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Research Paper

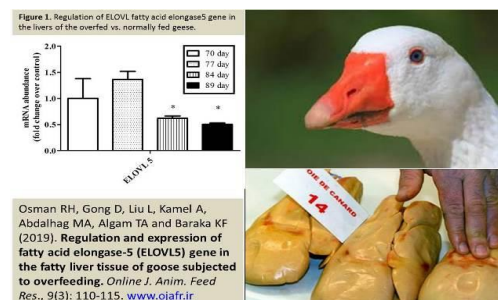
Regulation and expression of fatty acid elongase-5 (ELOVL5) gene in the fatty liver tissue of goose subjected to overfeeding.

Osman RH, Gong D, Liu L, Kamel A, Abdalhag MA, Algam TA and Baraka KF.

Online J. Anim. Feed Res., 9(3): 110-115, 2019; pii: S222877011900014-9

Abstract

Fatty acid elongase ELOVL plays an important role in the synthesis of long-chain polyunsaturated fatty acids (LCPUFA). The aim of this study was to investigate regulation and expression of ELOVL fatty acid elongase 5 gene in the fatty liver tissue of goose after feeding on a carbohydrate-rich diet. To understand how the Elov15 was down-regulated in the context of fatty liver, we treated goose primary hepatocytes with fatty liver-related factors, including high levels of glucose, fatty acids and insulin. Together, the present study suggested that the reduction of Elov15 expression is required for the development of goose fatty liver. We hypothesized that ELOVL5 are involved in goose fatty liver development. To address this, we determined the response of goose ELOVL5 gene to overfeeding and their expression in goose liver and primary hepatocytes with some related factors such as glucose, fatty acid and insulin. Expression data indicated that ELOVL5 was significantly reduced after a period of force-feeding lasting 2 weeks of overfeeding. In primary hepatocytes, gene expression was not affected by glucose and palmitate treatment while expression reduced by high level of insulin 50mM and 100mM. Also when we treated with 0.25mM of Oleate the expression level rapidly down-regulated.

Keywords: Fatty liver, Goose, ELOVL fatty acid elongase-5, Overfeeding[\[Full text-PDF\]](#)

Research Paper

Challenges of dairy production and marketing in urban and peri-urban areas of Amhara region, Ethiopia.

Moges N, Getu A, Guadu T, Bogale B, Mengistu A, Tesfaye Sh.

Online J. Anim. Feed Res., 9(3): 116-124, 2019; pii: S222877011900015-9

Abstract

Dairy production is an important component of livestock farming in Ethiopia. The huge and diverse livestock population, varied and favorable agro-ecology is good for dairy production to answer the demands for dairy products in urban and peri-urban areas. The aim of the study was to assess the challenges of dairy production and marketing in urban and peri-urban areas of Amhara region. Therefore, a total of 885 households were randomly selected for interview. In the dairy farm, the major feed resources used by the households were natural pasture (4.5%), concentrate feed (60.9%) and both pasture and concentrate feed (34.1%). According to the information stated by the respondents industrial by products (6.0%), hay (20.5%), straw and brewery by products (0.7%) were used as important feed resources, while 97% of the overall respondents stated that water available was accessible throughout the year. Whereas, the major challenges for dairy production interims of diseases in the current studied areas were mastitis (11.5%), ectoparasite infestation (10.6%), lumpy skin disease (2.7%) and foot mouth disease (1.9%). In addition, milk production and marketing system in the areas were highly challenged by disease prevalence, feed scarcity feed quality, and distant traveled to sell milk and seasonal price variation. Developmental constraints were also reported like lack of infrastructure and finance, poor education of households, seasonality of supplies and the lack of market and marketing infrastructure and facilities. On the same time reproductive problems like sterility, abortion, immature birth, retained placenta, repeat conception and dystocia with the proportion of 3.6, 23.7, 1.8, 9.9, 17.9, 9.1 and 34% respectively were reported. Therefore, feed scarcity throughout the year, disease prevalence and veterinary service problem are some of the identified challenges. So, appropriate research work, development, policy and crosscutting interventions should be taken in to account to make improve the dairy industry

Keywords: Dairy Production, Marketing, Urban, Peri Urban, Amhara, Ethiopia.[\[Full text-PDF\]](#)

Research Paper

Assessment of prescription patterns of veterinary drugs in Gondar, north west Ethiopia.

Berihun B, Kebede E, Birhan M and Mohammed A.

Online J. Anim. Feed Res., 9(3): 125-133, 2019; pii: S222877011900016-9

Abstract

Veterinary drugs play an important role in the control and prevention of animal disease, but have the potential to cause harm if not used rationally. Irrational prescription of drugs is a common occurrence in veterinary clinical practice. To evaluate the prescription patterns of veterinarians and animal health workers in Gondar town of three veterinary clinics, Northwestern Ethiopia. A retrospective study was conducted using a systematic random sampling method of 1000 patient's encounters. Data were collected from prescription and case books retained in the clinic for the last two years. Average number of drugs per encounter in these health facilities was 1.291. Generic prescribing was low at 88.40% while encounters with antibiotic prescription were high at 44.4%. About 98.20% of prescribed drugs were listed in the national veterinary drug list while 64.4% of encounters had at least one injection prescribed. The most commonly prescribed drugs were Albendazole 330(25.6%), Oxytetracycline 243(18.8%), Ivermectin 157(12.16%), Penicillin and Streptomycin fixed combination 133(10.3%), Acaricides 108(8.3%), vitamin supplements 77(6%), and other drugs including gastrointestinal stimulants, Anti-acids, anti-inflammatory drugs, lubricants and anti-foaming agents 243(18.8%). Among a total of 1000 animal patient encounters, only 158(15.8%) prescription contain name of the prescriber, while 128(12.8%) of prescriptions have signature of the prescriber and 109(10.9%) of prescriptions contained qualification of the prescriber. The prescribing practices for antibiotic, genetic drug and injection shows deviation from the standard recommended by WHO, so it should be improved. On the other hand, polypharmacy, generic prescribing and prescribing from Ethiopian veterinary drug list were not found to be a problem in this study. Further comprehensive studies on medication error are necessary to investigate the scale of problem and their economic impact.

Keywords: Assessment, irrational drug use, Prescription, Rational Veterinary

[Full text-[PDF](#)]



Berihun B, Kebede E, Birhan M and Mohammed A (2019). Assessment of prescription patterns of veterinary drugs in Gondar, north west Ethiopia. *Online J. Anim. Feed Res.*, 9(3): 123-133. www.ojafr.ir

Research Paper

The influence of dried brewery grain in broiler diets on production performance.

Kuleile N, Adoko G and Nkheche M.

Online J. Anim. Feed Res., 9(3): 134-138, 2019; pii: S222877011800017-9

Abstract

As a result of high feed costs in Lesotho the majority of farmers especially those producing under semi intensive are diluting commercial feeds with a non-conversional feeds such as dried brewery grain (DBG) in order to increase the quantity and to lower the costs of feeds. In most cases this practice resulted in poor broiler performance and low carcass yields because of high inclusion rates. A completely randomized study with four dietary treatments was undertaken at the National University of Lesotho farm. The aim of the study was to investigate the effect of DBG inclusion in broiler diets during growing and finishing and to determine the dilution or the inclusion rate that can maintain broiler performance and carcass yields like commercial feeds. Dietary treatments were made up of control represented by commercial feeds and three inclusion rates of DBG at 25, 50 and 75% respectively. A total of 360 day-old Ross 308 chicks were randomly assigned to four treatments replicated four times. A total of ten birds per replicate were used for carcass parameters determination. Feeds and water were provided on ad libitum basis. Light was provided for maximum of 20 hours per day. Performance data were collected on weekly basis as average feed intake, growth rate, body weight, feed conversion ratio and mortality while carcass parameters were collected at the end of finishing phase on carcass weight, dressing percentage, gizzard and intestinal weight. The feeding experiment lasted for four weeks. The dietary treatments had a significant ($P < 0.05$) effect on average feed intake, growth rate, body weight, feed conversion ratio, carcass weight, dressing percentage, gizzard and intestinal weights whereby broilers under control and 25% DBG had similar and better performance than animals in other treatments except for gizzard and intestinal weight which were higher in 75% DBG. The higher fibre content of DBG was found to be the limiting factor in the utilization by broiler especially at inclusion rate beyond 25%. Cost benefit analysis indicated that there was a 21% reduction in feed costs when using 25% DBG in broiler diets. It was concluded that 25% DBG inclusion rate is the one giving similar production performance and carcass yield to the commercial feeds except for the visceral parts. Therefore farmers can include the DBG up to 25% in broiler feeds for optimum performance and carcass yield between growing and finishing stages and save 21% in feed costs.

Keywords: Dried brewery grain, Commercial feeds, Broiler performance, Carcass parameters, Feed costs.

[Full text-[PDF](#)]



Kuleile N, Adoko G and Nkheche M (2019). The influence of dried brewery grain in broiler diets on production performance. *Online J. Anim. Feed Res.*, 9(3): 134-138. www.ojafr.ir

Research Paper

Assessment of major reproductive disorders of dairy cows in Gondar town, north west Ethiopia.

Simeneh Y and Moges N.

Online J. Anim. Feed Res., 9(3): 139-145, 2019; pii: S222877011800018-9



Simeneh Y and Moges N (2019). Assessment of major reproductive disorders of dairy cows in Gondar town, north west Ethiopia. Online J. Anim. Feed Res., 9(3): 139-145. www.ojafri.ir

Abstract

A cross sectional study was conducted in Gondar town from November 2016 to April 2017 with the objectives of determining the prevalence rate of major reproductive health problems of dairy cows and assessing risk factors with roles in predisposing to reproductive problems. Cross sectional questionnaire survey and regular follow-up were used to determine reproductive parameters and abnormalities. The study was carried out on a total of 316 dairy cows. From the total study animals 25% (n=79) were affected by at least with one reproductive health problem. Among the problems repeat breeder, retained fetal membrane, abortion and anestrus were mostly found with their respective prevalence of 6.96%, 6.01%, 3.48% and 2.53%. The overall prevalence of reproductive problems were significantly ($P<0.05$) influenced by breed, production system, age, parity, body condition and hygiene. Generally the current finding revealed that reproductive health problems commonly exist in the study area through their percentage and types vary from time to time; hence, regular reproductive health management and proper formulation of ration could be the possible solutions to alleviate the problems encountered in different production systems. From the different risk factors studied BCS and parity were significantly associated with reproductive health problems. From this study feeding, housing and health managements should be restudied and improved to reduce the incidence of reproductive problems. This study showed that reproductive disorders highly affected the reproductive performance of dairy cows. Further detailed studies on the major reproductive health disorders in the area should be carried out.

Keywords: Dairy cows, Gondar town, Reproductive health problems.

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REGULATION AND EXPRESSION OF FATTY ACID ELONGASE-5 (ELOVL5) GENE IN THE FATTY LIVER TISSUE OF GOOSE SUBJECTED TO OVERFEEDING

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✉ Supporting Information

ABSTRACT: Fatty acid elongase ELOVL plays an important role in the synthesis of long-chain polyunsaturated fatty acids (LCPUFA). The aim of this study was to investigate regulation and expression of ELOVL fatty acid elongase 5 gene in the fatty liver tissue of goose after feeding on a carbohydrate-rich diet. To understand how the Elov15 was down-regulated in the context of fatty liver, we treated goose primary hepatocytes with fatty liver-related factors, including high levels of glucose, fatty acids and insulin. Together, the present study suggested that the reduction of Elov15 expression is required for the development of goose fatty liver. We hypothesized that ELOVL5 are involved in goose fatty liver development. To address this, we determined the response of goose ELOVL5 gene to overfeeding and their expression in goose liver and primary hepatocytes with some related factors such as glucose, fatty acid and insulin. Expression data indicated that ELOVL5 was significantly reduced after a period of force-feeding lasting 2 weeks of overfeeding. In primary hepatocytes, gene expression was not affected by glucose and palmitate treatment while expression reduced by high level of insulin 50mM and 100mM. Also when we treated with 0.25mM of Oleate the expression level rapidly down-regulated.

Keywords: Fatty liver, Goose, ELOVL fatty acid elongase-5, Overfeeding

INTRODUCTION

Fatty acids are one of the important sources of energy in the cell biology are always play vital role in the regulation of cellular signaling by the reflecting the cellular homeostasis. The cell metabolic state is influences the lipid pool in by two ways; on one hand it alters the lipid storage lipid and on the other hand it alters fatty acid oxidation in order to generate energy.

Seven different types of ELOVL proteins were found in mammals, which includes both enzymes ubiquitously expressed and some which are tissues specific enzymes. They are characterized as monosaturated and polysaturated fatty acid elongases. Elov13, Elov16, Elov11 and Elov17 belong to the saturated and monounsaturated fatty acid elongases while the Elov12, Elov14 and Elov15 are classified into polysaturated fatty acid elongases (Leonard, et al., 2004). The Elov15 was extremely expressed in testis, adrenal glands and liver, it has been found to be expressed, to some extent, in all tissues tested (LEONARD, et al., 2000). The which enzyme has been reported to play an important role in liver development during the postnatal stage in rat (Wang, et al., 2005). Elov15 was reported to be involved in elongation of polyunsaturated fatty Acyl-CoA substrates of 18 and 20 carbons in length (Parker-Barnes, et al., 2000, Moon, et al., 2001, Inagaki, et al., 2002, Wang, et al., 2005). In rat primary hepatocytes cell the Elov15 expression an increased elongation of arachidonic acid (20:4, n-6) and eicosapentaenoic acid (20:5, n-3) into adrenic acid (22:4, n-6) and docosapentaenoic acid (22:5, n-3) (Wang, et al., 2008). The highly expression gave rise to changed fatty acid content, which in turn affected the lipid and carbohydrate composition. Elov15 deletion lead to develops hepatic steatosis in mouse with increased hepatic cholesterol and triglyceride levels by increasing activation of sterol regulatory element-binding protein-1c (SREBP-1c) and its target genes (Moon, et al., 2009). The levels of arachidonic acid (20:4, n-6) and docosahexaenoic acid (22:6, n-3) were reduced in this mouse model. However, there was an increased elongation activity of ELOVL2 and ELOVL6, pointing towards compensation of these enzymes in the Elov15-ablated mice.

In this study, we are used diet content high carbohydrate for fed Landes geese for 19 days, at which time the average weight of a fatty liver could reach 800g, approximately more than 10 time than the normal weight. We hypothesized that goose liver Elovl5 was involved in the development of fatty liver in a different way. To test this, Landes geese were normally fed or overfed, and their livers were used for transcriptome analysis with RNA-sequencing (RNA-seq) technology. The differentially expressed gene resulted from this analysis was subjected to further bioinformatics analysis. Indeed, Elovl5 was extremely differentially expressed gene, and a majority of Elovl5 was down-regulated in overfed geese compared to normally fed geese. This result was verified by quantitative PCR.

MATERIALS AND METHODS

Ethical approval

The care and treatment of experimental animals conformed to the “Guide for the Care and Use of Laboratory Animals” of Yangzhou University. All procedures performed in this study involving animals were in accordance with the ethical standards and approved by the Animal Ethical and Welfare Committee of Yangzhou University.

Animals experiment

A total of 36 Healthy Landes geese one-day-old were purchased from Wu Wang Farm (Chuzhou, China) and randomly divided into two groups, i.e., a control and an overfeeding group. The geese were raised under the condition of natural light and temperature. The control geese were allowed *ad libitum* feeding of cooked maize, while the overfed geese were provided with a diet that contains cooked corn, 1% plant oil and 1% salt. All the geese were kept in a cage with free access to water. For the overfeeding group, a 5-day-long pre-overfeeding was performed to prepare the geese for formal overfeeding, which lasted 19 days. During the pre-overfeeding period, the feed intake of the geese was gradually increased from 100 g to 300 g per day. The formal overfeeding began at 70-day-old of the geese. The following protocol was applied: in the first 5 d the daily feed intake (3 meals a day) reached 500 g, followed by 800 g of daily feed (4 meals a day) for the following week and 1,200 g of daily feed intake (5 meals a day) for the remaining days. The geese were sacrificed at 70, 77, 84 and 89 days of age. The livers from the geese were snap-frozen in liquid nitrogen and stored at -70 °C until use.

Preparation of goose primary hepatocytes

Hepatocytes were isolated from Landes goose embryos at 23 days' post-hatch. The preparation was performed as previously described (Osman, et al., 2016b). After the primary hepatocytes were obtained, the cells were dilute with culture medium to 1×10^6 cells/ml, plate 1×10^6 cells per well in 12-well dishes, followed by incubation in 5% CO₂ incubator until treatment. The media was renewed at first 6 h of incubation and every 24 h for later incubation.

Treatment of cultured goose primary hepatocytes with glucose, fatty acids and insulin

The isolated hepatocytes were cultured for at least 24 h before any treatments. The cell culture treatment was performed as previously described (Osman, et al., 2016a). The control cells were treated with serum free culture media containing 11.6L/mL of HCl. All the primary hepatocytes were rinsed with PBS twice, followed by harvesting the cells at the end of treatment with 1 mL TRIzol Reagent (Cat. No. 15596026, Life, USA) per well.

Isolation of total RNA and amplification to cDNA:

Total RNA was extracted by TRIzol (Tiangen Biotech (Beijing) Co., Ltd.) from the liver of the overfeeding and control group, according to manufacturer's instructions. RNA was eluted in nuclease-free water and was subjected to DNAase treatment to remove genomic DNA. Both the quality and quantity of total RNA were assessed at OD A260/A280 values were ranged between 1.8 to 2, indicating high quality RNA using a NanoDrop® Spectrophotometer (Nano Drop Technologies, Inc. Wilmington, DE, USA). Samples were stored at -70 °C before reverse transcription was performed. We reverse-transcribed 2 µg of RNA per sample following the manufacturer's instructions SuperQuickRT cDNA kit (CWBIO). The cDNA was stored at -20 °C until analysis.

Determination of mRNA abundance by quantitative PCR

Quantitative analysis on gene expression was previously described (Zhang et al., 2013). Briefly, expression levels of ELOVL fatty acid elongase5 gene in the liver of the overfed and normally fed geese as well as the treated goose primary hepatocytes was performed with SYBR® Green Master Mix kit (Vazyme Biotech Co., Ltd). The primer for quantitative PCR was listed in Table 1. The glyceraldehyde-3-phosphate dehydrogenase gene (GAPDH) gene was used as an internal control gene for normalization. Cycle threshold (Ct) was determined with the supplied software. The relative mRNA abundance of genes of interest was calculated using $2^{-\Delta\Delta Ct}$ and presented as fold change over control using the method previously described (Livak and Schmittgen, 2001).

Bioinformatics analysis

ELOVL fatty acid elongase5 and GAPDH genes primers were designed by Premier5® Software (PremierBiosoft, Palo Alto, CA, USA) and figures were constructed by Graph pad version 5 software.

Statistical analysis

Statistical analysis was performed using SPSS 16.0 (SPSS China, Shanghai, China) for Windows. The statistical significance of differences among the means of the control and different treatments was determined by one-way analysis of variance. A $P < 0.05$ was considered statistically significant.

Table 1 - Primers used in this study

Gene	Forward 5'-3'	Reverse 5'-3'	Product size
ELOVL5	ATTCTGATACTCTTCCTCCTC	TCCAGCAATGCGTCCTTA	235 bp
GAPDH	GCCATCAATGATCCCTTCAT	CTGGGGTCACGCTCCTG	200 bp

Fatty acid elongase-5 (ELOVL5), The glyceraldehyde-3-phosphate dehydrogenase gene (GAPDH)

RESULTS

Induction of ELOVL fatty acid elongase5 gene in goose fatty liver by overfeeding

ELOVLs play an important role in mammalian LCPUFA and EFA metabolisms, which may have involved in regulate some biological processes and several metabolic disorders. As the gene has not been cloned and sequenced yet in goose, cDNA was synthesized from liver total RNA as template to specifically amplify the complete coding sequences (CDSs) of the gene with the primers designed based on the sequences of their duck counterparts. The amplicons were subsequently cloned, and several clones were sequenced. The sequence result was also validated by RNA-seq analysis of goose liver transcriptome that we performed. Bioinformatics analysis indicated that the sequences of the amplicons shared 98% identity to duck sequence, which confirmed the cloned amplicons was indeed goose ELOVL5 genes. Moreover, the predicted amino acid sequence of goose ELOVL5 shared 98, 94 and 93% homology to the counterparts of other animals, including duck (*A. platyrhynchos*), turkey (*Meleagris gallopvo*) and chicken (*Gallus gallus*), respectively (Table 2), suggesting the gene was considerably conserved among avian species.

Table 2 - Comparisons of goose ELOVL fatty acid elongase5 nucleotide sequences with their counterparts of some other animals

Species	GenBank accession number	Length (pb)	Nucleotide identity (%)
Duck	XM_005009190.2	888	98
Turkey	XM_003204431.3	888	94
Chicken	XM_015284840.1	887	93

Fatty acid elongase-5 (ELOVL5), The glyceraldehyde-3-phosphate dehydrogenase gene (GAPDH)

Regulation of ELOVL5 by-related factors in goose primary hepatocytes

To identify whether the differentially expressed of ELOVL fatty acid elongase-5 gene was regulated by fatty liver-associated factors, we treated goose primary hepatocytes with different levels of glucose, free fatty acids (palmitate & oleate) and insulin. Data indicated that ELOVL5 has not been affected by glucose treatment (5.5, 25 and 50 mM) (Figure 2), while in Insulin 50mM and 100 was significantly inhibited ($P < 0.05$) the expression of ELOVL5 gene (Figure 3), 0.25mM but not 0.5mM Oleate has significantly ($P < 0.05$) reduced only the expression of the gene (Figure 4), and 0.25mM and 0.5mM Palmitate also did not significantly induced the expression of the genes, though the expression of the gene was slightly increased in the cells treated with 0.25mM oleate vs. control (Figure 5).

Figure 1. Regulation of ELOVL fatty acid elongase5 gene in the livers of the overfed vs. normally fed geese. The messenger RNA abundance was determined by quantitative PCR. The control group consists of the geese that were normally fed, while overfeeding group consists of the geese that were overfed for 0, 7, 14, and 19 days (i.e., the overfed geese at 70, 77, 84 and 89 days of age). The messenger RNA abundance in the overfeeding group was presented as fold change over the control group. N=6. * denote $P < 0.05$ vs. control, all data are presented as means \pm SEM.

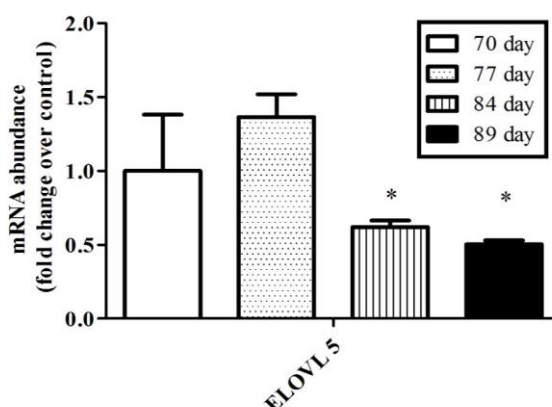


Figure 2. Messenger RNA expression of ELOVL fatty acid elongase5 gene in goose primary hepatocytes treated with vs. without glucose. The expression of the genes was determined by quantitative PCR. Primary hepatocytes isolated from goose embryos at 21 days of hatch were treated with 25 mM, and 50 mM glucose in serum-free media, while primary hepatocytes untreated with glucose were used as control. N=3. The average mRNA abundances of the genes in the hepatocytes treated with different levels of glucose are presented as fold change over the control. N=3. All data are presented as the means \pm SEM.

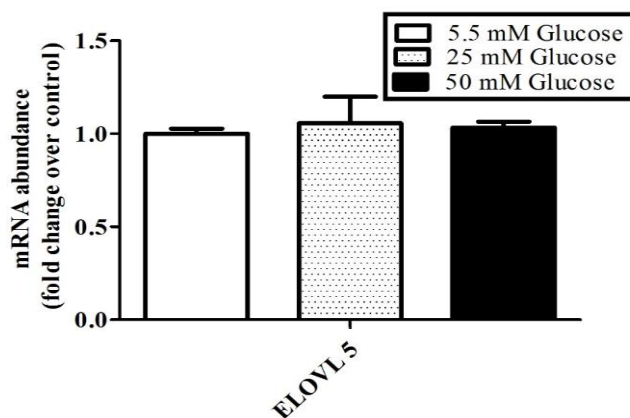


Figure 3. Messenger RNA expression of ELOVL fatty acid elongase5 in goose primary hepatocytes treated with vs. without insulin. The expression of the genes was determined by quantitative PCR. Primary hepatocytes isolated from goose embryos at 21 days of hatch were treated with 50 mM, and 100 mM insulin in serum-free media, while primary hepatocytes untreated with insulin were used as control. N=3. The average mRNA abundances of the genes in the hepatocytes treated with different levels of insulin are presented as fold change over the control. N=3. *denote $P < 0.05$ vs. control. All data are presented as the means \pm SEM.

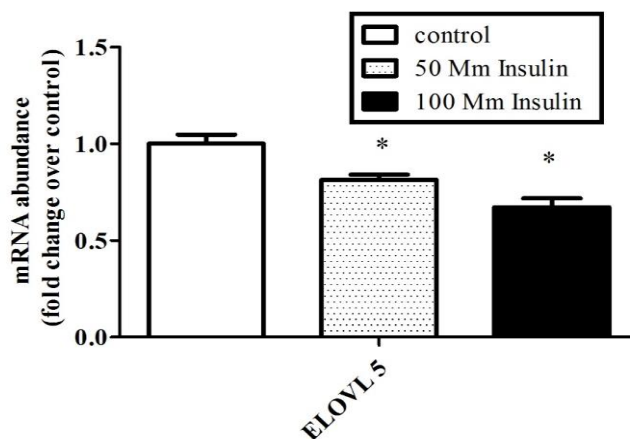


Figure 5. Messenger RNA expression of ELOVL fatty acid elongase 1/2 in goose primary hepatocytes treated with vs. without Oleate. The expression of the genes was determined by quantitative PCR. Primary hepatocytes isolated from goose embryos at 21 days of hatch were treated with 0.25 Mm and 0.50 mM Oleate in complete cell culture media, while primary hepatocytes untreated with oleate were used as control. N=3. The average mRNA abundances of the genes in the hepatocytes treated with different levels of oleate are presented as fold change over the control. N=3. *denote $P < 0.005$ vs. control. All data are presented as the means \pm SEM.

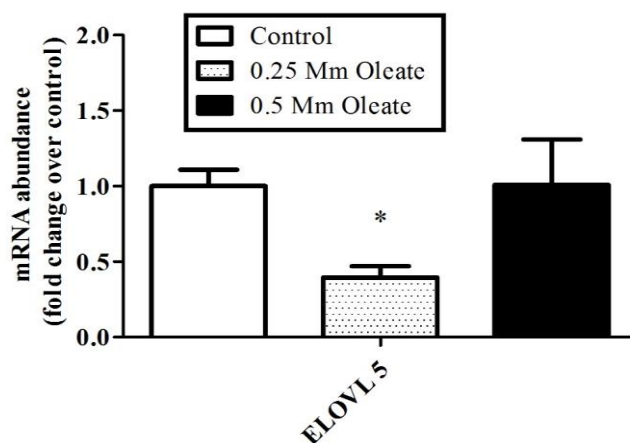
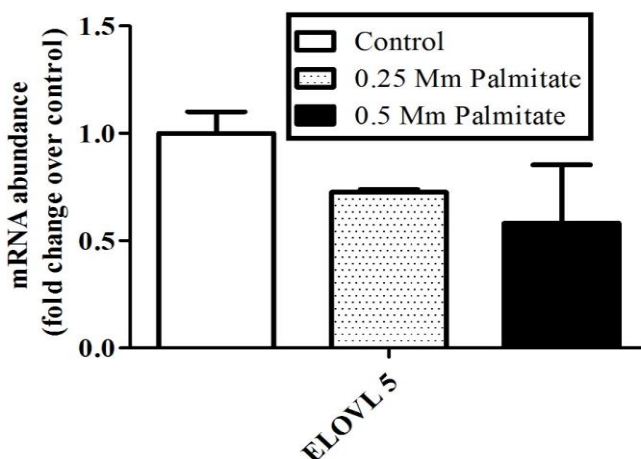


Figure 4. Messenger RNA expression of ELOVL fatty acid elongase 5 in goose primary hepatocytes treated with vs. without Palmitate. The expression of the genes was determined by quantitative PCR. Primary hepatocytes isolated from goose embryos at 21 days of hatch were treated with 0.25mM and 0.5 mM Palmitate in complete cell culture media, while primary hepatocytes untreated with palmitate were used as control. N=3. The average mRNA abundances of the genes in the hepatocytes treated with different levels of palmitate are presented as fold change over the control. N=3. All data are presented as the means \pm SEM.



DISCUSSION

Goose, as the descendant of a migratory bird, has an excellent capacity to deposit fat in the liver (Hermier, et al., 1991). In the goose industry, this capacity has been utilized for fatty liver (foie gras) production within 2–3 weeks of overfeeding. In this study, at 19 day of overfeeding, the phenotypic data (body and liver weights, and the ratio of liver weight to body weight) of the overfed group was significantly ($P < 0.01$) higher than the control group (Osman, et al., 2016b).

Interestingly, the reduction of ELOVL5 was associated with the development of goose fatty liver, which is opposite to the observation that the induction of hepatic ELOVL5 expression is associated with increased total hepatic fat content. ELOVL5 was highly expressed in liver tissue and increased rapidly during the peak-laying period in laying hens (Zhang, et al., 2017). The duck and turkey ELOVL5 activities were limited to C18 and C20 PUFA substrates, as found in most vertebrates (Agaba et al., 2004, Gregory et al., 2010, Gregory et al., 2011) and invertebrate ELOVL5 enzymes (Monroig, et al., 2012).

In the present study, we found that ELOVL5 was decreased expressed in the goose fatty liver after two weeks from overfeeding period than control group. Previous study suggested that the ducks and turkey ELOVL5 enzymes activities were different from chicken ELOVL5, which has unique DPA to 24:5n-3 activity (Gregory et al., 2013; Gregory and James, 2014). Gregory et al. (2013) found the relative abundance of the rats ELOVL5 is lower than in the chickens. We speculated that the expression of goose ELOVL5 gene was regulated by different transcriptional factor(s). Indeed, we treated goose primary hepatocytes with higher dosages (25 or 50 mM) of glucose due to glucose transporter may pump a large amount of glucose into the hepatocytes in the liver when insulin resistance occurs in goose fatty liver, in addition to the diffusion of glucose, which may lead to intracellular glucose level much higher than blood glucose level (Han et al., 2009). The fatty liver-associated factors (i.e., hypoinsulinemia, hypoglycemia and hypolipidemia) may share in contribute to the reduction of the genes in goose fatty liver.

Moreover, the regulation expression of ELOVL5 gene by insulin and Oleate was different from that regulated by glucose and palmitate in goose hepatocytes cells. Transcription factors and several hormones (insulin, T3, glucocorticoids, and leptin) have no impact on hepatic ELOVL5 expression. Only PPAR α , n-3 PUFA-enriched diets (Wang et al., 2005), high-fat diets and obesity affect ELOVL5 expression. suppression of ELOVL5 in high-fat-fed mice correlates with a decreased hepatic 20:4, n-6-to-18:2, n-6 ratio (Wang, et al., 2006).

CONCLUSION

The findings suggest the ELOVL5 gene is an important role to the development of geese fatty liver. Our data indicated that goose fatty liver was different from other animal organism fatty liver in some respects, which supports the notion that goose liver is a unique model for fatty liver study in birds. Importantly, the protective role of the genes in goose fatty liver should be validated by functional study in the future.

DECLARATIONS

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Author's contribution

All authors contributed equally to this work.

Competing interests

The authors declare that they have no competing interests.

REFERENCES

- Agaba et al. (2004). Agaba M, Tocher DR, Dickson CA, Dick JR and Teale AJ. (2004). Zebrafish cDNA encoding multifunctional fatty acid elongase involved in production of eicosapentaenoic (20: 5n-3) and docosahexaenoic (22: 6n-3) acids. *Marine Biotechnology*. 6 (3): 251-261. Link Retrieved from journal.
- Gregory et al. (2013). Gregory MK, Geier MS, Gibson RA and James MJ. (2013). Functional characterization of the chicken fatty acid elongases. *The Journal of nutrition*. 143 (1): 12-16. Link Retrieved from journal.

- Gregory, et al. (2011). Gregory MK, Gibson RA, Cook-Johnson RJ, Cleland LG and James MJ. (2011). Elongase reactions as control points in long-chain polyunsaturated fatty acid synthesis. *PLoS One*. 6 (12): e29662. Link Retrieved from journal.
- Gregory and James (2014) Gregory MK and James MJ. (2014). Functional characterization of the duck and turkey fatty acyl elongase enzymes *elovl5* and *elovl2*. *The Journal of nutrition*. 144 (8): 1234-1239. Link Retrieved from journal.
- Gregory et al. (2010). Gregory MK, See VH, Gibson RA and Schuller KA. (2010). Cloning and functional characterisation of a fatty acyl elongase from southern bluefin tuna (*thunnus maccoyii*). *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology*. 155 (2): 178-185. Link Retrieved from journal.
- Han et al. (2009). Han C, Wang J, Li L, Zhang Z, Wang L, et al. (2009). The role of insulin and glucose in goose primary hepatocyte triglyceride accumulation. *Journal of Experimental Biology*. 212 (10): 1553-1558. Link Retrieved from journal.
- Hermier et al. (1991). Hermier D, Saadoun A, Salichon M-R, Sellier N, Rousselot-Paillet D, et al. (1991). Plasma lipoproteins and liver lipids in two breeds of geese with different susceptibility to hepatic steatosis: Changes induced by development and force-feeding. *Lipids*. 26 (5): 331-339. Link Retrieved from journal.
- Inagaki et al. (2002). Inagaki K, Tsunehiro A, Fukuda Y, KAWAMOTO S, SHIGETA S, et al. (2002). Identification and expression of a rat fatty acid elongase involved in the biosynthesis of c18 fatty acids. *Bioscience, biotechnology, and biochemistry*. 66 (3): 613-621. Link Retrieved from journal.
- Leonard et al. (2000). LEONARD AE, BOBIK EG, DORADO J, KROEGER PE, CHUANG L-T, et al. (2000). Cloning of a human cDNA encoding a novel enzyme involved in the elongation of long-chain polyunsaturated fatty acids. *Biochemical Journal*. 350 (3): 765-770. Link Retrieved from journal.
- Leonard, et al. (2004). Leonard AE, Pereira SL, Sprecher Hand Huang Y-S. (2004). Elongation of long-chain fatty acids. *Progress in lipid research*. 43 (1): 36-54. Link Retrieved from journal.
- Livak and Schmittgen (2001). Livak KJ and Schmittgen TD. (2001). Analysis of relative gene expression data using real-time quantitative pcr and the 2- $\delta\delta$ ct method. *methods*. 25 (4): 402-408. Link Retrieved from journal.
- Monroig et al. (2012). Monroig O, Guinot D, Hontoria F, Tocher DR and Navarro JC. (2012). Biosynthesis of essential fatty acids in octopus vulgaris (cuvier, 1797): Molecular cloning, functional characterisation and tissue distribution of a fatty acyl elongase. *Aquaculture*. 360: 45-53. Link Retrieved from journal.
- Moon et al. (2009). Moon Y-A, Hammer RE and Horton JD. (2009). Deletion of *elovl5* leads to fatty liver through activation of *srebp-1c* in mice. *Journal of lipid research*. 50 (3): 412-423. Link Retrieved from journal.
- Moon et al. (2001). Moon Y-A, Shah NA, Mohapatra S, Warrington JA and Horton JD. (2001). Identification of a mammalian long chain fatty acyl elongase regulated by sterol regulatory element-binding proteins. *Journal of Biological Chemistry*. 276 (48): 45358-45366. Link Retrieved from journal.
- Osman et al. (2016a). Osman RH, Liu L, Xia L, Zhao X, Wang Q, et al. (2016a). *Fads1* and 2. Molecular and cellular biochemistry. 418 (1-2): 103-117. Link Retrieved from journal.
- Osman et al. (2016b). Osman RH, Shao D, Liu L, Xia L, Sun X, et al. (2016b). Expression of mitochondria-related genes is elevated in overfeeding-induced goose fatty liver. *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology*. 192: 30-37. Link Retrieved from journal.
- Parker-Barnes et al. (2000). Parker-Barnes JM, Das T, Bobik E, Leonard AE, Thurmond JM, et al. (2000). Identification and characterization of an enzyme involved in the elongation of n-6 and n-3 polyunsaturated fatty acids. *Proceedings of the National Academy of Sciences*. 97 (15): 8284-8289. Link Retrieved from journal.
- Wang et al. (2005). Wang Y, Botolin D, Christian B, Busik J, Xu J, et al. (2005). Tissue-specific, nutritional, and developmental regulation of rat fatty acid elongases. *Journal of lipid research*. 46 (4): 706-715. Link Retrieved from journal.
- Wang, et al. (2006). Wang Y, Botolin D, Xu J, Christian B, Mitchell E, et al. (2006). Regulation of hepatic fatty acid elongase and desaturase expression in diabetes and obesity. *Journal of lipid research*. 47 (9): 2028-2041. Link Retrieved from journal.
- Wang et al. (2008). Wang Y, Torres-Gonzalez M, Tripathy S, Botolin D, Christian B, et al. (2008). Elevated hepatic fatty acid elongase-5 activity affects multiple pathways controlling hepatic lipid and carbohydrate composition. *Journal of lipid research*. 49 (7): 1538-1552. Link Retrieved from journal.
- Zhang et al. (2017). Zhang M, Li C-C, Li F, Li H, Liu X-J, et al. (2017). Estrogen promotes hepatic synthesis of long-chain polyunsaturated fatty acids by regulating *elovl5* at post-transcriptional level in laying hens. *International Journal of Molecular Sciences*. 18 (7): 1405. Link Retrieved from journal.
- Zhang et al. (2013). Zhang R, Zhu L, Zhang Y, Shao D, Wang L, et al. (2013). Cdna cloning and the response to overfeeding in the expression of stearoyl-coa desaturase 1 gene in landes goose. *Gene*. 512 (2): 464-469. Link Retrieved from journal.

CHALLENGES OF DAIRY PRODUCTION AND MARKETING IN URBAN AND PERI-URBAN AREAS OF AMHARA REGION, ETHIOPIA

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✉ Supporting Information

ABSTRACT: Dairy production is an important component of livestock farming in Ethiopia. The huge and diverse livestock population, varied and favorable agro-ecology is good for dairy production to answer the demands for dairy products in urban and peri-urban areas. The aim of the study was to assess the challenges of dairy production and marketing in urban and peri-urban areas of Amhara region. Therefore, a total of 885 households were randomly selected for interview. In the dairy farm, the major feed resources used by the households were natural pasture (4.5%), concentrate feed (60.9%) and both pasture and concentrate feed (34.1%). According to the information stated by the respondents industrial by products (6.0%), hay (20.5%), straw and brewery by products (0.7%) were used as important feed resources, while 97% of the overall respondents stated that water available was accessible throughout the year. Whereas, the major challenges for dairy production interims of diseases in the current studied areas were mastitis (11.5%), ectoparasite infestation (10.6%), lumpy skin disease (2.7%) and foot mouth disease (1.9%). In addition, milk production and marketing system in the areas were highly challenged by disease prevalence, feed scarcity feed quality, and distant traveled to sell milk and seasonal price variation. Developmental constraints were also reported like lack of infrastructure and finance, poor education of households, seasonality of supplies and the lack of market and marketing infrastructure and facilities. On the same time reproductive problems like sterility, abortion, immature birth, retained placenta, repeat conception and dystocia with the proportion of 3.6, 23.7, 1.8, 9.9, 17.9, 9.1 and 34% respectively were reported. Therefore, feed scarcity throughout the year, disease prevalence and veterinary service problem are some of the identified challenges. So, appropriate research work, development, policy and crosscutting interventions should be taken in to account to make improve the dairy industry

Keywords: Dairy Production, Marketing, Urban, Peri Urban, Amhara, Ethiopia.

INTRODUCTION

Reproduction, long-standing culture of dairy products consumption, and favorable policy are indicators of the importance and potential of dairying in the country. Cattle play a significant role in the socio-economic aspects of the life of the people of Ethiopia. In addition to the products like meat and milk cattle provide draught power for cultivation of the agricultural lands of many peasants. Skins and hides are also important components of the livestock sector in generating foreign export earnings (Tamiru and Abebaw, 2010). According to CSA (2012/13) about 53.99 million cattle's, 25.5 million sheep and 24.06 million goats, 1.91 million horses, 6.75 million donkeys, 0.35 million mules, 0.92 million camels, 50.38 million poultry and 5.21 million bee hives are reported in Ethiopia. Ethiopia maintains huge number of livestock population. Despite the huge number of cattle and their economic importance, breeds the productivity is low due to the constraints of disease, nutrition, poor management, lack of marketing facilities and opportunity, inadequate animal health services, uncoordinated development programs between various levels of government institutions and /or non-government organizations and poor performance low genetic potential of indigenous breeds (Lobago et al., 2006).

The development and sustainability of urban and peri-urban dairy production systems require a relatively large initial investment and long term commitment. In addition, the major technical and non-technical constraints associated with these dairy production systems such as availability and cost of genetic materials, breeding systems, feed resources, feeding systems, animal health, processing, marketing, public health, waste handling, managerial and policy issues need to be addressed (Abera, 2016). In Ethiopia dairy production depends mainly on indigenous livestock genetic resources; more specifically on cattle, goats, camels and sheep. Cattle has the largest contribution (81.2%) of the total national annual milk output, followed by goats (7.9%), camels (6.3%) and sheep (4.6%) (CSA, 2009). Despite its potential for dairy development, productivity of indigenous livestock genetic resources in general is low, and the direct contribution to the national economy is limited. In the other hand, Ethiopia has a huge potential for dairy development in Africa. The large and diverse livestock genetic resources, existence of diverse agro-ecologies

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suitable for dairy production, increasing domestic demand for milk and milk products, better market opportunity, and proximity to international markets indicate the potential and opportunities for dairy development in the country. However, dairy development has been hampered by multi-faced, production, system-specific constraints related to genotype, feed resources and feeding systems, access to services and inputs, low adoption of improved technologies, marketing and absence of clear policy support to the sector.

Thus, in order to mitigate challenges that limit productivity and thereby exploit the untapped potential, it is necessary to characterize and analyze dairy production and marketing systems, identify major constraints along the value chains and devise pertinent and practical strategies to alleviate the problems to improve the dairy production and marketing systems in the country. Therefore, objective of this project is: to assess the overall dairy production and marketing challenges in urban and peri-urban areas of Amhara Region, Ethiopia.

MATERIALS AND METHODS

Study area

This study was conducted in the selected milk shade areas of Amhara region (Gondar, Bahir Dar, Debre Tabor, Debre Markos, Debre Birhan and Dessie) towns and their surroundings.

Study population

The considered population was urban and peri-urban residents and institutions (farms, milk processing plants, associations, distributors and others) of the selected towns, who are directly/or indirectly working with the dairy industry. These residents and institutions recorded had house number in their administrative area. Then, study subjects households were randomly selected in which the survey conducted after the selection of the houses and each household was surveyed only once.

Research design

Cross-sectional study design was used to assess the challenges in dairy development and marketing on milk shade areas of Amhara Regional State. In this particular study, milk shade refers to the geographical location where milk is produced and transported a specific market centre. In this case, Gondar, Bahir Dar, Debre Tabor, Debre Markos, Debre Birhan and Dessie towns were considered.

Sampling technique and sample size

The sampling technique was stratified sampling in which the first selection was done randomly and selection from the next strata was systematically done. According to selection at town level was purposive and six towns, namely Gondar, Bahir Dar, Debre Tabor, Debre Markos, Debre Birhan and Dessie towns were selected. These towns were selected with a view that they have relatively high population size demanding high milk to be produced and transported their respective towns. Five Kebeles from each town and surrounding peri-urban area was selected randomly. The humans, farm owners, association members/managers, milk/milk product distributors and milk processors of selected Kebeles and towns were the units of the study. The sample size of the study was calculated by using the formula for the estimation of single proportion as shown below;

$$N = \frac{(Z_{\alpha/2})^2 \times P(1-P)}{D^2}$$

Where; N = Sample size; P = Proportion assumed (50%, no research conducted on this area); D = the margin of error between the sample and the population or Desired precision (5%); $Z_{\alpha/2}$ = critical value at 95% confidence level of certainty (1.96). Therefore, the required sample size was: 384 subjects \times 2 design effect=768+20% non-response rate with the total sample size of 822 subjects

Data collection procedures

Data collection instruments. The questionnaire was pre-tested out of the study population and the questionnaire translated to Amharic (native language). The Amharic version pre-tested and standardized to ensure uniform understandings among the members of the team. Twelve data collectors were trained for three days about data management system and also about the questionnaire and ways of collecting data by the respective researchers. Data quality checking was conducted every day by the researchers via checking its completeness and errors in the questionnaire. Each day at least four questionnaires were crosschecked for its completeness.

Data processing and analysis

After completed check-up the data coded and entered to SPSS version 20.0 statistical packages for windows and analysis was made. The quantitative data was analyzed using descriptive statistics and the qualitative data was analyzed using descriptive statistics and compared as percentages, mean and others statistical tools.

RESULTS

Socio economic aspects of the study area

Frequently distributed dairy farm owners in the six milk shade towns of the study area were considered (Table 1). Among dairy farms having 3-10 and 1-2 milking cows were characterized by 46.2 and 45.1 percent's respectively. Most of the dairy farms (about 63.5%) were having cross-breed cows with open barn (32.4%), stall feeding method (60.9%), use mixed feeding method (pasture, industrial byproducts, hay and straw) (66.8%), while, dairy farms in and around Dessie town were better in using industrial by products for milking cows with the proportion of 23.2%. Similarly, hay and straw were found to be the most common feed (57%) for farms in Debre Tabor.

The interviewed dairy owners also stated that the total animal dairy population was about 63.5% cross breed, 16.7% local dairy cows and 15.8% were exotic (Table 2). Higher proportions of crossed and exotic breeds are indicated for better milk production trends in the area.

The type of housing used was open barn 287(32.4), partitioned barn 138(15.6), common house 248 (28), partitioned common house 201(22.7) and common house with human-beings 11(1.2) (Table 3). Less attention to the livestock sector due to traditional, attitude and poor milk product consumption trends were the major reason for housing constraints. Knowledge and skills on the management of dairy animals, and production of quality milk is associated to separate houses.

Feeding methods and type of feeds

The feeds were obtained from natural pasture land 40(4.5), stall feeding 539(60.9), pasture and stall feeding 302(34.1) and others 4 (0.4). In addition, industrial byproducts, hay and straw, brewery by products 53(6.0), 181(20.5) and 6(0.7) respectively were purchased feeds from different sources (Tables 4 and 5).

Breeding practice

Among the producers (47.7%) preferred AI for breeding purposes of their cows, while (30.3%) opted bulls for natural breeding of their cows. Both types of breeding methods were accepted (22.0%). From Table 6, it has been concluded that (64.3%) of the individuals did not prefer AI due to shortage of AI technicians (11.1%) and shortage of semen (7.6%) and also it has been recorded that about 46% of owners can use AI for breeding purposes, if the constraints are removed. The majority of livestock owners (66.1%) preferred local breeds due to less feed requirement (14.8%) and high disease resistance (3.5%). Breeding practices used in the area were AI, bull mating and both with the proportion of 47.7, 30.3 and 22 % in that order.

Major dairy production problems

Accordingly about 71.8% of livestock owners stated that feed shortage was serious issue while the remaining 27.8% of the respondents did enter into feed shortage. Generally, the majority of the respondents underlined that feed shortage was due to high price of feed. Whereas, except 0.3% of the respondents other interviewers indicated that water shortage is not the major problem in the area. Regarding milk production about 9.3% of dairy producers was used milk for their consumption. At the same time 48.1% of the produced milk was used for marketing purpose. The dairy producers prefer to sell out their milk produced to the individuals 341(38.5%) while 180(20.3%) to the merchants and also 77(8.7%) to the cooperative societies. The table 7 revealed that fresh milk was fetching highest revenue of their milk produced while 86(9.8%) revenue was being generated by preparing butter. Table 6 indicated that marketing was the major constraints 538(60.8%) to the milk producers. Only 315(35.6%) individuals were indicating no marketing problem. The distance of the market place was the major strategy faced by the milk producers. Only 29(3.3%) of the individuals was agreed with this problem. Due to spiritual reasons especially fasting period milk consumption was hampered 131(14.8%).

According to the result which indicated that the majority of the dairy producers 598(67.6%) complained about no extension activities in their areas by the concerned development agencies while only 284(32.1%) was agreed with the extension activities. The reasons for absence of extension services was lack of training and consultancy about feeding and management 191(21.6%), milk management 110(12.4%) and reproductive health management 109 (12.3%). The reasons for technology transfer on milk production were recorded as inadequate technologies on extension services 147(16.6%). The majority of the individuals 682(77.1%) responded that experience sharing was not sufficient while only 198(22.4%) accepted about experience sharing. The reason for no on- farm support might be due to lack of formal communication systems 272(30.7%), lack of perception on extension services 125(14.1%) and shortage of extension workers 108(12.2%). Type of diseases encountered by dairy producers was mastitis 102(11.5%), tick and lice infestation 94(10.6%) and LSD 24(2.7%). Table 8 revealed that major reasons for disease occurrence was due to insufficient animal health services 232(26.2%) followed by poor diagnostic services 128(14.5%) and shortage of animal health workers 63(7.1%). During the present investigation it has been found that the major reproductive problems was due to abortion 144(16.3%), repeat breeders 109 (12.3%) and retained

placenta 60 (6.8%). The majority of the dairy producers suggested that the major reproductive problems was solved taking their dairy animals to the nearby veterinary clinics 567 (64.1%) and 94 (10.6%) agreed that traditional healers solve the reproductive problems.

The data feedback collected from the dairy producers (Table 9) revealed that the major culling reasons for cows in dairy farms was due to aging 243(27.5%), inadequate space 56(6.3%), reproductive problems 54 (6.1%), low milk production 52(5.9%) and feed shortage 31(3.5%).

Table 1 - Number of milk cows in each farm in the study areas.

S/N	Study site	Number of milk cows/farm			Total (%)
		1-2 cows (%)	3-10 cows (%)	➤ = 11 cows (%)	
1.	Gondar	57(14.3)	66(16.1)	18 (23.4)	141(15.9)
2.	Debre Tabor	123(30.8)	26(6.4)	0 (0)	149(16.8)
3.	Bahir Dar	2(0.5)	129(31.5)	21(27.3)	152(17.2)
4.	Dessie	72(18.0)	69(16.9)	10 (12.9)	151(17.1)
5.	Debre Markos	39(9.8)	89(21.8)	25 (32.5)	153(17.3)
6.	Debre Birhan	106(26.6)	30(7.3)	3 (3.9)	139(15.7)
Total (%)		399 (45.1)	409 (46.2)	77(8.7)	885(100)

Table 2 - Distribution of milk cow breeds in the study areas.

S/N	Study Area	Local (%)	Cross (%)	Exotic (%)	Total
1.	Gondar	23 (15.5)	91(16.2)	27 (19.3)	141(15.9)
2.	Debre Tabor	30 (20.3)	115(20.5)	4(2.9)	149(16.8)
3.	Bahir Dar	3 (2.0)	127(22.6)	0 (0)	152 (17.2)
4.	Dessie	12 (8.1)	55 (9.8)	82 (58.6)	151(17.1)
5.	Debre Markos	58 (39.2)	81 (14.4)	13 (9.2)	153 (17.3)
6.	Debre Birhan	22(14.9)	93(16.5)	14 (10)	139 (15.7)
Total (%)		148(16.7)	562(63.5)	140(15.8)	885(100)

Table 3 - House type of milk cows in the study areas

No	Study site	House type of milk cows					Total (%)
		Open barn (%)	Partitioned barn (%)	Common house (%)	Partitioned common house (%)	With human-beings (%)	
1.	Gondar	36 (12.5)	10 (7.2)	67 (27.0)	18 (9.0)	10 (90.9)	141(15.9)
2.	Debre Tabor	31(10.8)	14 (10.2)	92 (37.1)	11(5.5)	1 (9.1)	149 (16.8)
3.	Bahir Dar	7 (2.4)	0 (0)	22 (8.9)	123 (61.2)	0 (0)	152 (17.2)
4.	Dessie	36 (12.5)	46 (33.3)	29 (11.7)	40 (19.9)	0 (0)	151(17.1)
5.	Debre Markos	103 (35.9)	27(19.6)	20 (8.1)	3 (1.5)	0 (0)	153 (17.3)
6.	Debre Birhan	74 (25.9)	41(29.7)	18 (7.2)	6 (2.9)	0 (0)	139(15.7)
Total (%)		287 (32.4)	138(15.6)	248 (28)	201(22.7)	11(1.2)	885(100)

Table 4 - Method of feeding of milk cows in the study areas

S/N	Study site	Method of feeding of milk cows				Total (%)
		Pasture land (%)	Stall feeding (%)	Pasture and stall feeding (%)	Others (%)	
1.	Gondar	4(10)	100(18.6)	37(12.3)	0(0)	141(15.9)
2.	Debre Tabor	2(5)	109(20.2)	36(11.9)	2(50)	149 (16.8)
3.	Bahir Dar	0(0)	118(21.9)	34(11.3)	0(0)	152 (17.2)
4.	Dessie	2(5)	111(20.6)	37(12.3)	1(25)	151(17.1)
5.	Debre Markos	24(60)	15 (2.8)	113(37.4)	1(25)	153 (17.3)
6.	Debre Birhan	8(20)	86(15.9)	45(14.9)	0(0)	139 (15.7)
Total (%)		40 (4.5)	539 (60.9)	302 (34.1)	4 (0.4)	885 (100)

Table 5 - Type of feed for milk cows in the study areas.

No	Feeding type	Study site						Total (%)
		Gondar (%)	D/Tabor (%)	B/Dar (%)	Dessie (%)	D/Markos (%)	D/Birhan (%)	
1.	Pasture	0 (0)	2 (1.3)	0 (0)	3 (2.0)	40 (26.1)	8 (5.8)	53 (6.0)
2.	Industrial byproduct	1 (0.7)	4 (2.7)	6 (3.9)	35 (23.2)	3 (2.0)	4 (2.9)	53 (6.0)
3.	Hay and straw	19 (13.5)	85 (57.0)	5 (3.3)	27 (17.9)	37 (24.1)	8(5.8)	181(20.5)
4.	Molasses	0 (0)	0 (0)	0 (0)	0 (0)	1(0.7)	0 (0)	1(0.1)
5.	Brewery byproducts	0 (0)	0 (0)	0 (0)	4 (2.6)	1(0.7)	1(0.7)	6 (0.7)
6.	1, 2 and 3	121 (85.8)	58 (38.9)	141 (92.8)	82 (54.3)	71(46.4)	118 (84.8)	591(66.8)
Total (%)		141 (15.9)	149(16.8)	152(17.2)	151(17.1)	153(17.3)	139(15.7)	885(100)

Table 6 - Reason of bull mating

S/N	Preference of bull instead of AI		
	Reason	Frequency (%)	Group percentage (%)
1.	Do not prefer AI	569 (64.3)	
2.	Shortage of AI equipment's	23 (2.6)	23 (7.3)
3.	Administrative and financial problems	55 (6.2)	55 (17.4)
4.	Poor heat detection	32 (3.6)	32 (10.1)
5.	Inappropriate time of AI	17 (1.9)	17 (5.4)
6.	Shortage of AI technicians	98 (11.1)	98 (31.0)
7.	No AI service	13 (1.5)	13 (4.1)
8.	Reluctance of AI technicians	11(1.2)	11(3.5)
9.	Shortage of semen	67(7.6)	67(21.2)
No	Are you ready to use AI if problems are solved?		
1.	Yes	407 (46.0)	
2.	No	414 (46.8)	
3.	No response	64 (7.2)	
No	Reasons for selecting local breeds		
1.	Those who select local breeds	585(66.1)	
2.	To obtain male calves	47(5.3)	
3.	Less feed requirement	131(14.8)	
4.	Easy for management	49(5.5)	
5.	High fat content	6(0.7)	
6.	High disease resistance	31(3.5)	
7.	2 or more of them	36(4.1)	
Total		885(100)	

Table 7 - Marketing problem

No	Type of problem	Frequency (%)	Group-percentage (%)
1.	No problem	321(36.3)	
2.	Far from market	29(3.3)	29(5.1)
3.	Seasonal variation of milk demand and supply	131(14.8)	131(23.2)
4.	Unsuitable market condition	172(19.4)	172(30.5)
5.	Culturally milk selling is unaccepted	3(0.3)	3(0.5)
6.	Low milk shelf life	1(0.1)	1(0.2)
7.	Low milk production	1(0.1)	1(0.2)
8.	2 or more of them	227(25.6)	227(40.3)
Total		885(100)	564(100)

Table 8. Major cattle diseases and status of reproductive health problems in farms.

No	Type of diseases encountered	Percentage (%)
1.	Ticks and Lice	94 (12.2)
2.	LSD	24 (3.1)
3.	Lameness	9 (1.2)
4.	Mastitis	102 (13.3)
5.	Hoof cracking	8 (1.0)
6.	FMD	17(2.2)
7.	Coughing	33(4.3)
8.	Anthrax	5(0.6)
9.	Others	2(0.3)
10.	all	476(61.8)
No	Reproductive problems	Percentage
1.	No reproductive problems	
2.	Sterility	22(3.6)
3.	Abortion	144(23.7)
4.	Immature birth	11(1.8)
5.	Retained placenta	60(9.9)
6.	Repeat breeder	109(17.9)
7.	Dystocia	55(9.1)
8.	All	207(34.0)
	Total	885(100)

Table 9 - Culling reasons of cows in dairy farms

No	Activities	Percentages
1.	No culling system	23(2.6)
2.	Diseases	17(1.9)
3.	Aging	243(27.5)
4.	Reproductive problems	54(6.1)
5.	Low milk production	52(5.9)
6.	Inadequate space	56(6.3)
7.	Feed shortage	31(3.5)
8.	Cash income	18(2.0)
9.	All	391(44.2)
	Total	885(100)

DISCUSSION

Dairying was a good source of income for urban and peri-urban producers which accounted for selling raw milk 426(48.1%), by products 32 (3.6%) and for house consumption 82(9.3%). Despite the fact that crop-livestock producers' are generated only the little share (23.1%) from dairying. The result not agree with finding that crop-livestock production systems are none market oriented in which most of the milk produced was retained for home consumption (Pervaiz et al., 2003). These characteristics were also noted by other authors for different production systems in some part of the country such as Wollega (Alganesh, 2002). According to Debela (2016) Oromia Regional State and Eyasu and Asaminew (2014) at Bahir dar zuria Mecha district in Amhara Regional State, hiring labor was very uncommon in urban areas, whereas herding and milking operation in the peri-urban production system as operated by hired labor.

Feed resources identified in the area included grazing land 53(6.0%), hay and straw 181(20.5%) industrial by products 53(6.0%), and brewery by products 6(0.7%) balanced homemade concentrates plant weeds, and non-conventional feeds like *Atella'*. Poor quality feed resources are affecting the fertility of cows and milk production. Ibrahim and Olaloku (2000) who also reported that feeding systems in smallholder dairying was primarily based on grazing of native pasture of low productivity. Etigen and Reaves (1978) also indicated that feed resources from crop residue (straw and stover) and pastures (both green and mature) was low digestibility. High population growth and density causing shortage of grazing land for livestock of production by smallholders. The un-availability and poor

quality of feed resources and in-efficient nutritional management were the principal constraints to dairy production. This was the case in an assessment of livestock research priorities for crop animal systems in rain-fed agro-economical zones of nine countries of South East Asia (Amin, 2014). Falvey (1992) indicated that within an integrated farming system where dairying is important components, one of the major constraints for production is feed and nutrition. ESAP (1995) indicated one of the factors affecting the adoption of crossbred dairy cows is lack of feed shortage. The development and sustainability of urban and peri-urban dairy production systems require a relatively large initial investment and long term commitment. In addition, the major technical and non-technical constraints associated with these dairy production systems such as availability and cost of genetic materials, breeding systems, feed resources, feeding systems, animal health, processing, marketing, public health, waste handling, management and policy issues need to be addressed (ILRI, 1996).

Rivers, pipe water, dams and wells, lakes, spring water were the main sources of water identified in the present study areas. Most of the households in urban and peri-urban areas obtained water from rivers and pipe water. Regarding the accessibility of the water, 97% of the interviewed dairy producers in both areas responded that they have an access to water throughout the year, and the rest (3%) reported that during the dry seasons there was a scarcity of drinking water in area during which they used spring water.

Majority of households in the study areas has open barn, partitioned barn, common house, partitioned common house and common house with human beings 287(32.4%), 138(15.6%), 248(28.0%), 201(22.7%) and 11(1.2%), respectively. In the peri-urban areas farmers kept their cattle within their own residence as night shelter. Based on the results from the respondents as well as my personal observation, types of shelter used by all the producers in the surveyed areas as designed in such a way that routine activities like feeding, watering, milking, waste management and other activities cannot be easily and effectively handled, and was found varied significantly respect of production. Dairy cattle breed in the study areas was indigenous zebu, cross and exotic breeds 183(20.67%), 562(63.5%) and 140(15.8%), respectively and have not been characterized well. Most of the foundation stocks of both areas were replaced from their own farm or purchased from open markets which revealed that producers were not curious and/or did not have access to the selection of dairy cattle. Local bulls as allowed freely in the herds to run on mating, and this was an indication for existing of uncontrolled mating in the studied areas. Provision of genetically potential dairy cattle and/or good breeding services as per the demands of producers was one of the prerequisites for the development of dairying (Azage and Alemu, 1998).

Traditional hand milking was the only type of milking practiced in the surveyed areas. Almost all dairy cattle producers in urban and peri-urban areas practiced partial suckling prior to milking, and there was no proper sanitary procedure to be followed during milking especially in peri-urban producers. At the time of milking, washing of teats was not practiced, and the producers believe that during calf suckling for milk let-down, the teat get washed by the saliva of calf. In Ethiopia, most smallholders dairy producers are milking twice (95.5%) per day (Sintayehu et al., 2008). The relatively higher proportion of early feed supplementation and early weaning observed in the urban producers' sides was associated with the assumption of profit maximizations from sale of milk that was otherwise used by calves.

Among the major problems, disease was identified as one of major constraints that pose major threat to cattle production in the current study areas of Amhara region. The major diseases of cattle identified in the studied areas as mastitis 102(11.5%), ticks and lice 94(10.6%), lumpy skin disease 24(2.7%) and FMD17(1.9%). Based on the respondents and personal observation in the study area, the loss of animals due to diseases was aggravated by shortage of veterinary professionals, accessibility of veterinary service in the area and lack of adequate transport facility as the major problems. The existing of such a poor performance of veterinary service indicated that regional government give less attention to the livestock sector in general. Livestock keepers therefore, tend to divert to traditional ethno-veterinary practices in the villages and make use of various herbs and/or illegal drugs to treat their animals. Many animal health problems result from the interaction among the technical and non-technical constraints themselves such as poorly fed animals develop low disease resistance and have fertility problem. Many of the disease constraints was also a consequence of the non-technical constraints e.g., insufficient money to purchase drugs or vaccines. Even if there are veterinary services delivered by the office of agriculture, only few farmers take their animals to the veterinary service. This is because of the fact that high cost for the medicine and low productivity of the animal which discourages farmers to use veterinary services (Getachew, 2003).

In regard to the type of product processed, butter was the primary dairy product traditionally processed by most of the peri-urban areas. Most of the households in peri-urban areas preferred churning to get butter and use buttermilk for household consumption, in addition to lack of accessing market for whole milk marketing. And this was not in the case of urban producers where majority of households did churn during fasting days where there was less demand for dairy products and because of preference of butter and other by-products, if all milk could not be marketed, and because of taboos against selling whole milk. Marketable dairy products in the study areas include whole milk 582(65.8%), traditionally processed butter 86(9.8%) cottage cheese 2(0.2%). Sale of milk to individuals 341(38.5%), merchants 180(20.3%), cooperatives 77(8.7%) and distributors 14(1.6%). Since informal dairy

marketing was the only means of marketing in the current studied area, there was no fixed price for each dairy product.

All dairy producers in the study area as constrained on unavailability of AI services 98(11.1%), shortage of semen 67(7.6%) and poor heat detection 32(3.6%). Abortion, retained placenta, repeat breeder, dystocia, immature birth and sterility 144(16.3%), 60(6.8%), 109(12.3%), 55(6.2%), 11(1.2%) and 22(2.5%) respectively, as serious reproductive problems affecting performance of dairy herds. Concerning to livestock extension service 191(21.6%) respondents said no training and consultancy about feeding and management of dairy cattle, 109(12.3%) no training on reproductive health and 110(12.4%) no training on milk management. Shortage of each to purchase replacement stock or cover animals and animal related expenses (such as veterinary, feed) was another problem in livestock production system. Getachew (2003) indicated that in Ginchi watershed among the other problems with expansions of smallholder dairy production are capacity problem and lack of adequate livestock extension service.

The dairy industry includes the production, processing and marketing of milk and milk products. There are several constraints to its development, e.g. lack of infrastructure and finance, poor education of households, seasonality of supplies and the lack of market and marketing structure and facilities. Because of lack of cooling facilities or lack of suitable equipment or utensils for milking and storing milk, milk deteriorates rapidly (ILCA, 1992).

CONCLUSION AND RECOMMENDATIONS

After reviewing the retrospective and current situations of the Ethiopian dairy sector, it might be appropriate to consider the following: research, development, policy and crosscutting issues in order to make improvement interventions for the development of the dairy industry. In general, milk production and marketing system as constrained by feed scarcity, disease, poor veterinary service, limited access to markets, less quantity of milk which related to poor breeding services and seasonal price fluctuation. Above all, feed scarcity, disease, and poor veterinary service are the most important constraints hindering the dairy development. Dairy marketing system identified in the study area was entirely informal marketing system, in which the producers sell dairy products directly to consumers and/or traders with no fixed price. The farmers are poorly organized into cooperatives and unions, while their products are sold at sub optimal prices. The poor infrastructure network, inadequate provision of veterinary services and lack of continuous supply of animal feeds throughout the year are among some of the challenges faced by dairy producers in the study area. However, the rapid urbanization of the zonal capital towns in Amhara region with that of human population increase, access of land and water for rearing dairy are an opportunity and prospects for the development of dairying in the study area.

Therefore, based on the above findings the following recommendation are made

- ✓ Provision of training to the farming communities is imperative so as to improve their knowledge and skills on the management of dairy animals and production of quality milk.

- ✓ Improving animal health services and drug supply system as well as strengthening diseases surveillance and reporting system.

- ✓ Cultivation of improved forage crops suitable for the different agro-ecological zones and farming systems with accompanied technologies should be encouraged.

- ✓ Promotion of efficient use of alternative feed sources such as silage, hay, crop and vegetable by-products and local beverage by-products are also essential.

- ✓ Policies on dairy should be comprehensive and focused on ensuring increased milk production. These should include: appropriate strategies on breeding (selection and cross-breeding), improved feed utilization systems and adequate veterinary services. The policies should establish an appropriate marketing infrastructure to ensure milk collection, processing, storage, and distribution, the quality of products.

DECLARATIONS

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Competing Interests

The competing interest is assured by copy right agreement and there is no computing interest in this research paper.

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REFERENCES

- Tamiru T and Abebaw G (2010). Prevalence of ticks on local and crossbreed cattle in and around Asella town, southeast Ethiopia, *Ethiopian Veterinary Journal*, 14 (2), p. 79-89.
- Central Statistics Authority (CSA), (2012/13). Ethiopia agricultural Statistical report on livestock and livestock characteristics.
- Lobago F, Bekana M, Gustafsson H, Kindahl H (2006). Reproductive performance of dairy cows in smallholder production system in Selalle, Central Ethiopia. *Tropical Animal Health and Production*, 38: 333-342.
- Abera B (2016). Challenges and opportunities of investment on dairy sector of Ethiopia. A Review, Munich, GRIN Verlag, <https://www.grin.com/document/349085>.
- Central Statistical Authority (CSA), (2009). Report on livestock and livestock characteristics; Volume II, Agriculture Sample Survey 2008/09.
- Pervaiz K. Ahmed, Mohammed Rafiq, (2003). Internal marketing issues and challenges, *European Journal of Marketing*, Vol. 37 Issue: 9, pp.1177-1186.
- Alganesh T (2002). Traditional milk and milk products handling practices and raw milk quality in Eastern Wollega. MSc Thesis. Haramaya University, Ethiopia.
- Debela B (2016). Traditional butter preservation techniques and Comparison of their efficiency through Determination of microbial quality and Organoleptic properties of butter in west shewa Zone, Oromia regional state, Ethiopia. MSc Thesis. Ambo University. pp. 106.
- Eyassu S and Asaminew T (2014). Small-scale milk processing, utilization and marketing of traditional dairy products in bahir dar zuria and mecha districts, northwestern Ethiopia. *J. Food Technol. Res.*1(2):122-132.
- Ibrahim H and Olaloku E (2000). Improving cattle for milk, meat and traction. International livestock research institute (ILRI) manual 4 Nairobi, Kenya. 135 Pp 28-29.
- Etgen WM and Reaves PM (1978). Dairy cattle feeding and management. 6th ed. New York: Saunders. Pp. 274.
- Amin RU (2014). Nutrition; its role in reproductive functioning of cattle a review, 2(1),pp. 1-9.
- Falvey L (1992). Livestock Development Assistance: Australia's experience, paper presented to the sixth congress of the ASEAN- Australian association of animal production, Bangkok, Thailand, November 1992.
- ESAP (Ethiopian Society of Animal production), (1995). Ruminant livestock development strategy. Newsletter of the Ethiopian Society of Animal production (ESAP), vol.3, no.1 and 2, (Addis Ababa, Ethiopia).
- ILRI (1996). Annual project report, ILRI, Addis Ababa, Ethiopia 2-4.
- Azage T and Alemu G, (1998). Prospect for peri- urban Dairy development in Ethiopia, Ethiopian Society of Animal production (ESAP) publication No. 5. Addis Ababa. Ethiopia.
- Sintayehu Y, Fekadu B, Azage T, Berhanu G (2008). Dairy production, processing and marketing systems of Shashemene, Dilla area, South Ethiopia. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 9. ILRI (International Livestock Research Institute), Nairobi, Kenya. P 62.
- Getachew F (2003). Milk and Dairy Products, Post- and harvest Losses and Food Safety in Sub-Saharan Africa and the Near East. A Review of Dairy Sector -Ethiopia. FAO Prevention of Food Losses Programme. FAO, Rome, Italy.
- ILCA (International Livestock Center for Africa), (1992). Annual Report. Addis Ababa, Ethiopia, Pp. 2-11.

ASSESSMENT OF PRESCRIPTION PATTERNS OF VETERINARY DRUGS IN GONDAR, NORTH WEST ETHIOPIA

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✉ Supporting Information

ABSTRACT: Veterinary drugs play an important role in the control and prevention of animal disease, but have the potential to cause harm if not used rationally. Irrational prescription of drugs is a common occurrence in veterinary clinical practice. To evaluate the prescription patterns of veterinarians and animal health workers in Gondar town of three veterinary clinics, Northwestern Ethiopia. A retrospective study was conducted using a systematic random sampling method of 1000 patient's encounters. Data were collected from prescription and case books retained in the clinic for the last two years. Average number of drugs per encounter in these health facilities was 1.291. Generic prescribing was low at 88.40% while encounters with antibiotic prescription were high at 44.4%. About 98.20% of prescribed drugs were listed in the national veterinary drug list while 64.4% of encounters had at least one injection prescribed. The most commonly prescribed drugs were Albendazole 330(25.6%), Oxytetracycline 243(18.8%), Ivermectin 157(12.16%), Penicillin and Streptomycin fixed combination 133(10.3%), Acaricides 108(8.3%), vitamin supplements 77(6%), and other drugs including gastrointestinal stimulants, Anti-acids, anti-inflammatory drugs, lubricants and anti-foaming agents 243(18.8%). Among a total of 1000 animal patient encounters, only 158(15.8%) prescription contain name of the prescriber, while 128(12.8%) of prescriptions have signature of the prescriber and 109(10.9%) of prescriptions contained qualification of the prescriber. The prescribing practices for antibiotic, genetic drug and injection shows deviation from the standard recommended by WHO, so it should be improved. On the other hand, polypharmacy, generic prescribing and prescribing from Ethiopian veterinary drug list were not found to be a problem in this study. Further comprehensive studies on medication error are necessary to investigate the scale of problem and their economic impact.

Keywords: Assessment, irrational drug use, Prescription, Rational veterinary

INTRODUCTION

The rational use of drugs requires that “patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, at the lowest cost to them and their community” (WHO, 1987). The irrational use of drugs is a problem, and to manage it the World Health Organization (WHO) convened an international conference in Nairobi, Kenya, in 1985 to develop useful guidelines (FMHACA, 2012).

Before activities are started to promote rational drug use, an effort should be made to describe and quantify the situation. Several well-established survey methods are available for this purpose. One assessment method is a prescribing and patient care survey using the WHO health facility drug use indicators. These quantitative indicators are now widely accepted as a global standard for problem identification and have been used in over 30 developing countries (Laing and Hogerzeil, 2001).

The irrational use of drugs is a major problem in present day clinical practices as it could result in toxicities and treatment failures in patients and in the emergence of drug resistant pathogens (Bisht et al., 2009). Whilst drug resistant bacteria were traditionally acquired in hospitals due to high antimicrobial use and disease transmission rate, community acquired drug resistant bacteria are becoming increasingly common (Nelson et al., 2009). Resistance may escalate to the point at which the efficacy of drugs will no more be predictable and infections once treatable could become untreatable (Morley et al., 2005).

Prescription writing is an art as it reflects the instructions given by the prescriber to the patient. Irrational prescription of drugs is a common occurrence in clinical practice. The cost of such irrational drug use is enormous in terms of both scarce resources and the adverse clinical consequences of therapies that may have real risks but no objective benefits (Ramsay, 1993). Improper prescribing habits lead to ineffective and unsafe treatment, exacerbation or prolongation of illness, distress and harm to the patient and higher costs. They also make prescriber vulnerable to influences which can cause irrational prescribing. Important reasons of irrational drug prescription are

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lack of knowledge about drugs, unethical drug promotions and irrational prescribing habits of clinicians (de Vries et al., 1994).

Monitoring of prescriptions and drug utilization studies can identify the problems and provide feedback to prescribers so as to create awareness about irrational use of drugs. Variations in types of drugs used and in the way they are used is considerable even when comparing small adjacent areas and in comparing veterinarians working within same area. Drug utilization reviews (DURs) are useful for obtaining information about drug usage patterns and for identifying high cost drugs, which are of economic interest (Pradhan et al., 1988). Thus, appropriate drug utilization is essential in achieving quality of health and medical care for animal patients.

Worldwide, more than half of all medicines are prescribed, dispensed, or sold improperly, and 50% of patients fail to take them correctly. Moreover, about one third of the world's population lacks access to essential medicines (WHO, 2002).

A survey conducted in southern Ethiopia that investigated the prescription patterns of drugs concluded that irrational prescribing, as evidenced by high average number of drugs prescribed per encounter, high percentage of injections, and high percentage of antibiotic use, was prevalent in the studied region (Debalto et al., 1991). However, another study found good signs of rational drug prescribing at Jimma Hospital, south west Ethiopia (Abdulahi and Shiferaw, 1997). A prescription written by a veterinarian or an authorized person is a reflection of his attitude to the disease and the role of drug in its treatment. It also provides an insight into the nature of the health care delivery system (Ravi et al., 2002). Setting standards and assessing the quality of care through performance review should become part of everyday clinical practice (Sharif et al., 2008). Hence, this study was aimed to assess the prescriptions in the context of their adherence to prescription format and rationality of prescription

Most studies on prescription practice focus on medical health institutions. Studies on the evaluation of prescription pattern among clinicians in veterinary medicine in the country, particularly in northern part of Ethiopia is lacking to our knowledge. In this part of the country, data about drug usage patterns is not satisfactory especially in veterinary drug prescription pattern. It is essential to define prescribing pattern and to identify the irrational prescription habits to recommend a science based remedial message to the prescribers. So, the present study was planned to assess the prescription pattern in veterinary clinics of Gondar, northwest Ethiopia.

MATERIAL AND METHODS

Study setting

The study was conducted in three veterinary clinics which are found in Gondar. Gondar is one of the most historical places which found 727 km far from the capital city of Ethiopia. The study was conducted from March first to May 30, 2016. The town consisted of three public veterinary clinics.

Study population

All prescription papers which were filled for the past two years in three public veterinary clinics the prescription papers were systematically selected from drug prescriptions retained at the dispensary of each veterinary clinic.

Study design and methods

A retrospective and cross-sectional study was carried out in 3 veterinary clinics namely Azezo town veterinary clinic, Gondar town veterinary clinic and University of Gondar veterinary clinics a minimum of 250 prescriptions per facility were obtained from subsequent animal patient encounters in these selected veterinary clinics. The data were collected by principal investigator after obtaining necessary orientation and guidance from the advisor how to collect data on prescribing indicators retrospectively by using prescriptions and prescription registration books. The samples were selected using a systematic random sampling method.

One thousand prescriptions that contain the animal's characteristics (age, sex, breed, body condition, clinical signs and symptoms observed), disease diagnosis treatment (name, empiric or physical clinical examination and confirmatory laboratory tests used), prescribed drugs (type, dose, strength, frequency, route of administration, dosage form, duration of treatment, drug withholding period, naming (generic or brand), number of drugs prescribed, prescriber's signature, level of education and name of prescriber were collected retrospectively from more than 12,000 prescriptions written for the last 2 years (from February 01, 2014 to January 01, 2015). The availability of both veterinary standard treatment guidelines (STG) and Ethiopian veterinary drug list (EVDL) in the clinic was also observed.

The specific types of data necessary to measure the prescribing indicators were recorded for each patient encounter and entered directly into an ordinary prescribing indicator form then transferred to excel 2007 version. A prepared format (Annex II) was used to check whether the following information's were written or not in the prescription.

- ❖ Information about animal patient

- ❖ Information about drug
- ❖ Information about prescriber
- ❖ Information about animal owner

Data management

There was no available guideline for prescribing indicators used in veterinary medicine as a result. The WHO prescribing indicators was used to analyze the data which are listed below:

1. The average number of drugs prescribed per encounter was calculated to measure the degree of poly-pharmacy by dividing the total number of different drug products prescribed by the number of encounters surveyed.
2. Percentage of drugs prescribed by generic name was calculated to measure the tendency of prescribing by generic name by dividing the number of drugs prescribed by generic name by total number of drugs prescribed, multiplied by 100.
3. Percentage of encounters with an injection prescribed was calculated to measure the overall level use of commonly overused and costly forms of drug therapy by dividing the number of patient encounters in which an injection was prescribed by the total number of encounters surveyed, multiplied by 100.
4. Percentage of drugs prescribed from an essential veterinary drug list (EVDL) was calculate to measure the degree to which practices conform to a national drug policy as indicated in the national veterinary drug list of Ethiopia. Percentage was calculated by dividing number of products prescribed which are in essential drug list by the total number of drugs prescribed, multiplied by 100.

RESULTS

A total of 1000 prescriptions and cases from case books obtained from animal patient encounters in the 3 veterinary clinics Azezo town veterinary clinic (250) Gondar town veterinary clinic (250) and University of Gondar veterinary clinic (500) were evaluated. All the encounters had one or more drugs prescribed. A total of 1291 drugs were prescribed in the 1000 animal patient encounters evaluated with an average of 1.291 with a maximum of five drugs. The total number of drugs prescribed by generic name was 1146 which is (88.8%) of the total number. The total number of antibiotic drugs prescribed was 444 of the total animal patient encounters (44.4%) and an injection was prescribed in 644 animal patients (64.4%). Moreover this study found that out of the total patient encounters, 1267 drugs (98.14%) prescriptions were belonging to Ethiopian veterinary drug list (EVDL).

Analysis of the 1000 prescriptions revealed that demographic profile or animal and owner information of the patients was recorded in 100% prescriptions. Tentative diagnosis of the disease was mentioned in 100 % of prescriptions. While assessing the components of the prescription, the superscription (symbol Rx) was present in 100% prescriptions.

The dose of the drug was recorded in 94.6% of the prescriptions. The route of drug administration was mentioned only in 21% of the prescriptions and the frequency of drug administration was also mentioned in only 4.7 % prescriptions. The dosage form of the drug was mentioned only in 16.4% of the total prescriptions. In addition to the above prescription components, the duration of treatment was specified in 70.4% prescriptions. None of the prescriptions above was writing drug withholding period. All animal patients admitted to Gondar town Veterinary clinic, Azezo town veterinary clinic and university of Gondar veterinary clinic were treated empirically without definitive diagnosis or laboratory examination. Among a total of 1000 animal patient encounters, only 158 (15.8%) prescription contain name of the prescriber, while 128 (12.8%) of prescriptions have signature of the prescriber and 109 (10.9%) of prescriptions contained qualification and name of the prescriber (Figure 1).

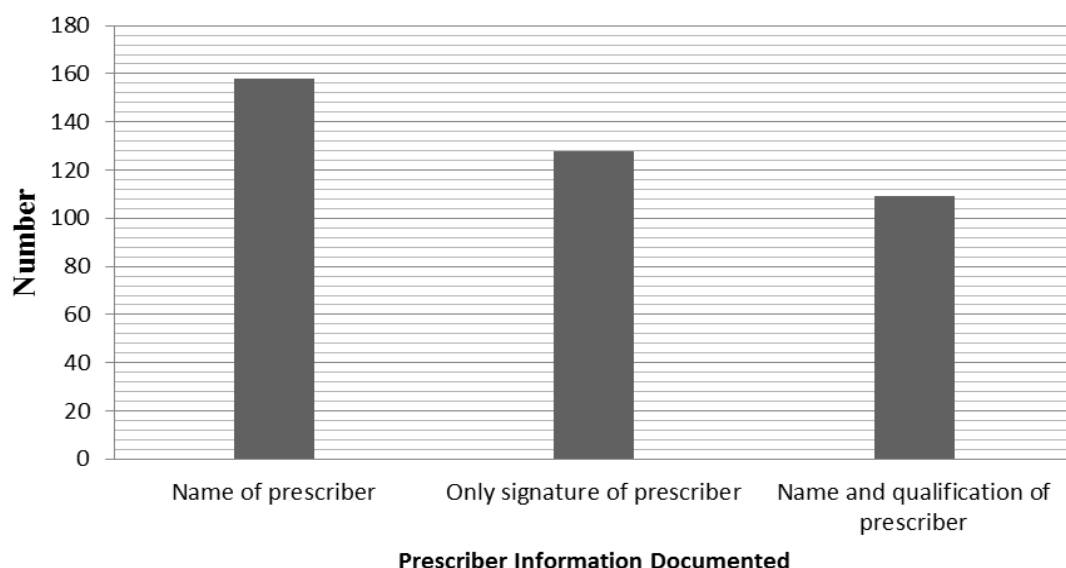
Out of the total 1291 drugs prescribed, the most commonly prescribed drugs were; 243 (18.8%) was oxytetracycline, 133 (10.3%) was penicillin and streptomycin fixed combination, 157(12.16%) was ivermectins, 330 (25.6%) was albendazole, 108 (8.3%) was acaricides, 77 (6%) vitamin supplements, and 243(18.8%) other drugs including gastrointestinal stimulants, antacids, anti-inflammatory drugs, lubricants and anti-foaming agents (Table 2). In all of three veterinary clinics none of them had the Ethiopian veterinary drug list and drug formulary

Table 1 - Summary of prescribing indicators in three veterinary clinics of Gondar from 2014 to 2015.

Prescribing indicators assessed	Total number of drugs	Average/percent
Average number of drugs encountered	1291	1.291
Percentage of encounters with antibiotics	444	44.4%
Percentage of encounters with injections	644	64.4%
Percentage of drugs prescribed by generic name	1146	88.8%
Percentage of drugs from Ethiopian veterinary drug list	1267	98.14%

Table 2 - Percentage of prescriptions with prescription components (n=1000)

S. No.	Prescription components	Total encounters	Percentage
1.	Prescriptions with demographic parameters of animal patients and owners information	1000	100%
2.	Prescriptions with Rx or treatment mentioned	1000	100%
3.	Prescriptions with diagnosis mentioned	1000	100%
4.	Prescriptions with route of drug administration mentioned	210	21%
5.	Prescriptions with dose of drug mentioned	946	94.6%
6.	Prescriptions with frequency of drug administration mentioned	47	4.7%
7.	Prescriptions with dosage form mentioned	164	16.4%
8.	Prescriptions with duration of treatment mentioned	704	70.4%

**Figure 1 - Results of prescriber information in three veterinary clinics of Gondar from 2014 to 2015 (n=1000)****Table 3 - The most commonly prescribed antimicrobials and antihelmintics at three veterinary clinics of Gondar from 2014 to 2015 (n=1291).**

Therapeutic agent class	Frequency	Percentage of total
Antimicrobials		
Oxytetracycline	243	18.8%
Penicillin-streptomycin combination	133	10.3%
Sulphamethoxazole trimethoprim	37	2.8%
Combination		
Procaine penicillin	19	1.47%
Mammary infusion	12	0.93%
Antihelmintics		
Albendazole	330	25.56%
Ivermectin	157	12.16%
Diazinon	108	8.3%
Triclabendazole	31	2.4%
Fenbendazole powder	18	1.4%
Others		
Amprolium hydrochloride	26	2%
Vitamin supplement	77	5.96%
Diminazene aceturate	25	1.93%
Dexamethasone	21	1.6%
Digestion powder	16	1.24%
Liquid paraffin	15	1.12%
Vegetable oil	9	0.7%
Ecthammol	9	0.7%
Sodium bicarbonate	5	0.4%
Total	1291	100%

DISCUSSION

A prescription written by a veterinarian or an authorized person is a reflection of his attitude to the disease and the role of drug in its treatment. It also provides an insight into the nature of the health care delivery system (Ravi et al., 2002). Setting standards and assessing the quality of care through performance review should become part of everyday clinical practice (Sharif et al., 2008). In this study, majority of the prescriptions adhere to the ideal pattern of prescription writing with regards to important demographic parameters of animal identification and owner's information. The name, age, sex and address of the patient were written in 100% of the prescriptions in the present study indicating that the clinicians adhere to the pattern of prescription writing. This is in line with a study done in central part of Ethiopia which also indicated that most of the prescriptions were having demographic parameters (Beyene et al., 2015).

These parameters are important as they help to establish the animal patient's identity and also help in tracing the patient during the follow up visits. A brief note about the diagnosis of the disease is also helpful to the pharmacist to ensure that the drugs prescribed are appropriate for the patient's condition. In the present study, diagnosis was mentioned by the clinicians in 100% of the prescriptions although most were based on empirical or tentative diagnoses. The prescription of drugs using merely empirical or tentative diagnoses is one contribution to an irrational drug use as the wrong drug can be administered while the diagnoses can be another disease. This is because several diseases can have similar clinical signs, especially those infectious and febrile diseases (Beyene et al., 2015).

In this study the percentage of dosage form, frequency, duration of drug therapy and its route of administration were 16.4%, 4.7%, 70.4%, 21% respectively out of the total prescriptions. The dose of the drug that has to be administered was specified in 94.6% of the prescriptions. This figure is quite higher as compared to other studies where dose was mentioned in only 80% of the prescriptions in a study conducted in Jammu (Sharif et al., 2008). With respect to route of administration, the route of drug administration was mentioned in 21% of the total prescriptions in this study. Our finding is in contrast to a result from a study conducted in central Ethiopia where it was found that route of drug administration were not mentioned in 98.9% prescriptions (Beyene et al., 2015). The duration of treatment was specified in 70.4% of the total prescriptions in the current study. On the other hand our result was higher than the result of a study carried out in adama veterinary clinic where duration of treatment was mentioned only in 6.5% of the total cases (Beyene et al., 2016). This study revealed that directions regarding the duration of drug therapy were verbal. Such practices should be corrected.

The WHO prescribing indicators have provided a reproducible and objective measure of characterizing prescriptions by clinicians. This study reveals areas of irrational prescribing that needs to be corrected with intervention programs or by work trainings. Whilst the WHO guidelines on rational use of drugs had reference values of (1.6 - 1.8) drugs per encounter, the average of 1.291 drugs prescribed per patient encounter as seen in this study is comparatively low this may be occur due to absence of some drugs in the veterinary clinics or may be due to rational prescribing of the veterinarians.

However, this low average number is similar to those of public health institutions in the same setting, suggesting the therapeutic tradition in the regions. Sharif et al. (2008) reported a 2.2% average drug prescription in Ghana while in central Ethiopia a research which have been done on "evaluation of rational use of veterinary drugs especially antimicrobials and anthelmintics" the average number of drugs per prescription at CVMVTH and Ada district veterinary clinic was 1.23, (Beyene et al., 2015) which indicates the absence of poly-pharmacy. Their result is almost the same as the result of the present study (1.21). Poly-pharmacy provides a fertile ground for drug-drug interactions, toxic effects and incurs high cost treatment and should be discouraged in clinics where it is apparent.

Although there is no other study on veterinary drug prescription pattern, when we see reports of studies performed on human subjects in contrast to our study, the study done in southwest Ethiopia, Jimma Hospital, has shown that the average number of drugs per encounter was 1.59 (Abdulahi et al., 1997). Additionally, in other study conducted in three hospitals in north Ethiopia, the average number of drugs per patient was 0.98 at Gondar Hospital, 1.8 in Bahir Dar Hospital, and 2.2 in Debre Tabor Hospital. A high average number of drugs on humans might be due to financial incentives to prescribers to prescribe more, lack of therapeutic training of prescribers, or shortage of therapeutically correct drugs. The low values might mean there is constraint in the availability of drugs, or prescribers have appropriate training in therapeutics (Anteneh, 2013).

Low generic prescribing is seen in this study as compared with WHO standard as it should be 100%, as the result of our study is 88.76% only had drugs prescribed by their generic name. In a study conducted in Nigeria, almost 100% of the prescriptions in the name of generic drug were reported; although only 50% of the prescriptions were correct according to the standard treatment guidelines (Mallet et al., 2001). Another study carried out at a non-governmental organization in India reported that 46.2% of the drugs were prescribed by generic name, but 45.6% of the prescribed drugs were irrational drug combinations, while similar studies conducted in central Ethiopia Bishoftu reported that the percentage of veterinary drugs prescribed by generic name was 90.1% which is less than the standard derived to serve as ideal (100%) (Beyene et al., 2015). In contrast to our finding in the study conducted in

12 developing countries (human subject), the percentage of generic drugs prescribed was low in Nigeria (58%) and Sudan (63 %) but encouraging in Tanzania (82 %) and Zimbabwe (94 %) (Bimo, 1997).

Antibiotic resistance among pathogenic microorganisms is a matter of worldwide concern. Antibiotics are among the most commonly prescribed drugs in veterinary clinics and hospitals and in developed countries around 30% of the hospitalized patients are treated with these drugs (Van der and, Gyssens, 2001). In the present study, antibiotics were prescribed in 44.4% of the total prescriptions in contrast to a WHO standard for human medicine 20% to 26.8%, but it was almost similar to a research done by Beyene et al. (2016) who reported that number of antibiotics were 46.4%. In contrast, a study conducted in Nigeria reported that the majority of prescriptions (83.5%) contained antibiotics. Similarly, in a study conducted in Jordan, the percentage of prescriptions involving antibiotics averaged 60.9% which is high when compared to our study. In a related study in a private hospital in Dubai, the findings of 21.4% antibiotics prescription was much lower than that of this study (Sharif et al., 2008).

In related study conducted in central Ethiopia the percentage of encounters in which antibiotics and anthelmintics were prescribed at CVMA-VTH and Ada district veterinary clinics were 54.4 and 38.9 %, respectively, which were nearly similar to our study (Beyene et al., 2015). The high percentage of antibiotics prescribed in this study setting may be due to inadequate diagnosis and recognition of the disease, unavailability of diagnostic aids for confirmatory tests, absence of alternative drug, prescriber's belief of the therapeutic efficacy of the antibiotics is low and inadequate prescribers knowledge.

Unsafe use and overuse of injection play an important role in transmission of very serious blood-borne infections. In the present study, injections were prescribed in 64.4% of the total prescriptions which is higher than the standard (13.4%-24.1%) derived to serve as ideal (Hazra et al., 2000). Possible reasons for the high use of injections could be beliefs and attitudes of animal owners and health professionals about the efficacy of injection versus oral medication. A national baseline study on drug use indicators in Ethiopia in September 2002 found the percentage of encounters with an injection to be 23%, which is lower than our finding (64.4%). In a prescription pattern study in 12 developing countries, the percentage of encounters in which an injection was prescribed was high in Uganda (48%) and Sudan (36%) but very low in Zimbabwe (11%), and in the acceptable range in Indonesia (17%), Ecuador (17%), and Mali (19%) (Bimo, 1997). Injections are very expensive compared to other dosage forms and require trained personnel for administration. The percentage of drugs prescribed from the essential veterinary drug list was 98.14%, which is almost identical with the standard (100%) derived to serve as ideal (Isah et al., 2004). A study of the patterns of rational use of veterinary drugs in central Ethiopia revealed that number of drugs prescribed from essential veterinary drug list was 99.7% which is almost similar with our study. A study on evaluation of drug use in Jordan using WHO prescribing indicators concluded that the percentage of prescriptions involving drugs from the essential drugs list averaged 93% (Otoom et al., 2002).

CONCLUSION AND RECOMMENDATIONS

On the basis of the findings of the this study on veterinary drugs prescribing practices have showed that antibiotics are prescribed on clinical judgment of animal patient rather than taking the specimen of blood or urine for culture. Absence of standard case paper which has to contain all necessary animal related, drug and owners information of routine clinical examination and treatments, and the non-availability of both standard veterinary treatment guideline and drug formulary in the study area, could lead to irrational drug use. On the other hand, average number of drug which indicates the degree of poly pharmacy and prescribing from EVDL were not found to be a problem. The name, qualification and signature of prescribers were available in minimal number of prescriptions, so it should be improved because it leads to absence of accountability. This study reveals areas of irrational prescribing that needs to be corrected with intervention programs or by work trainings.

The result of the present study can be used by researchers and policymakers to improve drug prescribing practice in veterinary medicine. Hence, integrated cooperation between different stake- holders should be maintained to support a rational use of antimicrobials in food animals, which would ensure the effectiveness of these drugs and the safety of foods of animal origin. Based on the above findings and conclusions the following recommendations are forwarded:

- ❖ Veterinary medicine education in clinical pharmacology should be based on the practical needs of future prescribers, should include the principles of rational therapeutics and problem solving, and should immunize the students against the influences they are likely to encounter in their professional life.
- ❖ Further comprehensive studies on medication error are necessary to investigate the scale of problem and their economic impact.
- ❖ Sustainable interventional strategies and periodic audit at all levels of health care to avoid the negative consequences of inappropriate prescriptions should be established.
- ❖ Training and refresher courses should be given to prescribers on the basic principles of prescription order writing.

DECLARATIONS

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Consent to publish

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

BB conceived the study, coordinated the overall activity, and carried out the statistical analysis, drafted the manuscript. EK conceived the study, coordinated the overall activity, and reviewed the manuscript. MB conceived the study, coordinated the overall activity, and reviewed the manuscript. AM participated in drafting and reviewing the manuscript. All authors read and approved the final manuscript.

Availability of data and materials

Data will be made available up on request of the primary author

REFERENCES

- Abdulahi M and Shiferaw T (1997). Pattern of prescription in Jimma Hosptial. *Ethiop J. of Health Dev*, , 11(3):263–267.
- Mengistu A (2005). Patterns of drug utilization in inpatient departments, Jimma hospital south west Ethiopia. *Ethiop. J. Health Dev*. 15(2): 139-145).
- Angunawela II and Tomson GB (1988). Drug prescribing patterns: a study of four institutions in Sri Lanka. *Int J clin Pharmac Ther Tox*; 26 (2): 69-74.
- Anteneh A (2013). Assessment of drug use pattern using WHO prescribing indicators. *BMC Health Service Res*. 13:170.
- Beyene T, Endalamaw D, Tolossa Y, Feyisa A (2015) Evaluation of rational use of veterinary drugs especially antimicrobials and anthelmintics in Bishoiu, Central Ethiopia. *BMC Res Notes*, 8: 482.
- Beyene T, Assefa S, Ayana D, Jibat T, Tadesse F, (2016) Assessment of Rational Veterinary Drugs Use in Livestock at Adama District Veterinary Clinic, Central Ethiopia. *J Veterinar Sci Techno* 7: 319. doi:10.4172/2157-7579.1000319
- Bimo D (1992). Report on Nigerian field test. INRUD News. 3(1): 9–10. In: How to investigate drug use in health facilities. Geneva: WHO. 1993. Pp 74 (WHO/DAP/93.1
- Bisht R, Katiyar A, Singh R and Mittal P (2009). Antibiotic resistance – a global issue of concern. *Asian J. Pharm. Clin. Res.*, 2 (2), 34 -39.
- DACA (Drug Administration and Control Authority of Ethiopia) (2006). Standard veterinary treatment guidelines for veterinary clinics, 1st edn. Addis Ababa.
- Daniel Z, Yohannes J, Tsige G (1999). A preliminary assessment of outpatient counseling in four referral hospitals of Addis Ababa. *Ethiop. Pharm. J.*, 17: 44-51
- Dawit D, Sleet G, Shiferaw T. (1998). A base line survey on prescribing indicators and factors influencing prescribing in Southern Ethiopia, *Ethiop. J. Health Dev.*, 12(2):87-93
- Debalto D, Gobe Z, Teklemariam S (1991). A base line survey o f prescribing indicators and factors influencing prescribing in southern Ethiopia. *J Health Dev*, 11(3):263–267.
- Desalegn AA (2013). Assessment of drug use pattern using WHO prescribing indicators at Hawassa University teaching and referral hospital south Ethiopia: a crosssectional study. *BMC. Health Serv. Res.*, 13, 170. doi: 10.1186/1472-6963-13-170.
- Desta Z, Abula T, Ganes A, and Worku (2002). A prescribing pattern drugs for out patient in three hospitals in north West Ethiopia, *J. health Dev*. 16 (2): 183-189.
- Dikaso D, Gobe Z, Teklemariam S. (1998). A base line survey on prescribing indicators and underlying factors influencing prescribing in southern Ethiopia, *Ethiopia .J. health Dev*. 12 (2) 87-93
- Ernest J. (2005). Resistance to antimicrobials in humans and animals. *Biomed J*. 331: 1219–20.
- Fabricant S and Hirschhorn N (1987). Deranged distribution, perverse prescription, unprotected use: the irrationality of pharmaceuticals in the developing world. *Health Pol Plan*. 2: 204-213.

- Food, Medicine and Healthcare Administration and Control Authority (FMHACA) of Ethiopia (2012). 2nd edition. Addis Ababa: Manual for Medicines Good Prescribing Practice; Accessed <http://www.fmhaca.gov.et/Documents/Medicines%20Good%20Prescribing%20Manual%20second%20edition%202012.pdf.2>
- Giguere S, Prescott JF, Baggot JD, Walker RD, Dowling MP (2006). Antimicrobial therapy in veterinary medicine. Fourth Edition. Iowa State University Press/Ames
- Getachew E, Solomon A, Wuletaw A, Asrat A. (2013) Antibiotic prescribing pattern in a referral hospital in Ethiopia. *Afr J Pharm Pharmacol* 7: 2657-2661.
- Hazra A, Tripathi SK, Alam MS (2000). Prescribing and dispensing activities at the health facilities of a nongovernmental organization. *Natl Med J India*. 13:177-182.
- Hogerzeil HV. (1995). Promoting rational prescribing: an international perspective. *Br J Clin Pharmacol*. 39(1): 1–6 How to investigate drug use in health facilities: selected drug use indicators. Geneva, World Health Organization, 1993. WHO/DAP/93.1.]
- Isah AO, Ross-Degnan D, Quick J, Laing R, Mabadeje AFB: The development of standard values for the WHO drug use prescribing indicators. ICUM/EDM/ WHO. http://archives.who.int/prduc2004/rducd/ICIUM_Posters/1a2_txt.htm.
- Tamuno I (2011). Prescription pattern of clinicians in private health facilities in Kano, Northwestern Nigeria *Asian Paicfic Journal of Tropical Disease*, 235-238.
- Laing RO, Hogerzeil HV (2001). Ten recommendations to improve use of medicines in developing countries. *Health Policy Plan*, 16(1): 13–20. Oxford University Press.
- M de Vries, TPG, Henning RH, Hogerzeil HV, et al. (1994). Guide to Good prescribing. A practical guide W.H.O.
- Mallet HP, Njikam A, Scoufnaire SM. (2001) Evaluation of prescription practices and of the rational use of medicines in Niger. *Sante*. 11:185-193.
- Morley PS, Apley MD, Besser TE, Burney DP, Fedorka-Cray PJ, Papich MG, Traub-Dargatz JL, and Weese JS (2005). Antimicrobial drug use in veterinary medicine. *J. Vet. Intern. Med.*, 19(2), 617-629.
- Nelson N, Joshi M, and Kirika R (2009). Antimicrobial Resistance: The Need for Action in the East, Central and Southern Africa Region. Submitted to the U.S. Agency for International Development by the Strengthening Pharmaceutical Systems (SPS) Program. Arlington, VA: Management Sciences for Health.
- Otoom S, Batieha A, Hadidi H, et al. (2002). Evaluation of drug use in Jordan using WHO prescribing indicators. *East Mediterr Health J* 8(4-5):537-543.
- Pradhan SC, Shewade DG, Shashindren CH, et al. (1988). Drug utilization studies. *Natl Med J Ind*. 1:185-189.
- Ramsay LE. (1993). Bridging the gap between clinical pharmacology and rational drug prescribing. *Br J Clin Pharmacol*. 35:575-576
- Ravi, Partha P, Shenoy N. (2002) Prescribing patterns in medical outpatients. *Int J Clin Pract*. 56(7):549-551.
- Sanders P (2007). Veterinary drug residue control in the European Union. *Technologija mesa*. 1(2):59–68.).
- Sharif SI, Shaqra MA, Hajjar H, et al. (2008). Patterns Of Drug Prescribing In A Hospital In Dubai, United Arab Emirates. *Libyan J Med*. 3(1): 10–12.
- Van der Meer JW, Gyssens IC. (2001). Quality of antimicrobial drug prescription in hospital. *Clin Microbiol Infect* . 7:12-15
- Vitomir C, Silva D, Biljana A, Sanja C. (2011). The significance of rational use of drugs in veterinary medicine for food safety. *Tehnologija mesa*. 52(1):74–9
- Walker GJA, Hogerzeil HV, Sallami AO, Alwan AAS, Fernando G, Kassem FA (1990) Evaluation of rational drug prescribing in Democratic Yemen. *Soc Sci Med* 31: 823-828.
- WHO. (1994). Action programme on essential drugs. Guide to good prescribing: a practical manual (WHO/DAP/94.11). Geneva WHO; Costs
- WHO. Rational use of medicines. 2012. http://www.who.int/medicines/areas/rational_use/en/index.html. Accessed 18 Oct 2016
- WHO: The Rational Use of Drugs. Report of a conference of experts, Nairobi, 25–29 November 1985. Geneva: World Health Organization; 1987.
- WHO: World Health Organization promoting rational use of medicines: core components. WHO Policy and Perspectives on medicine no. 5 Document WHO/ EDM/2002.3. Geneva: WHO; 2002
- Zelege A, Chanie T and Woldie M (2014). Medication prescribing errors and associated factors at the pediatric wards of Dessie Referral Hospital, Northeast Ethiopia. *International Archives of Medicine*, 7, 18, <http://www.intarchmed.com/content/7/1/18>.

ANNEXES

Annex 1a

Animal patient and owners information																				
S no	name		address		Spp		age		breed		sex		DX		tent DX		Conf DX		Drug with holding period	
	Yes	no	Yes	no	yes	No	yes	no	yes	o	yes	no	yes	no	yes	no	yes	no	yes	no
1																				
2																				

Annex 1b

Drug related information																	
S. no	Dose		Strength		Frequency		Route of administration		Dosage form		Duration of treatment		No of drugs prescribe	NO of antibiotics per encounter	No of injection per encounter	No of generic drugs	Remark
	yes	No	yes	No	Yes	no	yes	no	yes	No	yes	no					

Annex 2

S No	PRESCRIBERS INFORMATION					
	Name of prescriber			Qualification		Signature
	yes		no	yes	No	yes no

THE INFLUENCE OF DRIED BREWERY GRAIN IN BROILER DIETS ON PRODUCTION PERFORMANCE

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✉Supporting Information

ABSTRACT: As a result of high feed costs in Lesotho the majority of farmers especially those producing under semi intensive are diluting commercial feeds with a non-conventional feeds such as dried brewery grain (DBG) in order to increase the quantity and to lower the costs of feeds. In most cases this practice resulted in poor broiler performance and low carcass yields because of high inclusion rates. A completely randomized study with four dietary treatments was undertaken at the National University of Lesotho farm. The aim of the study was to investigate the effect of DBG inclusion in broiler diets during growing and finishing and to determine the dilution or the inclusion rate that can maintain broiler performance and carcass yields like commercial feeds. Dietary treatments were made up of control represented by commercial feeds and three inclusion rates of DBG at 25, 50 and 75% respectively. A total of 360 day-old Ross 308 chicks were randomly assigned to four treatments replicated four times. A total of ten birds per replicate were used for carcass parameters determination. Feeds and water were provided on ad libitum basis. Light was provided for maximum of 20 hours per day. Performance data were collected on weekly basis as average feed intake, growth rate, body weight, feed conversion ratio and mortality while carcass parameters were collected at the end of finishing phase on carcass weight, dressing percentage, gizzard and intestinal weight. The feeding experiment lasted for four weeks. The dietary treatments had a significant ($P < 0.05$) effect on average feed intake, growth rate, body weight, feed conversion ratio, carcass weight, dressing percentage, gizzard and intestinal weights whereby broilers under control and 25% DBG had similar and better performance than animals in other treatments except for gizzard and intestinal weight which were higher in 75% DBG. The higher fibre content of DBG was found to be the limiting factor in the utilization by broiler especially at inclusion rate beyond 25%. Cost benefit analysis indicated that there was a 21% reduction in feed costs when using 25% DBG in broiler diets. It was concluded that 25% DBG inclusion rate is the one giving similar production performance and carcass yield to the commercial feeds except for the visceral parts. Therefore farmers can include the DBG up to 25% in broiler feeds for optimum performance and carcass yield between growing and finishing stages and save 21% in feed costs.

Keywords: Dried brewery grain, Commercial feeds, Broiler performance, Carcass parameters, Feed costs.

INTRODUCTION

In Lesotho, the majority of broiler farmers are producing their chickens under semi intensive production system. One of the limitations to the expansion of poultry industry is the high cost of animal feeds. In order to reduce high cost, efforts are being directed to the use of non-conventional feed ingredients such as brewery by-products. The use of by-products in animal diets can reduce the incorrect disposal of these products into the environment. Also, their use as an alternative source in animal feed may replace or complement other ingredients of high added-value, which are used as food sources in human diets (Parpinelli et al., 2018). Maluti Mountain Brewery is the sole brewery company in Lesotho and is offering wet brewery grain at affordable prices to the farmers but primarily dairy farmers. Wet brewer's grains contain 75-80% water and deteriorate rapidly due to the growth of bacteria, yeasts and fungi (Asurmendi et al., 2013). The nutritional content of brewers' grains varies depending on the grain used (barley, wheat, rice, or corn), the extent of the fermentation, and the type of fermentation process used. According to National Research Council (NRC) (1994) standards brewer's spent grain contain 25.3 % protein, 6.3 % fat, 92 % dry matter, approximately 2080 kcal/kg metabolizable energy (ME). The major problem limiting the use of dried brewers' grains in poultry rations is related to the grains' high fiber content (Levic et al., 2010).

Acceptable inclusion rates of DBG in poultry diets reported in the literature range from 10-20% in young birds and up to 30% in older poultry. Fasuyi et al. (2018) working with ensiled brewery grain in broiler chickens between starting and growing phase observed the highest weight gain at 30% inclusion rate. Parpinelli et al. (2018) reported that 10% inclusion rate of DBG in broiler chicken during the finishing phase maintained production performance very well. In broilers between twelve and thirty-three days the inclusion rate ranging between ten and twenty percent inclusion of DBG supported acceptable growth and feed utilization, and seemed to favor the development of a well-functioning gizzard (Denstadli et al., 2010).

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In Lesotho, the inclusion of brewery grain in poultry diets is not well document and therefore the main objective of this study was to determine the effect of including different levels of DBG in broiler diets on production performance, carcass quality and economic benefits.

MATERIALS AND METHODS

Ethical approval

The scientific and ethics committee of the Faculty of Agriculture, National University of Lesotho approved the study protocol.

Study area

The study was carried out at the National University of Lesotho, Faculty of Agriculture farm in Roma some 34 kilometers southeast of Maseru, the capital of Lesotho. The Roma valley is broad and is surrounded by a barrier of rugged mountains which provide magnificent scenery. The university enjoys a temperate climate with four distinct seasons.

Experimental design and treatments

A completely randomized design was used with four dietary treatments replicated three times. Four experimental diets were formulated at the farm in such a way that the control diet contained maize as the chief energy source while the other three diets had dried brewers grain (DBG) replacing maize at the rate of 25, 50 and 75% in diets 2, 3 and 4 respectively. Experimental diets were offered in a mash form. The composition and nutrients levels of the treated diet for growing phase are shown in [Table 1](#).

A total of 180 day-old broilers were used in this study. The birds were randomly divided into 4 treatments of 45 birds each. Each treatment was replicated 3 times with 15 birds per replicate. The experiment lasted for six weeks. The birds were reared in deep litter system. Fresh water and treatment diets were supplied ad libitum throughout the period of the experiment. Routine management practices including vaccination and drug administration when necessary was duly observed.

Table 1 - Physical and chemical composition of experimental diets

Ingredients	Control	T1 (25%DBG)	T2 (50%DBG)	T3(75%DBG)
Maize	50	38	25	21
Soya bean	17	20	20	20
Fish meal	7	2	2	2
Sunflower	15	10	10	10
Hominy feed	10.5	17.5	17.5	17.5
BDG	0	12	25	29
Salt	0.25	0.25	0.25	0.25
Mineral Premix	0.25	0.25	0.25	0.25
Determined Analysis				
CP (%)	18	17	19	20
ME (Mcal)	3.04	2.94	2.88	2.87
Starch (%)	35.73	32.69	25.56	23.37
ADF (%)	7.05	8.86	11.36	12.13
Calcium (%)	0.44	0.22	.26	0.27
Phosphorus (%)	0.56	0.48	0.53	0.55

Data collection

Data was collected on proximate composition of experimental diets, production parameters, carcass parameters and economic analysis.

Proximate analysis of formulated diet

The chemical analysis of experimental diets were done using standard methods according to [Association of Official Analytical Chemists\(AOAC,1990\)](#) this included the following test; dry matter determination, crude protein, energy, crude fiber (ADF & NDF), ether extract, minerals (calcium and phosphorus).

Production parameters

Feed intake was determined as the difference between the quantity of feed offered and the leftovers. Weekly data was collected on the following parameters; growth rate, feed conversion ratio and body weight while mortality rate was collected daily.

Carcass parameters

Carcass parameters including, dressing weight, visceral weight, fat pad weight and gizzard weight were measured at the end of the finishing phase (end of the trial). The birds were fasted overnight, 5 birds per replicate were selected for each slaughtering phase and weighed the following morning prior to slaughtering to obtain their live weights. The birds were slaughtered by severing the jugular vein. The carcasses were allowed to bleed freely for 5 minutes, defeathered using warm water and then re-weighed to obtain plucked carcass weight. They were then be decapitated, eviscerated and weighed to obtain the dressed weights. Dressing percentage was expressed as dressed carcass weight over live weight, multiplied by 100. An electronic top loading scale with maximum weight of 3kg (sensitive at 0.1g) was used to weigh the birds, the carcasses.

Cost benefit analysis

The cost per kg of the diet was calculated by multiplying the percentage composition of the feedstuffs with the price per kg of each feedstuff and summing all. Total feed intake x cost per kg feed gave total feed cost. Feed cost per kg weight gain was calculated as FCR x cost per kg of diet.

Data analysis

The response variables were analyzed as one-way ANOVA with four dietary treatments as the main effects using the Social Science Statistical Tool ([IBM SPSS version 20, 2011](#)). Once differences were detected by ANOVA, means were separated using Least Significance Difference (LSD).

RESULTS AND DISCUSSIONS

Production Parameters

The influence of DBG in broiler diets results on production parameter are shown in [Table 2](#). It is evident from these results that the dietary treatment had a significant ($P<0.05$) influence on feed intake, daily weight gain, feed conversion ratio (FCR) and final body weight, whereby birds that received the control diet performed significantly better than all birds in other treatments. It was also observed that the incremental inclusion of DBG resulted in an inverse relationship in all production parameters. Least significant difference result on the other hand revealed that there was no significant ($P>0.05$) difference in all production parameters between the control and 25% DBG inclusion. These results are in agreement with the findings of [Anyanwu et al. \(2008\)](#) who reported similar trends on final body weights and daily weight gains. [Aghabeigi et al. \(2013\)](#) observed similar trends for feed intake between day eleven and forty-two. On the other hand, [Swain et al. \(2012\)](#) reported that inclusion of DBG at 20% did not influence body weight of broilers but had a significant effect on feed intake and FCR whereby birds fed diets with DBG had higher feed intake and FCR than the control group. [Anjola et al. \(2016\)](#) used 0, 5, 8, 11 and 14%DBG inclusion in broiler diets and reported that there were no significant differences in feed intake, weight gain and FCR amongst the dietary treatments. The lower production parameters characterized by T2 and T3 could be a result of high fibre content associated with feeding of DBG which means that for inclusion level of 25% DBG, the diet was equally acceptable to the birds as they ate the same quantity feeds as the control group. The decrease in feed intake for T2 and T3 diets may be attributed to bulkiness and probably poor acceptability of the feed and this is supported by [Denstadli et al. \(2010\)](#) who observed that the inclusion rate of DBG in diets up to 40% decreased body weight gain and FCR. The researchers also concluded that birds cannot cope with the increased bulkiness of the diet when the inclusion rate is more than 40%.

Carcass parameters

The influence of DBG on carcass production results ([Table 3](#)) pointed out that dietary treatment had a significant ($P<0.05$) influence on all carcass parameters. The carcass parameters were also degreasing with an increase in DBG inclusion rate. The mean comparison test indicated that carcass parameters between control and 25% DBG groups were not statistically different however there was significant difference between control and 50 and 75%DBG. The results of the current study are similar to results of [Okpanachi et al., \(2014\)](#) who used a mixture of DBG and cassava tubers in broiler diets and observed that the incremental inclusion of DBG up to 45% reduced carcass weight, dressing percentage and gizzard weight. Contrary to observed results [Swain et al., \(2012\)](#) using maximum of 20% DBG in broiler diets reported significantly high meat yield and gizzard weight in broilers fed diets containing DBG than in control group. The results of the current study imply that DBG should not be included in broiler diets by more than 25% inclusion rate for optimum carcass yield.

Cost benefit analysis

The cost benefits analysis results ([Table 4](#)) confirmed that the inclusion of DBG in broiler diets can significantly ($P<0.05$) reduce the cost of feeds. However, cost of 50kg feeds were not statistically ($P>0.05$) different between

control and 25% DBG treatment but cost of 25% DBG were lower by 10.00 Maluti which is good saving for the farmer. These findings are in agreement with the work of Swain et al., (2013) who found that the incremental inclusion of DBG reduced the cost per kg feeds. Fasuyi et al., (2018) added that the cost of feed was reduced as the inclusion levels of DBG in the diets increased. The researcher further indicated the control diet had the highest cost while 30%DBG inclusion had the lowest cost. Ndams (2008) found contrasting results with regard to cost per kg weight gain and cost per kg feed.

Table 2 - The influence of DBG on broiler production parameters

Parameters	Dietary treatments				Significance	
	Control	T1 (25%)	T2 (50%)	T3 (75%)	P ¹	CV ²
Feed intake (g/week)	710.00 ^a	643.00 ^b	577.33 ^c	510.00 ^d	0.001	19.69
Daily weight gain (g)	91.41 ^a	90.26 ^a	81.99 ^b	73.36 ^c	0.002	26.32
FCR (g/g)	2.48 ^a	2.47 ^a	2.37 ^b	1.91 ^c	0.019	16.94
Live weight (g)	2325.67 ^a	2230.00 ^a	1943.53 ^b	1400.20 ^c	0.001	15.89

^{a, b, c} Means in rows with different superscripts differ significantly (P<0.05); ¹ Probability level at 0.05 percent; ² Coefficient of Variation; ³ Feed Conversion Ratio (gram feed/gram weight gain)

Table 3 - The influence of DBR on broiler carcass parameters

Parameters	Dietary treatments				Significance	
	Control	T1 (25%)	T2 (50%)	T3 (75%)	P ¹	CV ²
Carcass weight(kg)	1795 ^a	1720 ^a	1450 ^b	1010 ^b	0.001	6.45
Dressing percentage	77.2 ^a	77.3 ^a	75.0 ^a	72.4 ^b	0.010	10.2
Visceral weight(g)	321.67 ^a	313.33 ^a	275.00 ^b	246.00 ^b	0.001	11.4
Heart weight(g)	11.33 ^a	10.67 ^a	9.33 ^a	6.67 ^b	0.001	3.6
Liver weight (g)	50.00 ^a	47.67 ^a	39.67 ^b	36.33 ^b	0.001	2.3
Gizzard weight (g)	94.00 ^a	92.33 ^a	89.33 ^a	78.33 ^b	0.001	1.7

^{a, b} Means in rows with different superscripts differ significantly (P<0.05); ¹ Probability level at 0.05 percent; ² Coefficient of Variation

Table 4 - The influence of DBG on feed costs savings

Parameters	Dietary treatments			
	Control	T1 (25%)	T2 (50%)	T3 (75%)
Cost of diets/50kg	260.00	250.00	220.00	180.00
Cost/kg weight gain	12.92	12.35	10.43	6.88
Cost/kg feed	5.21	5.00	4.40	3.60

CONCLUSION

Based on observed results for proximate analysis of DBG, production and carcass parameters as well as cost benefit analysis, it was evident that the use of DBG in broiler diets at rate of 25% during growing and finishing phases gave similar production performance to broiler fed diets containing convention feedstuffs such as soyabean, sunflower, fish meal and maize which are the main factors that push the price of feeds to its limit. The proximate analysis results also proved beyond doubt that DBG can be used in broiler diets to substitute conventional proteins sources used in broiler diets.

DECLARATIONS

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Authors' contribution

Kuleile NP, Adoko G and Nkheche M, contributed on the design of the experiment, data collection and the write up of the manuscript. NP Kuleile participated in data analysis.

Conflict of interests

The authors have not declared any conflict of interests.

REFERENCES

- Aghabeigi R, Moghaddaszadeh-Ahrabi S and Afrouziyeh M (2013). Effects of brewer's spent grain on performance and protein digestibility in broiler chickens. *European of Experimental Biology*, 3(3):283-286
- Anjola OA, Adejobi MA and Tijani LA (2016). Growth performance and blood characteristics of broiler chicken fed on diet containing brewery spent grain at finisher phase. *International Journal of Animal and Veterinary Science*, 10(4): 214-217. ISNI 000000001950263
- Anyanwu GA, Iheukwumere FC and Emerole CO (2008). Performance, carcass characteristics and economy of production of broilers fed maize-grit and brewery dried grain replacing maize. *International Journal of Poultry Science*, 7(2): 156-160
- Asurmendi P, Barberis C, Dalcero A, Pascual L and Barberis L (2013). Survey of *Aspergillus* section *Flavi* and aflatoxin B1 in brewer's grain used as pig feedstuff in Córdoba, Argentina. *Mycotoxin Research*, 29:3-7. <https://doi.org/10.1007/s12550-012-0148-5>
- Association of Official Analytical Chemists AOAC (1990). Official Methods of Analysis. Volume 1. 15th Edition, Virginia, USA. pp 69-88. ISBN 0-935584-42-0
- Denstadli V, Balance S, Knutsen SH, Westereng B and Svihus B (2010). Influence of graded levels of brewers dried grains on pellet quality and performance in broiler chickens. *Poultry Science Journal*, 89 (12): 2640-2645.
- Fasuyi AO, Aturamu and OA and Lawal AS (2018). Part ii: economic analyses and the growth performance broiler finisher (29-58day) birds on high fibre-low protein industrial plant by-products. *Asian Journal of Advances in Agricultural Research*, 6(3):1-10. ISSN: 2456-8864
- IBM Corporation (2011). IBM SPSS Statistics for windows, version 20.0. Armonk New York
- Levic J, Djuragic O and Sredamovic S (2010). Use of new feed from brewery by-products for breeding layers. *Romanian Biotechnological Letters*, 15 (5): 5559-5565
- National Research Council (1994). Nutrient Requirements of Poultry. 9th Revised Edition, National Academic Press, Washington DC.
- Ndams SS (2008). Effect of re-fermented brewers' dried grains on the performance of broiler chickens. MSc Thesis University of Ahmadu Bello University Zaria Nigeria. pp 96.
- Okpanachi U, Musa AA, Adewoye AT and Adejoh OC (2014). Effects of replacing maize with graded levels of cassava tuber meal, brewer's dried grain and palm oil mixture on the serum biochemistry and carcass characteristics of broiler chickens. *Journal of Agriculture and Veterinary Science*, 7(4): 27-31. ISSN: 2319-2380.
- Parpinelli W, Cella PS, Savaris VDL, Broch J and Nunes RV (2018). Dry brewery residue in broiler chickens feed. *Semina: Agrarian Sciences, Londrina*, 39(4):1707-1716. <https://doi.org/10.5433/1679-0359.2018v39n4p1707>
- Swain BK, Naik PK, Chakurkar EB and Singh NP (2012). Effect of feeding brewers' dried grain on the performance and carcass characteristics of Vanaraja chicks. *Journal of Applied Animal Research*, 40(2): 163-166, <https://doi.org/10.1080/09712119.2011.645036>
- Swain BK, Naik PK, Chakurkar EB and Singh NP (2013). Effect of feeding brewers' dried on the performance of Japanese quail layers. *Indian Journal of Animal Nutrition*, 30 (2): 210-213.

ASSESSMENT OF MAJOR REPRODUCTIVE DISORDERS OF DAIRY COWS IN GONDAR TOWN, NORTH WEST ETHIOPIA

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✉ Supporting Information

ABSTRACT: A cross sectional study was conducted in Gondar town from November 2016 to April 2017 with the objectives of determining the prevalence rate of major reproductive health problems of dairy cows and assessing risk factors with roles in predisposing to reproductive problems. Cross sectional questionnaire survey and regular follow-up were used to determine reproductive parameters and abnormalities. The study was carried out on a total of 316 dairy cows. From the total study animals 25% (n=79) were affected by at least with one reproductive health problem. Among the problems repeat breeder, retained fetal membrane, abortion and anestrus were mostly found with their respective prevalence of 6.96%, 6.01%, 3.48% and 2.53%. The overall prevalence of reproductive problems were significantly ($P < 0.05$) influenced by breed, production system, age, parity, body condition and hygiene. Generally the current finding revealed that reproductive health problems commonly exist in the study area through their percentage and types vary from time to time; hence, regular reproductive health management and proper formulation of ration could be the possible solutions to alleviate the problems encountered in different production systems. From the different risk factors studied BCS and parity were significantly associated with reproductive health problems. From this study feeding, housing and health managements should be restudied and improved to reduce the incidence of reproductive problems. This study showed that reproductive disorders highly affected the reproductive performance of dairy cows. Further detailed studies on the major reproductive health disorders in the area should be carried out.

Keywords: Dairy cows, Gondar town, Reproductive health problems.

INTRODUCTION

For years, Ethiopia ranked first in cattle population in Africa. However the dairy industry is not as developed as that of east African countries. Consequently, national milk production remains among the lowest in the world even by African standard (Zegeye, 2003). Despite the huge number of cattle in the country productivity is low due to constraints of disease nutrition, poor management and poor performance of indigenous breed. These constraints result in poor reproductive performance of dairy cattle and lower economic benefit from the sector among the major problems that have direct impact on reproductive Performance of dairy cows are abortion, dystocia, retained fetal membrane, repeat breeding and vaginal prolapse. This could be classified as postpartum and prepartum (Lobago et al., 2006). Reproductive problems are the most common which occur in lactating dairy cows and can dramatically affect reproductive potential of the dairy herd. Poor reproductive performance is a major cause of involuntary culling and therefore reduces the opportunity for voluntary culling and has a negative influence on the subsequent productivity of a dairy herd (Hosseini-Zadeh, 2013).

Infectious diseases have direct impact on reproductive performance of dairy cows. They do have a potential to cause abortion, dystocia, retained placenta, clinical endometritis, uterine prolapse, anoestrus and repeat breeder. They can be classified as before gestation (anoestrus and repeat breeding), during gestation (abortion and dystocia) and after gestation (RFM and uterine prolapsed) (Shiferaw et al., 2005; Lobago et al., 2006). Among the infectious diseases, *Brucellosis* is highly characterized primarily by causing abortion in late pregnancy, retained placenta, endometritis and infertility in subsequent pregnancies in cattle. In addition to constraints of low production it continues to cause heavy economic losses and public health concern throughout the world (OIE, 2003).

Reproductive disorder of dairy animals was broadly studied throughout the world, but studies in Ethiopia are limited and mainly located in central high lands and in some parts of Eastern and Northern parts of the country. Although, major reproductive disorders greatly responsible for high economic loss in dairy cows, there is paucity of research done on the prevalence, etiology and relative importance of these problems in Gondar. Therefore, the

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present investigation had been planned to study: the prevalence of major reproductive health problems of dairy cows in Gondar and possible risk factors that play a role in precipitating such problems in dairy farms of the area. Although there are many small holder, medium size and large size dairy farms in Gondar town, few studies have been conducted on the major reproductive health problems in dairy animals (Lobago et al., 2006). Therefore, these studies were implemented with the following objectives: To study the major reproductive disorders in Gondar town, To identify risk factors important for problems that affect reproductive performance of dairy cows under existing level of management.

MATERIAL AND METHOD

Study area

This study was conducted in Gondar town, Northwestern part of Ethiopia. Gondar is located 727 km northwestern Addis Ababa in Amhara regional state and is 2220 m.a.s.l, with 1172 mm mean annual rainfall and 19.7°C average annual temperature. The rainfall varies from 880 mm to 1772mm with a monomodal distribution. The area is also characterized by two seasons, the wet season from June to September, and the dry season from October to May. According to zonal agriculture office, the livestock population of Gondar registered, cattle 1,936,514, sheep, 524,083, goats, 682,264, poultry 2,124,000, donkey 223,124, mule, 12,473, horse 36,828 and camel, 606. Its area is 257 km² (CSA, 2008).

Study population and study animals

According to the Gondar town livestock development agency, the area has large number of cattle population. However, the study population constituted of 316 dairy cows (local and cross breed) found in different farms of the study area. These animals were kept in different management systems. Sampled animals constituted different age groups, body condition scores and parity. Body condition (BCS) of the study animals was scored based on the criteria set by Matthew Man (1993), which ranged from 1 to 5. Body condition score 1 stands for cows with the very poor body condition while score 5 for cows with the very fat body condition (best condition).

Study design

A cross-sectional type of study was conducted from November 2016 to April 2017 on dairy farms found in Gondar town to determine the major reproductive problems cows, to assess the perception of farmers on major reproductive problems of dairy cattle and the associated risk factor in the dairy cattle. The study was being employ questionnaire and regular follow up in the randomly selected dairy cows.

Sample size and sampling method

A total of 316 dairy cattle with different parity, management and body conditions were included in this study. In this study the pregnant dairy cows in their trimester were followed weekly for any problems. The sample size required for this study was by considering 29% expected prevalence from previous study of Madot and Nibret (2015) depending on the expected prevalence of major reproductive disorders of dairy production and the desired absolute precision by the formula given by Thrusfield (2005) as follows.

$$N = \frac{(1.96)^2 P_{exp} (1 - P_{exp})}{d^2}$$

Where, N= Number of sample; D= Desired absolute precision; P_{exp}= expected prevalence. Therefore, 29% expected prevalence was used to estimate the sample size. Using 95% confidence interval, 5% precision and 29% expected prevalence, the sample size was 316:

Methods of data collection

Volunteer individuals were interviewed individually. Every data collected through questionnaire interview and regular follow up as well as personal on site observation was recorded on Microsoft excel work sheet. Data was then coded and stored.

Data management and analysis

The collected and stored data obtained from questionnaire and regular follow up were entered on a Microsoft Excel spreadsheet and analyzed using Statistical Package for Social Sciences version 20. The prevalence of reproductive problems was determined as a proportion of affected animals out of the total animal examined. The differences or association between in different risk factors such as breed, management, hygiene, age, body condition and parity with over all prevalence of reproductive problems was analyzed by using χ^2 (Chi-square) technique and value of P<0.05 considered as significant.

RESULT

Characteristics of respondents

Based on the questionnaire study general characteristics associated with household's respondents were distributed by sex, age, marital status and educational status was presented in Table 1. From the total interviewed respondents (N = 41), the majority (73.2%) of the respondents were male while the remaining (26.8%) were female. The majority age of the respondents in the study area ranges between 25-40 years (48.9%). This result showed that people in the most productive age are actively engaged in dairy activities. Of the total households interviewed, the majority (65.8%) were married while the remaining (34.2%) were unmarried. Concerning to level of education, the highest percentage (34.1%) of the respondents had college education 14.6% of those respondents had not attended any formal or informal education.

Table 1 - Characteristics of the respondents on sex, age, married status and educational status

Category and variables	Number of respondents (%)
Sex	
Male	30 (73.2%)
Female	11 (26.8%)
Age	
<25	6 (14.6%)
25-40	20 (48.9%)
>40	15 (36.5%)
Marital status	
Married	27 (65.8%)
Unmarried	14 (34.2%)
Educational level	
No formal education	6 (14.6%)
Primary education	13 (31.7%)
Secondary education	8 (19.5%)
College and above	14 (34.1%)

Animal management

From the total of 316 dairy cattle, 173 (54.75%) were managed intensively, 143 (45.25%) were semi intensive and of which 147 (46.52%) were local breed and the rest 169 (53.48%) were cross breed. Almost the entire respondent agreed that feeding practice depends on the availability of feed because land space and water that is important factors for cultivation of animal feed is limited in the farm area. The feed on which the animals are fed include natural pasture (cut-and-carry), grass hay, crop residues, alfa alfa, elephant grass and nonconventional feeds such as "atela" were among the commonest and mainly available feed types. Most of the respondents 82.93% (N=34) breed their animals using artificial insemination (AI) and 17.1% (N=7) use only natural method. As replied by the respondent, there was given regular drug treatment and deworming practices but they took their animals for treatment whenever diseases occurred.

Major reproductive health problems

From a total of 316 dairy cows included in the study period 25% (N=79) were found to be affected at least by one reproductive health problems. Overall prevalence of reproductive health problem sited by farmers/attendants or veterinarians in cross and local breed dairy cattle on different method of study is presented in Table 2. In this study (including questionnaire and regular follow up) major reproductive health problems were investigated. Hence abortion, retained fetal membrane, dystocia, anoestrus, repeat breeder and were found to be the major reproductive health problems containing 3.48%, 6.01%, 2.21%, 2.53% and 6.96%, respectively. Other reproductive health problems observed with lower prevalence include uterine prolapse, clinical endometritis and mixed disorder accounting 0.95%, 1.58%, and 1.58% respectively in Table 3.

Association of risk factor with reproductive health problems of dairy cattle

In this study among risk factors breed, management system, hygiene, age, parity and body condition score were considered to assess its association with the occurrence of the reproductive problems as shown on the tables below. As shown on the table 4 below, statistically no significant difference ($P>0.05$) was found in the prevalence of reproductive health problems with respect to breed. Higher prevalence of reproductive health related problems were found in local cattle than the cross breed and there was statistically significant association ($P<0.05$) of management system with the prevalence of reproductive problems. Highest prevalence was found in semi intensive management system (31.5%) and lowest in intensive system (19.7%) of management.

As shown on table 5, the influence of age on the prevalence of major reproductive problems was assessed and the result showed that there was significant association ($P<0.05$) with respect to age. The prevalence was significantly highest in cows with 4-6 years age group (38.7%) followed by above 6 years age group (20.2%) while the lowest in less than four years age (14.6%) as indicated. On the other hand, hygiene of the farms show a significant difference ($P<0.05$) on the occurrence of reproductive problems of the animals.

As shown on table 6, the influence of body condition score on the occurrence of the major reproductive problems was also assessed and the result showed that there is statistically significant ($P<0.05$) variation with regard to body condition. Highest prevalence was found in cattle with good body condition (34.1%) followed by medium body condition (21.4%) while the least in cows with poor body condition (13%). Parity prevalence was significant effect ($P<0.05$) on the higher prevalence of major reproductive problems was found in the primiparous animals (32.2%) while the lowest in the multiparous animals (16.2%).

Table 2 - Major reproductive disorders in dairy cows in Gondar town on different methods of study.

Method of study	Total No. of observation	No. of cows with reproductive disorder	Percent affected
Questionnaire study	254	65	20.57%
Regular follow up	62	14	4.43%
Total	316	79	25%

Table 3 - Relative occurrence of major reproductive disorders in dairy cows in Gondar town.

Types of RDs	Questionnaire survey no. (%)	Regular follow up no. (%)	Total (%)
Abortion	7 (2.75%)	4 (6.45%)	11 (3.48%)
Uterine prolapsed	3 (1.2%)	0 (0%)	3 (0.95%)
RFM	14 (5.5%)	5 (8.06%)	19 (6.01%)
Dystocia	5 (1.97%)	2 (3.2%)	7 (2.21%)
Clinical endometritis	5 (1.97%)	0 (0%)	5 (1.58%)
Anoestrus	8 (3.15%)	0 (0%)	8 (2.53%)
Repeated breeding	18 (7.09%)	4 (6.45%)	22 (6.96%)
Mixed	5 (1.97%)	0 (0%)	5 (1.58%)

RDs = reproductive disorders; *Mixed problems include abortion and retained placenta, dystocia and retained placenta, dystocia and clinical endometritis, retained placenta and clinical endometritis.

Table 4 - Prevalence and association of reproductive problems with breed and management system.

Factors	Total no. of animal examined	Total no. of affected animals	Prevalence (%)	X ²	p-value
Breed	169	40	23.7%	0.343	0.558
Cross	147	39	26.5%		
Local	316	79	25%		
Total					
Management system				5.829	0.016
Intensive	173	34	19.7%		
Semi intensive	143	45	31.5%		
Extensive	0	0	0		
Total	316	316	25%		

Table 5 - Prevalence and association of major reproductive problems with hygiene and age.

Factors	Total no. of animal examined	Total no. of affected animals	Prevalence (%)	X ²	p-value
Hygiene				39.27	0.00
Good	97	2	2.1%		
Poor	219	77	35.2%		
Total	316	79	25%		
Age				18.07	0.00
Below 4 years	96	14	14.6%		
4-6 years	111	43	38.7%		
Above 6 years	109	22	20.2%		
Total	316	79	25%		

Table 6 - Prevalence and Association of Reproductive Problems with Body Condition and Parity

Factors	Total no. of animal examined	Total no. of affected animals	Prevalence (%)	X2	p-value
Body condition					
Score	135	46	34.1%		
Good	69	9	13.0%	10.5	0.003
Poor	112	24	21.4%		
Medium	316	79	25%		
Parity	174	56	32.2%		
Primiparous	142	23	16.2%	10.65	0.001
Multiparous	316	79	25%		

DISCUSSION

In the present study 25% (n=79) of dairy cattle in the study area were affected by either one or more reproductive disorders based on questionnaires and regular follow up study (Table 2). This is in close agreement with 29% (n=71) which was reported by Madot and Nibret (2015) in North West Ethiopia. But it is higher than 18.5% which was reported by Hunduma (2013) in Assela town and 24.8% by Molalegne and Shiv (2011) in Bedelle for major reproductive problems, respectively. In addition, it is lower than 44.3% which was report by Hadush et al. (2013) in central Ethiopia and 43.3% by Adane et al. (2014) in Southern Ethiopia. This difference might be due to sample size, production system, study methodology and breed of animals, variation in management system as well as environmental factors that are applied in different dairy farms.

In this study (including questionnaire and regular follow up) repeat breeder, RFM, abortion and anestrous were found to be the major reproductive health problems containing 6.96%, 6.01%, 3.48% and 2.53%, respectively. Other reproductive health problems observed with lower prevalence include uterine prolapsed, dystocia, mixed and endometritis containing 0.95%, 2.21%, 1.58%, and 1.58% respectively (Table 3).

The prevalence rate of abortion recorded in the present study was (3.48%) which is close agreement with the finding of Bahlibi (2015) who reported 3.8%. On the other hand, Madot and Nibret (2015), Molalign and Shiv (2011), Degefa et al. (2011), Dinka (2013), Benti and Zewdie (2014) and Blen (2016), reported 19.7%, 13.9%, 8.7%, 14.6%, 12.2% and 7.5%, respectively which are higher than the current finding, but compared with the finding of Gashaw et al. (2011) who reported prevalence rate of 1% the present finding is higher. The difference in prevalence of abortion may be due to variation in practice of AI, genetic, nutritional status, infection, level of toxicities and husbandry management system in different areas.

Uterine prolapse represented a prevalence of 0.95% which agrees with the finding of Adane et al. (2014) who reported 0.76% and Blen (2016) who reported 0.8%. But, higher than 0.43% and 0.56% reported by Dawite and Ahmed (2013) and Bitew and Prasad (2011) respectively. In addition, the prevalence rates of mixed problems in the present study was 1.58% which is lower than the finding of Gashaw et al. (2011) who reported 5.6% in Jimma and Blen (2016) who reported 5.2%, but higher than 1.05% indicated by Simiret (2010). This variation could be due to inter relationship between of reproductive problems as predisposing factors for each other.

The prevalence rate of RFM of 6.1% in recent study is similar with the 7.1% reported by Adane et al. (2014) and but lower than (14.28%) reported by Mamo (2004), 10.1% by Blen (2016) and 19.2% by Gashaw et al. (2011) and but higher than 2.9% reported by Wujira and Nibret (2016) and 1.1% by Bahlibi (2015). The variation in the incidence of RFM may be attributed to variations in predisposing factors to which the animals are subjected to; among which include nutritional status and management such as lack of exercise. The prevalence rate of RFM in the current study could also be due to dystocia that accounted 2.21% of the problems, which is an important predisposing factor for occurrence of RFM and higher report by Gashaw et al. (2011) might be due to high report of (5.6%) mixed problems than current (1.58%), but Mamo (2004) calculated prevalence rate from positive animals not from total as current study.

Previous report on the prevalence of dystocia by Gashaw et al. (2011) 3.8% in small holder dairy production system and their reproductive health problems in Jimma town, 3.5% reported by Blen (2016), 7.75% reported by Dawit and Ahmed (2013) and 2.9% by Hadush et al. (2013) higher than the prevalence of 2.21% obtained in this study. This variation in the occurrence of dystocia may be due to the fact that it is influenced by the factors such as, age and parity of the dam as well as breed of the sire. Inseminating cows with semen collected from large sized bulls without taking into account the size and age of cows is an important factor in precipitating dystocia (Mee, 2008).

The incidence of endometritis in the present study was 1.58% lower than the prevalence rate (8.7%) reported by Hadush et al. (2013) in central Ethiopia, 28.5% reported by Amene (2006) in Alage dairy farm and 12.7% reported by Madot and Nibret (2015) north west Ethiopia. Factors influencing the incidence of endometritis may be retention of

fetal membrane, negative energy balance, dystocia, and parity of cow had been reported to be associated with endometritis (Roberts and Stephen, 2002). Other influencing factors for endometritis may include unhygienic parturition, unwise handling of parturition and injury of uterus by AI guns during insemination.

The prevalence rate of anoestrus found in the current study (2.53%) is higher than the previous reports by Haftu and Gashaw (2009), Bitew and Shiv (2011) and Gashaw et al. (2011) who reported an overall prevalence rate of 2.29%, 1.7% and 0.3%, respectively. Previous reports of the prevalence of anoestrus of 10.1% by Haile et al. (2010), 10.26% by Haile et al. (2014), 10.3% by Benti and Zewdie (2014), 12.9% by Hadush et al. (2013), 10.2% by Amene (2006) are higher than the current finding. The difference observed in the prevalence rate of anoestrus could be due to difference in heat detection practice and management system particularly nutritional variation in animals.

The higher prevalence of repeated breeding (6.96%) found in the present study is in close agreement with 7.7% reported by Blen (2016) in Bishoftu town, but lower than 11.42% prevalence rate reported by Hadush et al. (2013) from central Ethiopia. Repeated breeding can be caused by a number of factors, including sub-fertile bulls, endocrine imbalance, malnutrition, reproductive tract infections and poor management practices such as wrong time of insemination or faulty heat detection, inappropriate semen handling and insemination techniques. Hence the difference between the findings of the current study and previous reports may be attributed to the above-mentioned factors.

The prevalence of major reproductive problems revealed that breed had not statistically significant association and a higher (26.5%) prevalence rate of major reproductive problem was obtained in local breed cows than the cross breeds (23.7%) which is similar with Bahilibi (2015). The higher reproductive problems in local breed cows is possibly due to the cross breeds included in the study are having at most 50% Holstein Friesian blood type and this could help them to adapt the tropical weather conditions and have better management than the local breeds.

A higher prevalence rate of reproductive problems was observed in these cattle its age 4-6 years age (38.7%) followed by above 6 years of age when compared to the less than 4 years of age cows. The prevalence of parity had a significant effect ($P<0.05$) on the higher prevalence of major reproductive problems was found in the primiparous animals (32.2%) while the lowest in the multiparous animals (16.2%). This work is contradicted to the previous findings of Dinka (2013) and Hadush et al. (2013). BCS had showed a statistically significant difference ($P<0.05$), in that animals in good body condition are highly affected by major RDs. This finding agrees with the report from Gashaw et al. (2011).

CONCLUSION AND RECOMMENDATIONS

The results obtained from this study demonstrate that prevalence of reproductive health problems were high in the study area. Retained fetal membrane (RFM), repeat breeding and abortion were the most important and highly encountered reproductive health problems in dairy cows in Gondar town. The possible risk factors associated with the incidence of reproductive problem in the study area includes breed, production system, age, parity, body condition. Based on the current finding the following points are recommended:

- ❖ Giving awareness to dairy farm owners, attendants and improving management system (such as; housing, feeding and health care) to reduce the incidence of reproductive problems encountered.
- ❖ Routine and periodical examination of cows during postpartum and prepartum was essential; while most cows acquire reproductive problem during these periods.
- ❖ Heat detection and proper selection of bulls for breeding taking in to account the size of the cows could help in minimizing reproductive health problems.
- ❖ Further investigation should be performed to isolate and characterize the causes of the reproductive problems and associated risk factors in the study area.

DECLARATIONS

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Conflict of interests

No conflict of interest

REFERENCES

Adane H, Yisehak T and Niguse T (2014). Assessment of major reproductive disorders of dairy cattle in urban and per urban area of Hosanna, Southern Ethiopia. Department of Animal Science, Faculty of Agricultural Sciences, Wachemo

University, P.O.Box: 667, SNNP, Ethiopia.

- Amene F (2006). Studies on reproductive performance and major reproductive health problems of HF cows at Alage dairy farm. MSc Thesis, Addis Ababa University, Faculty of Veterinary Medicine. DebreZeit, Ethiopia,
- Bahlibi W (2015). Assessment of major reproductive problems of dairy cattle in selected sites of central zone of tigray region, northern Ethiopia.
- Benti A and Zewdie W (2014). Major reproductive health problems of indigenous Borena cows in Ethiopia. *Journal of Advanced Veterinary and Animal Research*, 1(4), p.182-188.
- Bitew M and Prased S (2011). Study on Major Reproductive Health Problems in Indigenous and Cross Breed Cows in and around Bedelle, South West Ethiopia. *Journal of Animal Veterinary Advance*, 10(6), p.723-727.
- Blen M (2016). Assessment of major reproductive health problems, their effect on reproductive performance and association with brucellosis in dairy cows in bishoftu town, Ethiopia.
- CSA (2008). Central Statistical Authority, Addis Ababa, Federal Democratic Republic of Ethiopia.
- Dawit T and Ahmed B (2013). Reproductive Health Problems of Cows Under Different Management Systems in Kombolcha, Northeast Ethiopia. *Advanced Biology Research*, 7(3), p.104-108.
- Degefa T, Duressa A and Duguma R (2011). Brucellosis and some reproductive problems of indigenous Arsi cattle in selected Arsi Zone's of Oromia Regional State, Ethiopia. *Global Veterinaria*, 7 (1), p.45-53.
- Dinka H (2013). Major reproductive disorders of dairy cows in and around Asella town, Central Ethiopia. *Journal of Veterinary Medicine and Animal Health*, 5(4), p.113-117.
- Gashaw A, Worku F and Mulugeta S (2011). Assessment of small holder dairy production system and their reproductive health problems in Jimma town South West Ethiopia, Jimma University College of Agriculture and veterinary medicine, Jimma, Ethiopia. *International Journal Applied Research*, 9, p.80-86..
- Hadush A, Abdella A and Regassa F (2013). Major prepartum and postpartum reproductive problems of dairy cattle in Central Ethiopia. *Journal of Veterinary Medicine and Animal Health*, 5(4), p.118-123.
- Haftu B and Gashaw A (2009). Major Reproductive Health Problems of Dairy Cows in and around Bako, West Ethiopia. *Ethiopian Journal of Animal Production*, 9(1), p.89-98.
- Haile A, Kassa T, Mihret M and Asfaw Y (2010). Major reproductive disorders in cross bred dairy cows under small holding in Addis Ababa, Ethiopia. *World Journal of Agricultural Sciences*, 6(4), p.412-418.
- Haile A, Tsegaye Y and Tesfaye N (2014). Assessment of major reproductive disorders of dairy cattle in urban and per urban area of Hosanna, Southern Ethiopia. *Animal and Veterinary Science*, 2(5), p.135-141
- Hossein-Zadeh G (2013). Effects of main reproductive and health problems on the performance of dairy cows: A review. *Spanish Journal of Agricultural Research*, 11(3), p.718-735.
- Hunduma D (2013). The major reproductive disorders of dairy cows in and around Asella town, Central Ethiopia. *Journal of Veterinary Medicine and Animal Health*, 5(4), p.113-117.
- Lobago F, Bekana M, Gustafson and Kindahl H (2006). Reproductive performance of dairy cow in small holder production system in sellable, Central Ethiopia. *Tropical Animal Health and Production*, 38, p.333-342.
- Madot K and Nibret M (2015). Major Reproductive Health Disorders of Cow in and Around Gondar, North West Ethiopia.
- Mamo T (2004). Study on major postpartum reproductive problems of smallholder dairy cows in and around DebreZeit. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeit, Ethiopia.
- Mee J (2008). Prevalence and risk factors for dystocia in dairy cattle: a review. *Veterinary Journal*, 176(1), p. 93-101.
- Molalegne B and Shiv P (2011). Study on Major Reproductive Health Problems in Indigenous and Cross Breed Cows in and Around Bedelle, South West Ethiopia. *Journal of Animal Veterinary Advance*, 10(6), p.723-727.
- OIE (2003). Bovine Brucellosis. Manual of standards for diagnostic tests and vaccine. Office Int. Des Epizooties. Paris.
- Robert and Stephen J (2002). Veterinary Obstetrics and Genital Disease. 2nded. China, Saunders, p.402
- Simret H (2010). Major reproductive disorders of dairy cows in and around mekelle. DVM thesis, college of Veterinary Medicine, Mekelle University, Mekelle, Ethiopia.
- Thrusfield M (2005). Veterinary Epidemiology. London: Blackwell Science.
- Wujira E and Nibret M (2016). Major Reproductive Health Problems in Dairy Cows in Wolaita Sodo Town in Selected Farms.
- Zegeye Y (2003). Imperative and challenges of dairy production, processing and marketing in Ethiopia. In Jobre Y and Gebru G challenges and opportunities of livestock marketing in Ethiopia proceeding of the annual conference of the Ethiopia society of animal production (ESAP) Held in Addis Ababa Ethiopia, 22-24 August 2002. ESAP, Addis Ababa Ethiopia, p.61-67.

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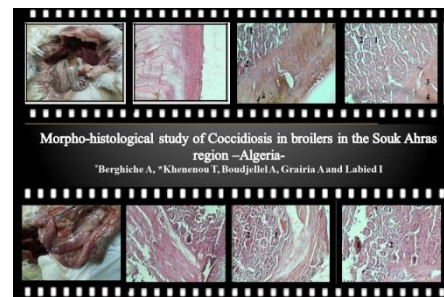
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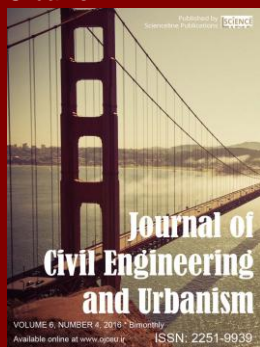
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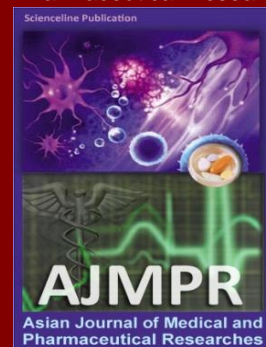
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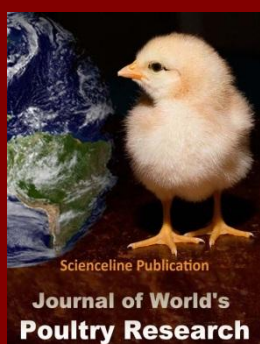
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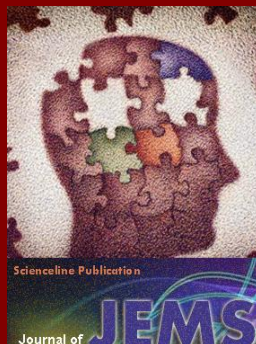
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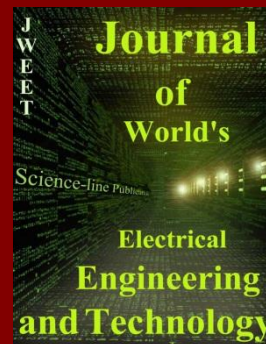
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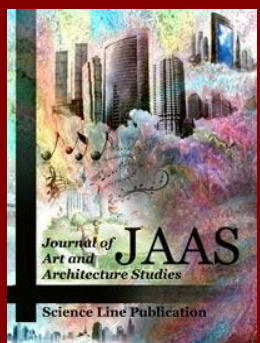
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