceu@ojceu.ir
Submit Online >>

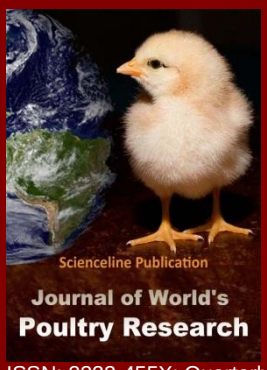
Journal of Life Sciences and Biomedicine

ISSN: 2251-9939; Bi-monthly
View Journal | Editorial Board
Email: editors@jlsb.science-line.com
Submit Online >>

Asian Journal of Medical and Pharmaceutical Researches

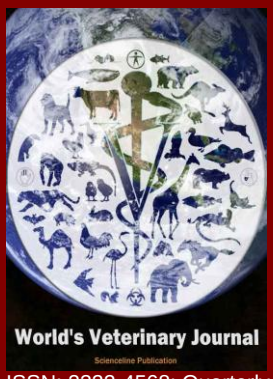
ISSN: 2322-4789; Quarterly
View Journal | Editorial Board
Email: editor@ajmpr.science-line.com
Submit Online >>

Journal of World's Poultry Research



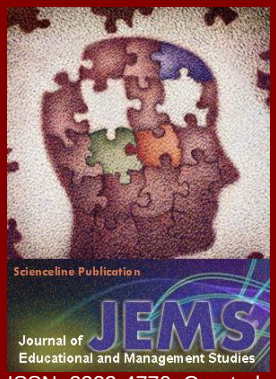
ISSN: 2322-455X; Quarterly
View Journal | Editorial Board
Email: editor@jwpr.science-line.com
Submit Online >>

World's Veterinary Journal



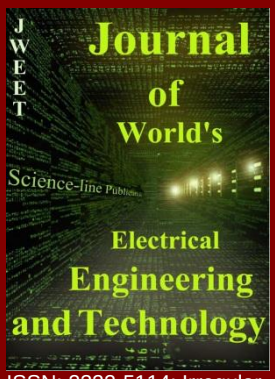
ISSN: 2322-4568; Quarterly
View Journal | Editorial Board
Email: editor@wvj.science-line.com
Submit Online >>

Journal of Educational and Management Studies



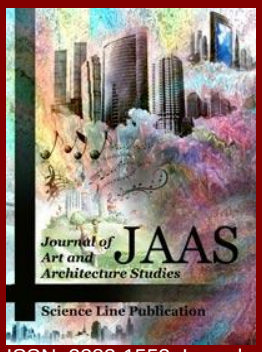
ISSN: 2322-4770; Quarterly
View Journal | Editorial Board
Email: info@jems.science-line.com
Submit Online >>

Journal of World's Electrical Engineering and Technology



ISSN: 2322-5114; Irregular
View Journal | Editorial Board
Email: editor@jweet.science-line.com
Submit Online >>

Journal of Art and Architecture Studies



ISSN: 2383-1553; Irregular
View Journal | Editorial Board
Email: jaas@science-line.com
Submit Online >>

Asian Journal of Social and Economic Sciences

ISSN: 2383-0948; Quarterly
View Journal | Editorial Board
Email: ajses@science-line.com
Submit Online >>

Journal of Applied Business and Finance Researches

ISSN: 2382-9907; Quarterly
View Journal | Editorial Board
Email: jabfr@science-line.com
Submit Online >>

Scientific Journal of Mechanical and Industrial Engineering

ISSN: 2383-0980; Quarterly
View Journal | Editorial Board
Email: sjmie@science-line.com
Submit Online >>

Scienceline Journals
Email: administrator@science-line.com