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TABLE OF CONTENT

Archive

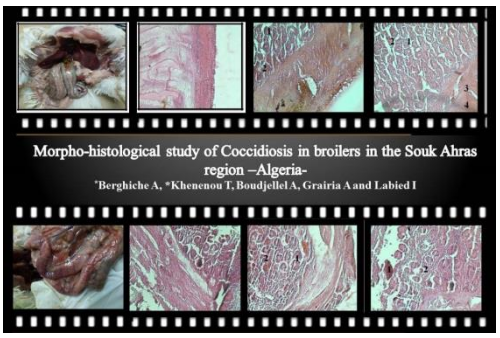
Volume 8 (6); November 25, 2018

Research Paper

Morpho-histological study of coccidiosis in broilers in the Souk Ahras region, Algeria.

Berghiche A, Khenenou T, Amira B, Amina G and Labied I.

Online J. Anim. Feed Res., 8(6): 136-144, 2018; pii: S222877011800018-8



Abstract
The aim of this study was assess the macroscopic and microscopic appearance of the normal and the abnormal gut in coccidiosis disease of broiler chickens during post hatching age in souk Ahras area. The results showed that the small intestine is the most sensitive organ to avian coccidiosis. The necropsy showed that the lesions are expressed according to the species, A strong congestion with hemorrhagic area in cecum coccidiosis. Atrophy of the intestinal villous with thickening of the mucosa was observed in the case of intestinal Coccidiosis. Microscopic translation revealed hydropic degeneration and necrosis of enterocytes with pycnotic in the intestinal mucosa and the presence of strong enteritis. Coccidiosis is one of the most frequent parasitic diseases in poultry in Algeria, it takes many forms and occurs all types of poultry farming around the world, this illness has serious economic damage, an epidemiological surveillance plan for this disease is necessary in order to control its propagation and to reduce its risk.
Keywords: Broiler Chickens, Post Hatching Age, Coccidiosis, Macroscopic and Microscopic Appearance.

[Full text-PDF]

Research Paper

Evaluation of pre-weaning growth performance and survival rate of sheep in Hulet Eju Enesie district, East Gojjam zone, Ethiopia.

Lamesegn D, Tegegne F, Mekuriaw Y and Chanie D.

Online J. Anim. Feed Res., 8(6): 145-149, 2018; pii: S222877011800019-8

Abstract
The study was conducted in Hulet Eju Enesie District, East Gojjam Zone, Ethiopia, with the main objectives of evaluating pre-weaning growth performance of sheep. The study district was stratified in to Dega, Weina dega and Kolla agro-ecologies. A total of 48 (16 from each agro-ecology) late pregnant sheep flocks were selected purposely for monitoring. The data were collected from sampled households using semi-structured questionnaires and through monitoring. Birth weight and 90 days weight were taken using 50kg weighing balance with 200g precision. Collected data monitoring of lambs were subject to GLM analyzed by using SPSS software (version 20.0). The average birth weight, 90 days weight and average growth rate of lambs were 2.46 ± 0.07 kg, 10.26 ± 0.12 kg and 89.66 ± 1.28 g/day which were significantly different (P< 0.05) among agro-ecology, breed, parity, types of birth and sex of lambs. Survival rate of lambs was 91.67%. Therefore, birth weight, pre-weaning growth weight, pre-weaning growth rate and survival rate were significantly affected by agro-ecology, parity, litter size and sex.
Keywords: Birth weight, Daily weight gain, Pre-weaning growth rate and Survival rate.

[Full text-PDF]

Research Paper

Husbandry practices of sheep in Hulet Eju Enesie district, East Gojjam zone, Ethiopia.

Lamesegn D, Tegegne F, Mekuriaw Y and Ayalew H.

Online J. Anim. Feed Res., 8(6): 150-157, 2018; pii: S222877011800020-8

Abstract
TThe study was conducted in Hulet Eju Enesie District, East Gojjam Zone, Ethiopia, with the main objective of assessing husbandry practices. The study district was stratified in to Dega, Weina Dega and Kolla agro-ecologies. Six kebeles were selected by proportional allocation methods. For survey, 150 sample households were selected for interviewed by using simple random sampling. In addition, 72 households were selected for group discussion by using simple random sampling, male and female with equal proportion. Collected data from survey were subject to Descriptive statistics, ANOVA and Chi-square ($\chi 2$) by using SPSS software (ver. 20). The mean flock size per household was 12.52 in Dega, 9.43 in Weina Dega and 8.32 in Kolla (P< 0.05). The

purpose of keeping sheep were sale (income source), meat and saving purpose as indicated with index value of 0.48, 0.28 and 0.12 respectively. Major feed source varied according to seasons; communal grazing 37.1% from (Sep-Nov), Grazing after math 47% from (Dec-Feb), Crop residue 38.1% from (Mar - May) and private grazing 31.8% from (Jun–Aug). Haricot bean straw (64%) is a major crop residue. Chi-square ($\chi 2$) analysis result showed that there was significant difference ($P< 0.05$) on types of supplementary feeds in different agro-ecological zones. Atela (97.3%) was dominant supplementary feed. Sheep house constructed attached to the family house and sharing a common wall is the most common sheep house. Mean age for castration and tail docking were 14.84 and 3.77 months respectively. Selection criteria of sheep for castration and fattening were physical characteristics, breed and conformation with index value 0.43, 0.26 and 0.23 respectively. Washera (79.3%), crossbred (12%) and both Washera crossbred and "local "sheep (17.3%) respectively. Age at first mating, age at first lambing, lambing interval, slaughtering age for male, slaughter age for female and marketing age of sheep were 7.47, 12.46, 8.05, 5.96, 6.25, 6.5 months respectively. Litter size (mean 1.55) was significantly ($P< 0.05$) different among agro-ecologies. Disease, and parasites, and feed shortage were reported to be the two major constraints of sheep production in the area with index value 0.381 and 0.357.
Keywords: Breed, Castration Practice, Constraints, Culling Practice, Husbandry practice, Opportunities, Tail docking, Weaning

[Full text-PDF]

Research Paper

Diagnosis of subclinical endometritis during postpartum period on subsequent pregnancy in small, medium and large scale dairy farms in and around Gondar, North West Ethiopia.

Moges N.

Online J. Anim. Feed Res., 8(6): 158-163, 2018; pii: S222877011800021-8

Abstract
During the study period 147 apparently healthy 3rd trimester pregnant cows were selected in smallholder, medium and large scale dairy farms in and around Gondar, North Western Ethiopia from January 2015 to September 2017. After calving, endometrial samples were collected from the uterus of apparently normal cows by using uterine lavage technique on postpartum dairy cows from 40-60 days. Collected samples were centrifuged and a drop of sediment was streaked onto a clean microscopic slide and stained with giemsa. The percentage of polymorphonuclear cells (neutrophils) was calculated. It was found that increase in the number of neutrophils correlated with decrease in pregnancy. The incidence of subclinical endometritis was different in small, medium and large scale dairy farms 25 (37.88%), 29 (43.94%) and 13 (18.18%), respectively. The mean number of services per conception was found as2.04 for subclinical endometritis positive cows. In the present study endometrial cytology revealed that the PMN count of 3% and above was suggestive for subclinical endometritis. In conclusion, subclinical endometritis diagnosed by endometrial cytology was associated with reduced rate of pregnancy.
Keywords: Endometrial Cytology, Neutrophiles, Pregnancy, Subclinical Endometritis

[Full text-PDF]

Research Paper

Relationship between eggs shape index and embryonic mortality

Jabbar A, Hameed A, Ditta YA and Riaz A.

Online J. Anim. Feed Res., 8(6): 164-168, 2018; pii: S222877011800022-8

Abstract
The study was conducted to assess the effect of eggs shape on hatchery parameters. The eggs shape (SI) is a critical tool to investigate the outcome from eggs during incubation. In this experiment three groups of good quality intact eggs (each n= 500) having thick shell without any kind of contamination were collected from three different broiler breeders' farms SP117 (Ross), SSF (Ross) and SP 118 (Ross).The manage mental and incubation conditions were same for all three groups. The SI was measured and maximum deviation from standard was found for SP117 (80.94±0.04a, 78.46±0.07b, 76.57±0.04c) then SSF and SP118 respectively. Due to SI deviation hatchability % (78.25±0.01a, 81.17±0.09b, 91.35±0.07c), candling% (8.67±0.02a, 9.36±0.06b, 4.71±0.09c), dead in shell % (13.08±0.10a, 6.94±0.03b, 3.94±0.07c), chick yield % (67.31±0.09a, 68.24±0.01b, 69.10±0.05c), hatch window hrs (28-30±0.03a, 24-26±0.07b, 22-24±0.03c) were significantly different for SP117, SSF and SP118 respectively. Water loss was significantly higher ($P<0.05$) for SP117 (12.01±0.03a) as compare to SSF and SP118 (11.89±0.04b, 11.87±0.04b). The effect of eggs shape index was also found on mal-position and mal-formations. The maximum dead and cull chicks 0.5% were found for SP117 as compare to SSF or SP118. Similarly mal-position head in small of eggs and feet over head were found maximum for SP117 0.3% and 0.8% respectively. The maximum mal-formation ectopic viscera 0.7 % and excess albumin 0.5% was found for SP 117 as compare to SSF or SP118. The maximum dead in shell, mal-position and mal-formation were found for SP 117 due to maximum deviation from SI as compare to SSF or SP118. Eggs shape Index is a good tool to access the quality of eggs.
Keywords: Dead in shell, Hatchability, Mal-Position, Mal-Formation, Shape Index

[Full text-PDF]

Review

Review on productive and reproductive performance of indigenous dairy cattle breeds under farmer's management practices in Ethiopia.

Ayalew H, Chanie D, Lamesegn D.

Online J. Anim. Feed Res., 8(6): 169-174, 2018; pii: S222877011800023-8

Abstract
The aim of the review is to summarize the Productive and reproductive performance of different indigenous dairy cattle breeds under farmer's management practices. Ethiopia is the home of large numbers of livestock due to having varied and extensive agro-ecological zones. From the total annual milk produced cattle milk, is the most prominent compared to other livestock species in Ethiopia. Numerous finding showed that calving interval, daily milk yield, lactation length and age at first calving are one of the major measures of productive and reproductive performance parameters for dairy cattle production. Different report indicated that productive and reproductive performances of cattle are very poor due to varied factors; the causes for low performances of dairy cattle were genetic and environmental factors like feeding, housing and health care. In Ethiopia most of (98.20%) cattle breeds are local breeds the remaining (1.8%) are hybrid and exotic breeds. Then, the genetic performances of these breeds are poor, even though they have good adaptation in harsh environmental conditions. So, training and awareness creation should be given particularly to the farmers on major management practices like feeding, housing and health care and genetic improvement strategies should planned and practiced.

Keywords: Dairy, Ethiopia, Productive performance, Management, Reproductive performance

[Full text-PDF]

Research Paper

Effect of feeding urea-molases treated teff straw on milk yield and composition of cross bred dairy cows.

Demoz Y, Assefa A and Endale K.

Online J. Anim. Feed Res., 8(6): 175-179, 2018; pii: S222877011800024-8

Abstract
An experimental work was conducted on crossbred lactating dairy cows in University of Gondar dairy farm with the objective of investigating the effect of urea-molasses treated teff straw feeds on milk yield and its composition. Six Holstein-Friesian crossbred experimental animals with the blood level of 75%, the first stage of lactation and all on fourth parity were purposively selected. Experimental animals were assigned to the three treatments by lottery system using completely randomized design. Treatments were prepared with the protocol of low protein concentrates mix + untreated straw (T1) as a control group, low protein concentrates mix + urea molasses treated straw (T2) and high protein concentrates mix + untreated straw (T3). The straw was sprayed with 5kg of urea, 50 liters of water and 5 kg of molasses solution per 100 kg of Teff straw incubated for 14 days in a pit silo. About 250 ml of milk was taken every week for milk composition analysis during the study. The result of this study indicated that statistically significant ($P<0.05$) difference on daily milk yield between cows fed on low protein concentrates mix plus urea molasses treated straw (T2) and cows fed on low protein concentrates mix (LPCM) + untreated straw (US) (T1). Similarly, there was statistically significant ($P< 0.05$) difference on daily milk yield between cows fed on low protein concentrates mix plus urea molasses treated straw (T2) and cows fed on high protein concentrates mix (HPCM) + untreated straw (US) (T3). But there was no statistically significant ($P> 0.05$) difference among treatments for fat, protein, lactose and ash contents of milk. The result also showed no statistically significant ($P> 0.05$) difference among treatments for dry matter intake. From this result, it can be concluded that treating crop residues like straw with urea and molasses can improve milk yield of dairy cows but has less impact on milk composition. The statistically non significant differences of milk yield between cows fed on low protein concentrate and high protein concentrate invites researchers to investigate the nutritional qualities of ingredients used in the high protein concentrate mixture.
Keywords: Composition, Milk Yield, Molasses, Treatment, Urea

[Full text-PDF]

Research Paper

Dairy cattle production, processing and handling of milk and milk products in Enemay district, Amhara, Ethiopia.

Ayalew H, Yinnesu A and Abatenhe A.

Online J. Anim. Feed Res., 8(6): 180-184, 2018; pii: S222877011800025-8

Abstract
The objective of the study was to assess dairy cattle production systems, processing and handling systems of cow milk and milk products in the highlands of Ethiopia. The study was conducted from 2017 to 2018 in Enemay district, Amhara, Ethiopia. The sample kebeles and household for the study were selected based on stratification and purposive sampling techniques. Three rural and two urban and pre urban kebeles were selected. From each kebele 30 households (total of 150 households) were selected randomly from those have at least two lactating cows. Dairy cooperatives and private farms were included during the study. Descriptive statistics was employed for data analysis using Statistical Procedures for Social Sciences (SPSS) version 20.0. Dairy cattle production systems that identified in the study areas were rural smallholder or mixed crop- livestock production which accounts 98% and the rest 2% were urban and pre urban system. Out of the total milk produced per households per day 0.42±1.8 liters was used for traditional milk processing. The study also revealed that 40.2% of the respondents were process milk into different milk products. The three most prioritized milk and milk products in the area were butter, ghee and whole milk with their ascending ranking order. The finding revealed that most of respondents (89.4 %) did not use udder washing before milking. The majority of the respondents were practiced washing of their hands (73.6%) and milk utensils (90.6%) before milking. There should be training for farmers and dairy cooperatives about milking hygienic practices, feeding and health care managements for their dairy cattle animals. The study is also recommend that improved and appropriate milk processing technologies like churner and cram separator should be accessible in place to improve milk processing for sustainable dairy production.
Keywords: Dairy cattle production, East Gojjam, Enemay, Milk handling, Milk processing

[Full text-PDF]

Review

Review on effects of climate change on livestock production in Ethiopia.

Lamesegn D.

Online J. Anim. Feed Res., 8(6): 185-189, 2018; pii: S222877011800026-8

Abstract
The main aim of this review is to assess the effects of climate change on livestock production in Ethiopia. Climate disruptions cause a huge impact on the agricultural production system. It is a primary factor for agriculture productivity. Livestock and climate change have a close relationship. Climate change could affect the costs and returns of livestock production. It has a significant effect on growth and production of animals. Climate change impairs feed intake and performance in the lactating period. Mid lactating dairy cows showed a higher decline in milk production (-38%) when the animals were exposed to heat. The higher production animals are the most affected. Heat stress increases the loss of body fluids due to sweating and panting and results in an altered water balance of the body and the osmolarity of cells. Global warming will also alter the distribution of animal diseases and the vectors. Warmer and wetter weather will increase the risk and occurrence of animal diseases, because species that serve as disease vectors, such as biting flies and ticks, are more likely to survive year-round. The most important effects of climate change on livestock production are changing the animal feed resources. It impact on rangeland biodiversity which influences livestock production. Change in precipitation patterns and intensity, increasing atmospheric water vapor, evaporation, water temperatures and changes in soil moisture and runoff. An increase in uterine temperature of 0.5°c above average is associated with a decline in conception rate of 12.8%. Heat stress compromises oocyte growth in cows by altering progesterone secretion.
Keywords: Climate, Climate Change effect, Disease, Livestock and Production

[Full text-PDF]

Previous issue Next issue | Archive

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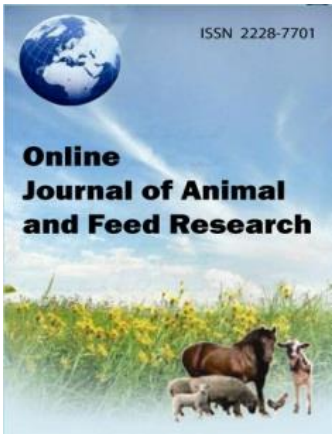

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MORPHO-HISTOLOGICAL STUDY OF COCCIDIOSIS IN BROILERS IN THE SOUK AHRAS REGION, ALGERIA

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✉*Supporting Information*

ABSTRACT *: The aim of this study was assess the macroscopic and microscopic appearance of the normal and the abnormal gut in coccidiosis disease of broiler chickens during post hatching age in souk Ahras area. The results showed that the small intestine is the most sensitive organ to avian coccidiosis. The necropsy showed that the lesions are expressed according to the species, A strong congestion with hemorrhagic area in cecum coccidiosis. Atrophy of the intestinal villous with thickening of the mucosa was observed in the case of intestinal Coccidiosis. Microscopic translation revealed hydropic degeneration and necrosis of enterocytes with pycnotic in the intestinal mucosa and the presence of strong enteritis. Coccidiosis is one of the most frequent parasitic diseases in poultry in Algeria, it takes many forms and occurs all types of poultry farming around the world, this illness has serious economic damage, an epidemiological surveillance plan for this disease is necessary in order to control its propagation and to reduce its risk.

Keywords: Broiler Chickens, Post Hatching Age, Coccidiosis, Macroscopic and Microscopic Appearance.

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INTRODUCTION

Avian coccidiosis is a very severe intestinal parasitic disease found in all parts of the world where poultry are kept, caused by protozoa of the sporozoa class: coccidia.1 (Henry et al., 1974). The coccidia of farmyard animals are mainly of the genus Eimeria (Tenter et al., 2002). Leuwenhoek discovered coccidia in 1674 when he found corpuscles in rabbit liver canals that could only be oocysts of Eimeria stiedae (Dobell, 1922).

Eimeria have a narrow specificity both for the host species and for their location along the digestive tract (Horton-Smith and Long, 1965, 1966; Long and Millard, 1976). The presence and multiplication of various coccidia of the genus Eimeria lead to the destruction of epithelial cells at the intestinal and/or caecal level during their development (Bussieras and Chermeite, 1992a); it manifests itself by an acute and fatal haemorrhagic enteritis, or by a subclinical form (Euzeby, 1987). This disease can seriously limit the development of poultry production, both in farm and industrial livestock (Yvoré et al., 1982; Sykes, 1994).

There are no farms without coccidia, but the presence of coccidia does not necessarily mean infestation (Crevieu-Gabriel and Naciri, 2001), Contamination by coccidia is an almost inevitable phenomenon in breeding. The only source of the parasite in a farm is infected animals that reject oocysts in their faeces. Contaminated by rejected oocysts, litter, feed and water also become sources of contamination (Yvoré et al., 1982; Naciri and Yvore, 1982.; Holdsworth et al., 2004). Coccidial oocysts are very resistant, especially after sporulation, which explains the durability of the infection (Matsui et al., 1989; Gajadhar et al., 2015). In water, oocysts are still infecting after 14 months (Eimeria necatrix) or even 24 months (Eimeria tenella) (Bussiéras and Chermette, 1992b).

Infection always occurs the by oral route, following ingestion of sporulated oocysts with food or drinking water. The more oocysts are ingested, the more severe the lesions. Massive ingestion at one time is more Pathogenic than the same total amount of oocysts ingested over several days. The doses required to cause disturbance vary widely between species (Conway and McKenzie, 2007; Williams, 1998). Several factors can favour the appearance or severity of coccidiosis in a farm: non-compliance with hygiene rules, overcrowding, the farming method (on slats or floors) and the management of the farm as a whole (humidity, temperature, ventilation, etc.). Responsiveness

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depends on the animal species, breed, lineage, age, immune status of the animals and the existence or absence of intercurrent diseases (Bussiéras and Chermette, 1992b). Food (composition and distribution mode) also plays an important role in susceptibility to coccidiosis (Crevieu-Gabriel and Naciri, 2001; Yun et al., 2000). The frequency of coccidial infections in chickens, even under modern production conditions, reflects both the adaptability of the parasite and the way birds are raised (Yvoré et al., 1982; Chapman et al., 2002). Once a building is contaminated, it is almost impossible to completely decontaminate the environment (Carbo Baptista et al., 1976). Studies with broilers have shown that exposure to sporulated oocysts usually begins shortly after chicks are placed on the litter (Braunius and Litjens, 1984.; Sanni, 1989). Contamination by Eimeria oocysts is generally low during the first two to three weeks, increases rapidly to a peak between the fourth and sixth weeks, and then decreases around the seventh to eighth week (Conway and McKenzie, 2007; Williams, 1998).

This protozoosis is the first parasitic disease of poultry (Azeroual et al., 2013; Titilincu et al., 2007) and has a considerable economic impact on poultry farms, due to losses due to mortality and reduced performance and to the cost of medication (Shirley et al., 2007.; Kinung'hi et al., 2004; Williams, 1999; Vermeulen, et al., 2001; Loószová et al., 2001). The global economic cost of preventing coccidiosis (chickens and turkeys) is more than $300 million per year (Ayad and Driss, 2015; Dalloul and Lillehoj, 2006). In medical terms, coccidiosis results in a mortality rate of up to 80-100% of the workforce (Buldgen, 1996; Triki-Yamani et al., 2014). The control of this disease is necessary for a real development of poultry farming and the timely use of prophylactic cocido-statics is a way to prevent this disease. Also poultry losses can be minimized by rapid chemotherapeutic treatment (Nweze, and Obiwulu, 2009; Hafez, 2008).

The determination of the intestinal necropsy consequences of coccidiosis in broilers is still a topic that is not studied in the pathological anatomy of poultry. Therefore, the aim of our work is a macroscopic and microscopic study of the intestine of broiler chickens in the normal state and during coccidiosis.

MATERIAL AND METHODS

Ethical approval

The experiment was carried out according to the National Regulations on Animal Welfare and Institutional Animal Ethical Committee.

Animals

The experimental study was conducted on 30 broilers 5-week-old of a single strain (coccidiosis is more susceptible in broilers between 3 and 5 weeks old), Ross strain 308 (fast-growing chicken). The animals are raised on the floor, on straw bedding in non-air-conditioned greenhouse buildings. Animals receive three types of preventive medication: an anti-infective (Vigal 2 X), an anticoccidial (Coccidiopon), and a protective hepatoid (Renyl). During the entire breeding period, the animals received only one type of feed whose formulation is shown in Table 1, this feed originates from the ONAB (Office National des Aliments du Livestock), the feed and water for drinking have been distributed ad libitum.

Table 1 - The composition of the food (ONAB).

Food	Quantities (%)
Corn	64.8%
Soja	27%
C.M.V (mineralo-vitamin supplement)	1%
Calcareous	1.2%
Gros son	5%
Phosphate	1%

Instrumentations

For the realization of this work the following equipment was used:

- Auto-clave memmert model 100-800
- SLEE MAINZ PLC / Type MTP / SN : K12024
- Paraffin / Nahita dispenser. Model No. 520
- OPTIKA photonic microscope
- DM series photographic microscope. OPTICA
- Microtome SLEE / CUT4062 / SN : A120038
- Cooling plate / Nahita. Model No. 520/1
- Dissection Kit

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Methods

Macroscopic study of the intestine in the normal state and during coccidiosis disease. Necropsies are performed on freshly euthanized chickens to maintain the integrity of the organs and tissues to be examined. The animals are sacrificed in the gentlest possible way, quickly dissected, the intestines carefully removed to avoid the risk of crushing and then placed in vials filled with fixative (10% formaldehyde).

Macroscopic study: Observation of the intestine with the naked eye, in both normal and abnormal states (in coccidiosis disease)

The microscopic study

Fixation of the organs. There are several fixing agents but formaldehyde remains the best fixative because it can fix large parts without dissection and penetrates quickly into the tissues.

Post fixation. Remove the attached intestine and put them under tap water for at least three hours, then cut three to six fragments and place them in identified plastic cassettes. According to Luna (1968), we have the following successive passages: Ethanol 80% (4 hours), Ethanol 95% (2 hours), 100% ethanol (3 hours), Xylene (2 hour), Paraffin (13 hours). The purpose of this passage in the automaton is dehydration (passages in alcohols, of different degrees); thinning (xylene) and impregnation (infiltration) in the paraffin. The duration of the passage of the fragments through the PLC is 24 hours.

Blocking. The paraffin inclusion is carried out within a device set at 55°; the parts are placed in stainless steel moulds then the heated paraffin is poured into the moulds and puts the labels on top of the molds; then the molds are detached after a complete cooling. The parts are put in blocks and kept cold indefinitely.

Microtomization and gluing of the cuts on the blade. They make it possible to obtain cuts whose thickness is from 5 to 7µ and to put them on a transparent glass support. The procedure described by Darboux (1994) should be followed, which includes the following steps:

Rendering by the removal of excess paraffin with a knife. Mounting the block on its support; the block must remain parallel to the knife. The microtome roughing eliminates the paraffin in front of the sample to obtain a complete cut of the tissue to be stained. The actual cutting is obtained by regularly passing the part to be cut in front of the razor or knife of the microtome. The glueing of the cups on a glass slide; on each slide is engraved the identification number of the block. The cutting is done on a heated plate and the drop of gelatinous water placed on the blade holds the cut on the blade.

Drying of the blades. It is made in an oven at 60°C for 24 hours, the cups are then covered with a thin film of paraffin which protects them from the air and keeps them indefinitely.

Staining with Eosin Haematoxylin:

- Xylene (4 minutes).
- 100% ethanol (2 minute).
- Ethanol 95% (1 minute).
- Tap water (10 minutes)
- Hematoxylin (15 minutes).
- Tap water (washing).
- Alcohol Acid: 3 to 5 dips.
- Tap water briefly.
- Ammoniacal water (ammonia waters): 3 to 5dips.
- Tap water (10 to 20 minutes).
- Eosin (15 seconds to 2 minutes).
- Ethanol 95% (2 minutes).
- 100% ethanol (4 minutes).
- Xylene (4 minutes).

Taking pictures. It is done through the use of a camera integrated in the DM series optical photographic microscope (OPTIKA); the sensitivity of this camera is adjusted to the sensitivity of the film used (100 ASA).

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RESULTS

Results of macroscopic and histological study of the intestine in its normal state and during coccidiosis have been presented in the following figures (Figures 1-2 for normal state, and Figures 3-6 for during coccidiosis).

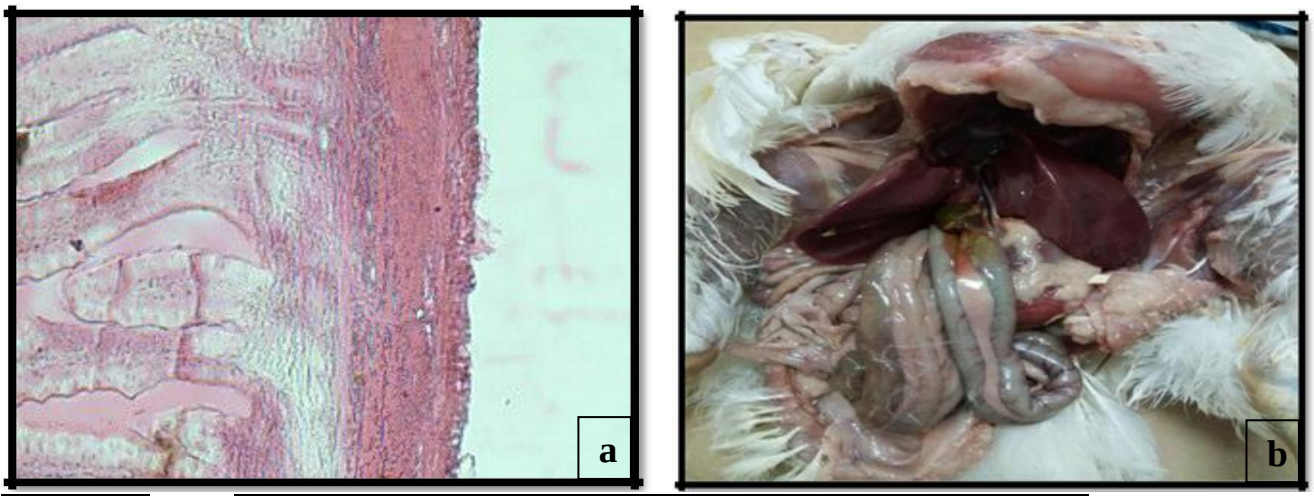

Figure 1 - (a) Intestine of a broiler chicken; (b) Intestine in a 5-week old broiler chicken (H&Ex40).

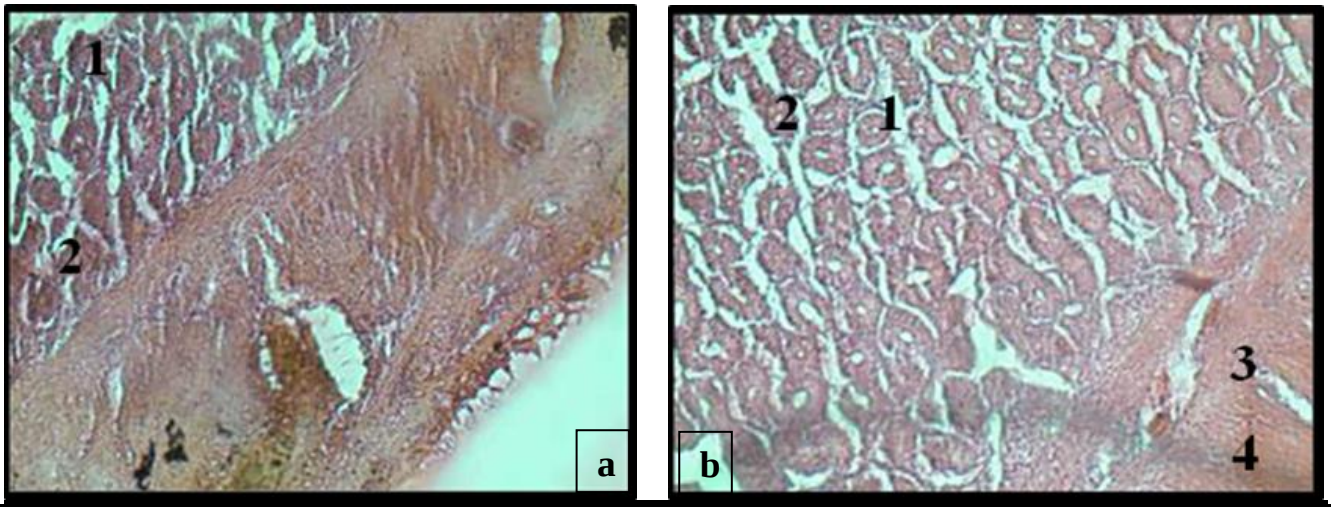

Figure 2 - (a) Intestine in a 5-week old broiler chicken (H&Ex100) 1: enterocytes. 2: villosity, (b)Intestin in a 5-week old broiler chicken (H&Ex100) 1: enterocytes; 2: villosity; 3: mucous membrane; 4: muscular membrane.

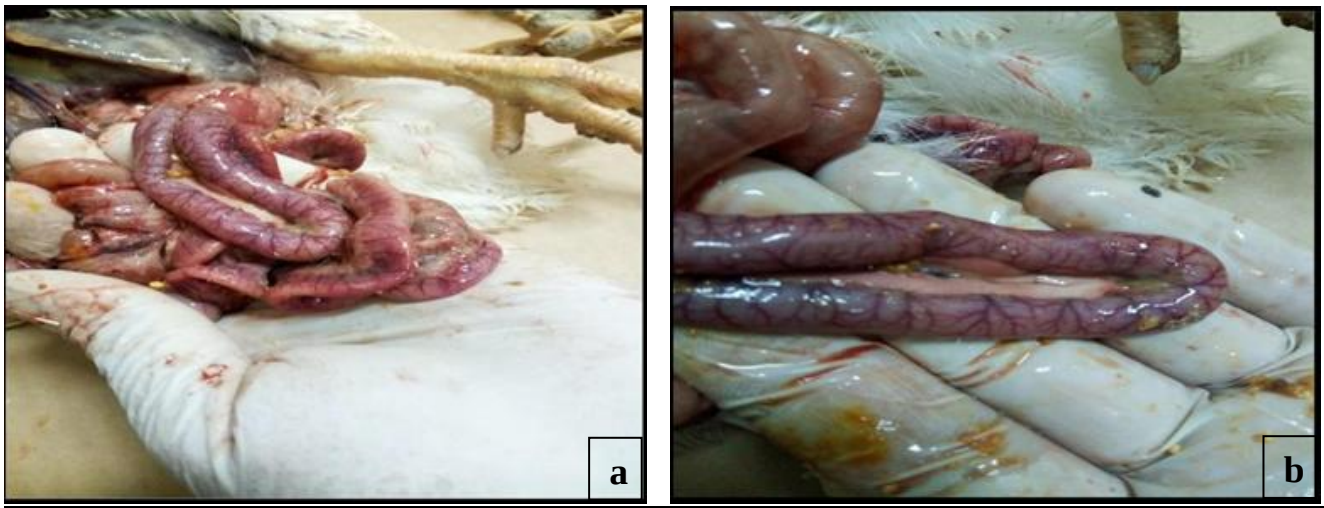

Figure 3 - (a) The presence of severe congestion in the duodenal area during the acute phase of *coccidiosis* (b) Congestion of the jejunal part during the acute phase of *coccidiosis*.

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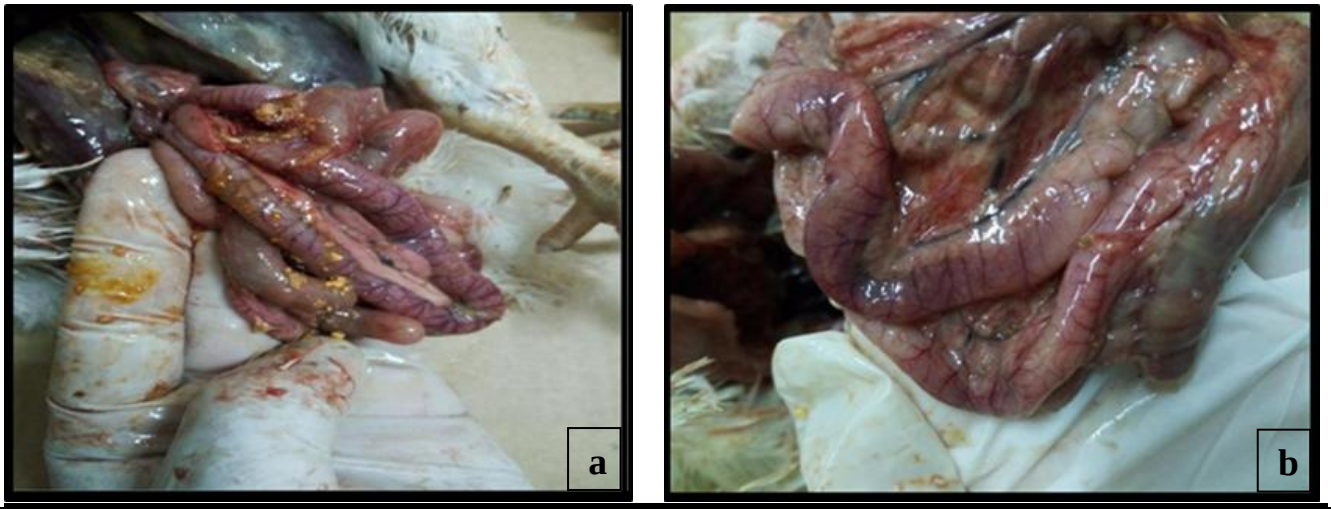

Figure 4 - (a) Congestion of the jejunal part during the acute phase of coccidiosis (b) The presence of congestion during caecal Coccidiosis

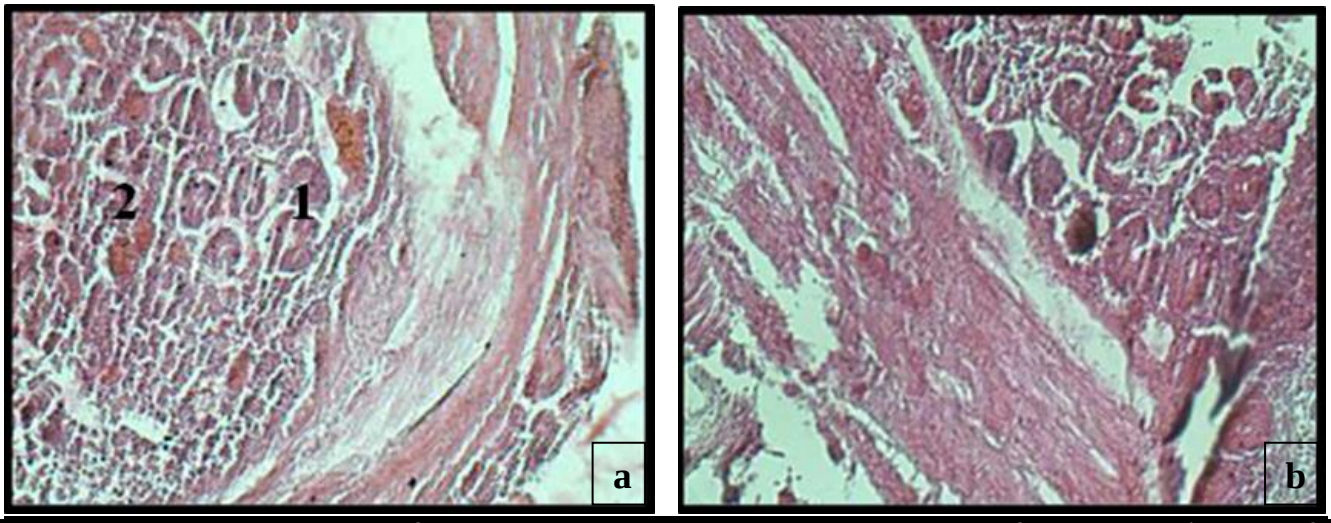

Figure 5 - (a) Histological aspect of intestinal coccidiosis with a degenerative phase of enterocytes. 1: oocyst. 2: degeneration. (b) Enteritis caused by coccidiosis (H&Ex100).

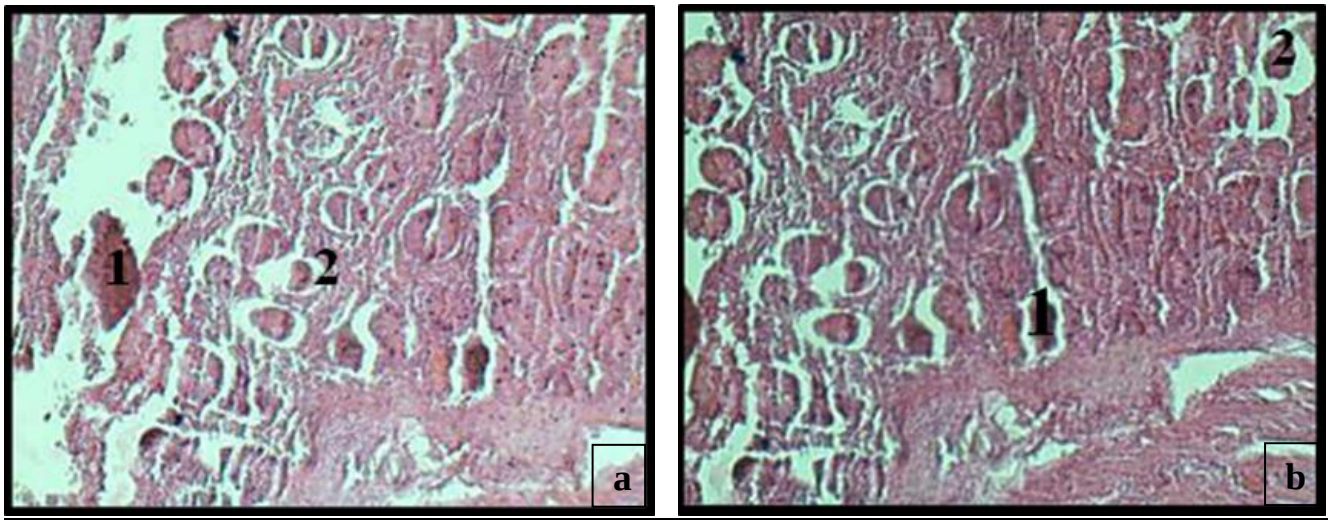

Figure 6 - (a) Intestinal coccidiosis with enterocyte necrosis and pycnosis (H&Ex100); 1: necrosis. 2: pycnosis (b) The presence of significant acute intestinal inflammation with hydrophilic degeneration during intestinal coccidiosis; 1: degeneration. 2: oocyst.

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DISCUSSION

Coccidiosis in broilers is a well-known and well-described disease that has been present for many years. We know both the clinical description (Molla and Ali, 2015; AKAKPO, 1974). The lesional description with the Johnson and Reid grid (1970) and the global economic impact (Johnson and Reid, 1970; Williams, 1999).

The autopsy of birds is performed in a classical way according to the method validated in the pathological anatomy laboratory of the Agronomic veterinary Institute. Each of the birds is then observed in the intestine with particular attention to coccidial lesions.

Analysis of the different species of coccidia shows that the pathology is dominated by E. acervulina, to a lesser extent by E. tenella and to a very low level by E. maxima. This is another reassuring fact: E. maxima and E. acervulina are classically perceived as the most pathogenic and economically costly coccidia because they affect the main absorption areas of the intestine, unlike E. tenella (Molla and Ali, 2015).

It therefore appears that these are under control on the national territory today thanks to medical and medical-health prophylaxis introduced by veterinarians (Baycox and Elancoban). Mostly it is E. acervulina which emerges as the most commonly found coccidial species. Analysis of bird ages shows that coccidial lesions are not completed at 26-28 days but later at 36 to 40 days, which is consistent with the literature on the establishment of immunity in broilers (Chapman, 2014; Chapman et al., 2010).

These results are in agreement with our results; the necrosis examination reveals sometimes haemorrhagic enteritis and the histological lesions consist of degeneration and necrosis of the enterocytes, the presence of significant inflammation and hydropical degeneration with functional repercussions.

It is therefore relevant if we wish to better control this pathology, particularly in the final stages of the chickens' lives, to control coccidiosis beyond 26 to 30 days and to continue using coccidiostats (Elancoban) beyond 20 days in order to limit the economic impact of the pathology, intestinal lesions, protect animal welfare and limit the resident populations of coccidial oocysts in farm buildings, a similar results report by Brugère-Picoux and Silim (1992); Yvoré, (1992).

CONCLUSION AND RECOMMENDATIONS

Coccidiosis is one of the most common parasitic diseases in poultry. They can take many forms and are found all over the world and in all types of poultry farming. Our macroscopic and histological study on the broiler chicken intestine during the disease in the Souk Ahras region led to the following result:

- Coccidiosis reduces zootechnical performance and disrupts digestive function.
- A strong enteritis, sometimes hemorrhagic, caused by different species of the Emeria genus.
- Active congestion related to hyperhaemia and passive congestion related to stasis has been demonstrated in different parts of the small intestine (duodenum, jejunum and ilium).
- Histological lesions consist of degeneration and necrosis of enterocytes.
- -The presence of significant inflammation, hydrophilic degeneration with functional repercussions.
- Pycnosis in the intestinal mucosa.

The severe damages for the economic context of this disease, requires the installation of a global epidemiological surveillance plan for this pathology is necessary in order to control its propagation and to reduce its risk.

DECLARATIONS

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Authors' contribution

"B Amine and K Tarek participated in the design of study. B Amira collected samples K Tarek and B Amine performed the experiments, B amine analyzed the data. K Tarek, B Amine, B Amira and L Ibtessam critically revised the manuscript. B Amine wrote the manuscript. All authors read and approved the final manuscript."

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To all students, teachers and employees of the agronomic and veterinary institute Taoura -Souk Ahras, **Algérie,**

Competing interest

The authors declare that they have no competing of interest.

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ÉTUDE MORPHO-HISTOLOGIQUE DE LA COCCIDIOSE CHEZ LES POULETS DE CHAIR DANS LA RÉGION DE SOUK AHRAS, ALGÉRIE

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RESUME: ***L'objectif de notre travail est d'étudier l'aspect macroscopique et microscopique de l'intestin à l'état normal et lors de la coccidiose chez le poulet de chair pendent la vie postnatale à la région de souk Ahras. Les résultats montrent que l'intestin grêle est l'organe le plus sensible à la coccidiose aviaire, l'examen nécropsique montre que les lésions sont exprimées selon l'espèce. Une forte congestion avec des zones hémorragiques dans le cas de la coccidiose caecale, la traduction macroscopique montre une atrophie des villosités intestinales avec un épaississement de la muqueuse dans le cas de la coccidiose intestinale, l'examen histologique révèle une dégénérescence parfois hydropique et nécrose des entérocytes avec pycnose au niveau des cellules de l'épithélium intestinal et la présence d'une forte entérite. La coccidiose est l'une des maladies parasitaires les plus fréquentes chez les volailles en Algérie, elle prend de nombreuses formes et touche tous les types d'aviculture dans le monde, cette pathologie a de graves dommages économiques, un plan de surveillance épidémiologique de cette affection est nécessaire afin de contrôler sa propagation et de réduire son risque.***

Mots clés: Poule De Chair, Intestin, Coccidiose, Aspect Macroscopique Et Microscopique.

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EVALUATION OF PRE-WEANING GROWTH PERFORMANCE AND SURVIVAL RATE OF SHEEP IN HULET EJU ENESIE DISTRICT, EAST GOJJAM ZONE, ETHIOPIA

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ABSTRACT: **The study was conducted in Hulet Eju Enesie District, East Gojjam Zone, Ethiopia, with the main objectives of evaluating pre-weaning growth performance of sheep. The study district was stratified in to Dega, Weina dega and Kolla agro-ecologies. A total of 48 (16 from each agro-ecology) late pregnant sheep flocks were selected purposely for monitoring. The data were collected from sampled households using semi-structured questionnaires and through monitoring. Birth weight and 90 days weight were taken using 50kg weighing balance with 200g precision. Collected data monitoring of lambs were subject to GLM analyzed by using SPSS software (version 20.0). The average birth weight, 90 days weight and average growth rate of lambs were 2.46 ± 0.07 kg, 10.26 ± 0.12 kg and 89.66 ± 1.28 g/day which were significantly different (P<0.05) among agro-ecology, breed, parity, types of birth and sex of lambs. Survival rate of lambs was 91.67%. Therefore, birth weight, pre-weaning growth weight, pre-weaning growth rate and survival rate were significantly affected by agro-ecology, parity, litter size and sex.**

Keywords: Birth weight, Daily weight gain, Pre-weaning growth rate and Survival rate.

INTRODUCTION

Growth performance is the most important production traits for successful animal production. The growth performance of sheep is influenced by age of the dam, pre-mating weight of the dam, type of birth, sex, breed and season of birth (Mengistie et al., 2009; Solomon et al., 2011). Birth weight and pre-weaning growth rate of lambs have been investigated in several countries on several sheep breeds under varying environmental and/or management conditions (Markos, 2006). In Ethiopia birth weight is strongly influenced by breed (genotype), sex of lamb, birth type, age of dam, feeding conditions, season of birth and production system. Birth weight affects the survival rate and pre-weaning growth of the lamb (Markos, 2006). Pre-weaning growth performance of lambs depends up on the inherent genetic potentiality and the mothering ability of ewes (Aemero et al., 2012). In Ethiopia lambs, which are heavier at birth, are usually single or due to ewes larger body size and good feeding management. Lambs heavier at birth have fast growth capacity and have higher mature body weight (Tesfaye, 2008).The objective of this research was to evaluate pre-weaning growth performance and survival rate of lamb in farmers' level.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Hulet Eju Enese District Amhara Region, Ethiopia. It is located in the North West direction 370 km far from Addis Ababa, in the northeast direction 200 km far from Debre Markos and in the southeast direction 120 km far from Bahir Dar. It is bordered with Goncha Siso Enesie in the East direction, Enarge Enawega in the South direction, Debay Telate in the Southwest direction, Sinan Bibugne in the West direction and South Gondar in the north direction. The district is geographically located 10' 45 00--11' 10 00N Latitude and 37' 45 69---38' 10 00 E longitude (BoARD, 2011). In addition, the district consists of 40 rural and 2 urban *Kebeles*.

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Sampling Methods and Data Collection

Data source and management

Pre-weaning growth performance and survival rate of lambs under traditional management, were evaluated through monitoring. It was performed in three agro-ecologies of Hulet Eju Enesie district for 3 months. To undertake the monitoring 16 households from each agro-ecology (a total of 48) that had late pregnant sheep were selected purposely with the assistance of development agents and the pregnant sheep was given identification number. The birth weights of the lambs were taken within 24 hours after birth. The subsequent weight of lambs was taken at 15 days interval until 90 days of age (Aemero et al., 2012). The agro-ecology, breed, parity, birth type, sex, birth weight, weaning weight (weight at 90 days), average daily weight gain of 90 days and survival rate of the monitored lambs were collected. The live weight measurement was taken early in the morning before the lambs were allowed to suckle their dams by using portable weighing balance which has a capacity to measure 50kg with 200g precision. To estimate lamb survival rate (%) the following formula was used (Ibrahim, 1998)

Overall lamb survival rate (%) of flocks (per sheep):

$$\text{Lamb survival rate (\%)} = \frac{\text{Number of offspring weaned}}{\text{Number of offspring produced}} \times 100\ \% \quad (1)$$

Statistical Analysis

Collected data were organized, summarized and analyzed using SPSS software (2011) version 20.0.

Sex, parity, birth type, breed and agro-ecology were fitted as fixed independent variables, while birth weight, pre- weaning weight and average daily weight gain were fitted as dependent variables. For analysis of pre-weaning growth performance and survival rates of lambs, the following model was used:

$$Yjkz = \mu + Sq + Tl + Bj + Pk + Xz + eqjkz \quad (1)$$

Where, Yqljkz= the observation on (birth weight, pre-weaning weight and average daily weight gain, survival rate) on the nth lamb of the qth agro ecology, lth breed, jth birth type born in kth parity and zth sex

μ= the overall mean common to all animals in the study.

Sq = fixed effect of the qth agro ecology (1= dega, 2=weina dega, 3= kolla).

Tl = fixed effect of the lth breed (1= not characterized ="local" sheep, 2=Washera crossbred).

Bj =fixed effect of the jth birth type (1= single, 2 =twin).

Pk= fixed effect of the kth parity (k = 1, 2, 3.....5).

Xz= fixed effect of the zth sex (1=male, 2= female).

Eqjkz = is the random error.

RESULTS AND DISCUSSION

Birth Weight

The average birth weight of sheep was 2.46 ± 0.07 kg (Table 1). This result is relatively lower than Shigdaf et al. (2013) reported that the average mean birth weight for Washera, Farta and their crossbred sheep were 2.61 ± 0.01 kg, 2.50 ± 0.02 kg and 2.59 ± 0.01 kg, respectively in Western highland of Amhara Region.

Birth weight is strongly influenced by breed (genotype), sex of lamb, birth type, age of dam, agro-ecology and production system (Deribe, 2009). Major factors, which affect birth weight of lambs, are shown in the Table 1. Birth weight of lambs significantly varied ($P<0.05$) in different agro-ecological zone. Lambs born in dega area has significantly lower ($P<0.05$) birth weight than lambs in Weina dega and Kolla areas. This might be due to breed difference; in dega area only "local" sheep were found but in Weina dega and Kolla areas both Washera crossbred and "local" sheep were found so Washera crossbred gave high birth weight (Shigdaf et al., 2013). Lambs born in Kolla area were significantly lower ($P<0.05$) birth weight than Weinadega and significantly ($P<0.05$) higher than dega area lambs. This might due to environmental difference (nutrition of dam, climate) (Yenesew Abebe et al. 2013).

There was a difference in birth weight between two sheep types, Washera crossbred and "local" sheep, birth weight of Washera crossbred lambs (2.78 kg) was heavier ($P<0.05$) than birth weight of lambs born from "local" sheep (2.3 kg). The reason of birth weight difference might due to breed difference (Mesfin et al., 2014) and also due to high birth weight of Washera crossbred than "local" sheep and higher body weight of their dams relatively (Shigdaf et al., 2013). Ewes that gave birth for the first time their lambs were ignificantly lower ($P<0.05$) birth weight than those ewes that gave birth for second, third and fourth parity. This might be due to the higher body weight of ewes from the later parity and better mothering ability than the first parity (Aemero et al.,2012). It might be due to less development of the reproductive organs of first parity ewes to bear large fetus in which the physiology adjusts the fetal size (Markos, 2006). This is accordance with Deribe (2009) and Solomon et al. (2011).

Single born lambs were significantly higher ($P<0.05$) birth weight (2.55 ± 0.08 kg) than twin born lambs (2.28 ± 0.13 kg). This might be due to competition for nutrient and space from their dam before birth in the case of twin births (Ayele, 2015). The current finding is in agreement with reports of Deribe (2009); Solomon et al. (2011); Aemero

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et al.(2012) and Shigdaf et al. (2013), who reported that single -born lambs are heavier than their multiple born contemporaries in Alaba sheep, Gumuz sheep, Sekota sheep and „Washera, Farta and their crossbreed sheep" respectively. Male lambs had significantly heavier (P<0.05) birth weight (2.65 ± 0.09 kg) than female (2.26 ± 0.11 kg). This might be due to the presence of androgen in males, which stimulates skeletal growth (Mesfin *et al.,* 2014).

Table 1 - The mean of birth weight and weight at three months of age of sheep

Factors		N	Birth weight (Kg) Mean ± S.E	N	Weight at 90 days (Kg) Mean ± S.E
Overall		48	2.46 ± 0.07	44	10.26 ± 0.12
Agro-ecology	Dega	16	2.10 ± 0.13^{a}	15	9.28 ± 0.19^{a}
	Weina dega	16	2.69 ± 0.12^{b}	15	11.34 ± 0.18^{b}
	Kolla	16	2.55 ± 0.12^{bc}	14	9.98 ± 0.18^{c}
Breeds	Washera crossbred	16	2.78 ± 0.12^{a}	14	10.78 ± 0.18^{a}
	"Local" sheep	32	2.30 ± 0.09^{b}	30	10.00 ± 0.13^{b}
Parity	1	12	1.97 ± 0.14^{a}	9	7.01 ± 0.21^{a}
	2	13	2.53 ± 0.14^{b}	13	11.22 ± 0.21^{b}
	3	16	2.84 ± 0.13^{b}	16	12.72 ± 0.19^{b}
	4	6	2.62 ± 0.19^{b}	5	10.50 ± 0.69^{b}
	5	1	2.10 ± 0.46^{ab}	1	9.87 ± 0.29^{a}
Type of birth	Single	34	2.55 ± 0.08^{a}	33	10.83 ± 0.13^{a}
	Twines	14	2.28 ± 0.13^{b}	11	9.11 ± 0.19^{b}
Sex	Male	27	2.65 ± 0.09^{a}	26	10.79 ± 0.14^{a}
	Female	21	2.26 ± 0.11^{b}	18	9.67 ± 0.16^{b}

a, b, c means with different letter within the same column are significantly different (P< 0.05); N= number of observations

Pre-weaning growth

The average mean pre-weaning growth of lambs was 10.26 ± 0.12 kg (Table 1). This result is in line with Deribe (2009), who reported that the average 90 days weight of lambs was 10.35 ± 0.19 kg of Alaba sheep in Alaba district Southern Ethiopia.

Factors that affect pre-weaning growth weight of lambs are presented in Table 1. Lambs born at first and fifth parity had significantly lower (P<0.05) pre-weaning growth weight (7.01 ± 0.21 kg and 9.87 ± 0.29 kg) than lambs born from second, third and fourth parity ewes. This might be due to milk production and mothering ability improves with parity of the ewe up to fourth parity (Berhanu and Aynalem, 2011). Single lamb was significantly heavier (P<0.05) pre-weaning growth weight (10.83 ± 0.13 kg) than twins lambs (9.11 ± 0.19 kg) this might be due to single born lambs are the sole users of their dam milk (Markos, 2006). Male was significantly higher at (P<0.05) pre-weaning growth weight (10.79 ± 0.14 kg) than female (9.67 ± 0.16 kg). This might be due to attributed physiological functions, which play a major role in accelerating growth (Abbas *et al*., 2010). The current finding result are comparable to Deribe (2009); Aemeroet al. (2012); Shigdaf et al. (2013) and Mesfin et al. (2014).

Growth Rate

The average daily weight gain of monitored lambs is presented in (Table 2). The average daily growth rate of lambs was 89.66 ± 1.28 g/day. This is in agreement with Deribe (2009), who reported that the least square means of pre-weaning daily gain of Alaba sheep was 89.2 ± 1.98 g/day in Alaba district Southern Ethiopia. In contrast, the current finding is quite lower from the findings of Mesfin et al. (2014) and Aemero et al. (2012) who reported that the average daily weights gains of the local sheep and Sekota sheep breed from birth to weaning age were 121.56 ± 2.31and 101 ± 2.66 g/day respectively. The difference might be due to birth weight, breed, parity and sex (Markos, 2006).

Factors that affect pre-weaning growth rate of lambs are presented in (Table 2). Lambs born in Weina dega had significantly higher (P<0.05) daily weight gain (98.28 ± 2.17 g/day) than dega and Kolla agro-ecologies. Pre-weaning growth rate difference between Weina dega and Kolla might be due to nutritional difference (Yenesew et al., 2013).

Washera crossbred lambs were significantly heavier (P<0.05) in their average daily weight gain (92.68 ± 2.20 g/day) than lambs born from "local" sheep (88.15 ± 1.57 g/day). This might be due to lambs born from Washera crossbred sheep were fast grower since maternal in heritance is high at this age (Shigdaf et al., 2012). Lambs born from first parity had lower (P<0.05) average daily weight gain (64.08 ± 2.51 g/day) than lambs born from second, third and fourth parity of ewes. Lambs born singly had significantly heavier (P<0.05) average daily weight gain than lambs born twins with the average result 93.85 ± 1.53 g /day) and (81.29 ± 2.30 g/ day) respectively. This might be due to their difference in weight at birth (Markos, 2006). Average daily weight gain (92.43 ± 1.71g) of males were heavier (P<0.05) than female (86.56 ± 1.91g). The superiority of males on pre-weaning average daily weight gain was

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apparently might be the result of their superior birth weights (Markos, 2006). In addition it might be to males being heavier than female due to testosterone estrogens and progesterone) hormone predominate in male and female (Mengistie et al., 2009). The current finding is in line with (Deribe, 2009; Aemero et al., 2012).

Table 2 - Effects of different factors on Average Body Weight Gain of monitored lambs

Factors		N	ADWG (g/day) Mean ± S.E
Overall		44	89.66 ± 1.28
Agro-ecology	Dega	15	83.83 ± 2.26[a]
	Weina dega	15	98.28 ± 2.17[b]
	Kolla	14	85.67 ± 2.20[a]
Breeds	Washera cross	14	92.68 ± 2.20[a]
	"Local" sheep	30	88.15 ± 1.57[b]
Parity	1	9	64.08 ± 2.51[a]
	2	13	96.55 ± 2.44[b]
	3	16	109.77 ± 2.27[c]
	4	5	86.11 ± 3.48[d]
	5	1	93.30 ± 8.21[bcd]
Type of birth	Single	33	93.85 ± 1.53[a]
	Twines	11	85.29 ± 2.30[b]
Sex	Male	26	92.43 ± 1.71[a]
	Female	18	89.56 ± 1.91[b]

a, b,c means with different letter within the same column are significantly different (P<0.05); N= Number of observations; ADWG=Average Daily Weight Gain

Survival Rate of Lambs

Factors that affect survival rate of lambs are presented in (Table 3). The overall survival rate of lamb was 89.57%. This result is consistent with Deribe, (2009) reported that the survival rate of lamb was 86.1%.in Alaba district Southern Ethiopia.Type of birth, sex of lambs, birth weight, parity and nutritional status of dam affect survival of lambs (Kassaye, 2011). Lambs born in dega and Weina dega agro-ecology had better pre-weaning survival rate than Kolla agro-ecologies. This might be due to sheep are versatile animal in dega and Weina dega agro-ecology (Deribe, 2009). Low survival rate of lamb in Kolla might be environmental factors (differences in feed availability, housing and ambient temperature, etc). "Local" sheep had highest survival rate than Washera crossbred lambs (Yenesew et al.2013). Lambs born from first parity had lowest survival rate than second, third and fourth party of ewes. This might be due to first parity ewes do not produce enough milk to nurse their lambs (Berhanu and Aynalem,2011). Might be to early age at first mating under uncontrolled traditional breeding system (Demissie, 2015). Single born lambs had higher survival rate than twins. This might be due to lambs born singly was sole user of dam milk and had better body weight during birth. Male lambs had better survival rate than female. The current finding is in agreement with reports of Deribe (2009) and Mengistie et al (2011) for Alaba and Washera sheep respectively.

Table 3 - Survival rate of monitored lambs

Factors		N	Survival to 90 days age (%)
Overall		44	91.67
Agro-ecology	Dega	15	93.75
	Weina dega	15	93.75
	Kolla	14	87.50
Breeds	Washera cross	14	87.50
	"Local" sheep	30	93.75
Parity	1	9	75
	2	13	100
	3	16	100
	4	5	83.33
	5	1	100
Type of birth	Single	33	97.06
	Twines	11	78.57
Sex	Male	26	96.30
	Female	18	85.71

N= number of respondents

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CONCLUSION

Birth weight, pre-weaning growth weight, pre-weaning growth rate and survival rate were significantly affected by agro-ecology, parity, litter size and sex.

To increase production and growth performance of sheep, the breed improvement and selective breeding program should be implemented.

DECLARATIONS

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Authors' contribution

All authors contributed equally to this work from starting proposal writing up to preparation of manuscript.

Competing interests

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

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HUSBANDRY PRACTICES OF SHEEP IN HULET EJU ENESIE DISTRICT, EAST GOJJAM ZONE, ETHIOPIA

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ABSTRACT: The study was conducted in Hulet Eju Enesie District, East Gojjam Zone, Ethiopia, with the main objective of assessing husbandry practices. The study district was stratified in to Dega, Weina Dega and Kolla agro-ecologies. Six kebeles were selected by proportional allocation methods. For survey, 150 sample households were selected for interviewed by using simple random sampling. In addition, 72 households were selected for group discussion by using simple random sampling, male and female with equal proportion. Collected data from survey were subject to Descriptive statistics, ANOVA and Chi-square ($\chi 2$) by using SPSS software (ver. 20). The mean flock size per household was 12.52 in Dega, 9.43 in Weina Dega and 8.32 in Kolla ($P<0.05$). The purpose of keeping sheep were sale (income source), meat and saving purpose as indicated with index value of 0.48, 0.28 and 0.12 respectively. Major feed source varied according to seasons; communal grazing 37.1% from (Sep-Nov), Grazing after math 47% from (Dec-Feb), Crop residue 38.1% from (Mar - May) and private grazing 31.8% from (Jun–Aug). Haricot bean straw (64%) is a major crop residue. Chi-square ($\chi 2$) analysis result showed that there was significant difference ($P<0.05$) on types of supplementary feeds in different agro-ecological zones. Atela (97.3%) was dominant supplementary feed. Sheep house constructed attached to the family house and sharing a common wall is the most common sheep house. Mean age for castration and tail docking were 14.84 and 3.77 months respectively. Selection criteria of sheep for castration and fattening were physical characteristics, breed and conformation with index value 0.43, 0.26 and 0.23 respectively. Washera (79.3%), crossbred (12%) and both Washera crossbred and "local "sheep (17.3%) respectively. Age at first mating, age at first lambing, lambing interval, slaughtering age for male, slaughter age for female and marketing age of sheep were 7.47, 12.46, 8.05, 5.96, 6.25, 6.5 months respectively. Litter size (mean 1.55) was significantly ($P<0.05$) different among agro-ecologies. Disease, and parasites, and feed shortage were reported to be the two major constraints of sheep production in the area with index value 0.381 and 0.357.

Keywords: Breed, Castration Practice, Constraints, Culling Practice, Husbandry practice, Opportunities, Tail docking, Weaning

INTRODUCTION

Domestic sheep (*Ovis aries*) were domesticated between 11000 and 9000 BC, and the domestication of the wild mouflon in ancient Mesopotamia (Hiendleder et al., 2002). Sheep are among the first animals to have been domesticated by humans, and there is evidence of sheep farming in Iranian statuary dating to that time. Woolly sheep began to be developed around 6000 BC in Iran, and cultures such as the Persians relied on sheep's wool for trading.

Ethiopia is home for many livestock species and suitable for livestock production. Ethiopia is believed to have the largest livestock population in Africa. In Ethiopia, there are about 27.3 million of sheep of which almost all 99.9% are indigenous breeds, which are managed by resource poor smallholder farmers and pastoralists under traditional systems (CSA, 2015).

Sheep are the second most important livestock species in Ethiopia followed by cattle (Gizaw, 2007) which have become adapted to a range of environments from the cool alpine climate of the mountains to the hot and arid pastoral areas of the lowlands (Tadele, 2010). Sheep have a unique niche in smallholder agriculture from the fact that they require small investments; have shorter production cycles, faster growth rates, greater environmental adaptability and a unique niche in smallholder agriculture as compared to large ruminants (Tibbo, 2006; Notter, 2012).

Ethiopian sheep breeds have great potential to contribute more to the poor farmers, smallholder crop-livestock and pastoral production systems (Kosgey and Okeyo, 2007). Sheep have social and economic importance to the

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producers who keep indigenous breeds for meat, hair production and income generation (Kocho, 2007; Ashagre, 2008; Getachew et al., 2011).

In Ethiopia, the attention given to the improvement of the sheep production system is inadequate. It is assumed that the low productivity of sheep is a combined effect of poor management, limited feed resources and high disease pressure (Abegaz et al., 2008). Other contributing factors also include low genetic potential, policy issues market, institutional problems, and problem of credit facilities (Gebremariam et al., 2006). And low fertility, prolificacy, weaning, late in age at first lambing, less birth weight and mature body weight and lack of appropriate culling and disposal strategies (Gizaw et al., 2010 ; Tegegne et al., 2011; Gizaw et al., 2013).

In Hulet Eju Enesie district sheep 67.2% from total livestock population. Even though the district has large number of sheep, the potential for sheep production is challenged and there is a knowledge gap in utilizing its maximum potential and the livelihood of the farmers is not improved. There was a need to conduct research survey on husbandry practice of sheep in the district to identify the knowledge gap and document the existing problems in the district. Generally, the overall husbandry practices of sheep are not studied and there was clearly research gap in the area. Therefore, this study was undertaken to fill the existing information gap with regard to husbandry practices of sheep in the study area.

MATERIAL AND METHODS

Description of the study area

The study was conducted in Hulet Eju Enesie District Amhara Region, Ethiopia. It is located in the North West direction 370 km far from Addis Ababa, in the northeast direction 200 km far from Debre Markos and in the southeast direction 120 km far from Bahir Dar. It is bordered with Goncha Siso Enesie in the East direction, Enarge Enawega in the South direction, Debay Telate in the Southwest direction, Sinan Bibugne in the West direction and South Gondar in the north direction. The district is geographically located 10' 45 00--11' 10 00N Latitude and 37' 45 69--38' 10 00 E longitude (BoARD, 2011). In addition, the district consists of 40 rural and 2 urban Kebeles.

The total livestock population in the district is estimated to be 727,157 heads out of which 12.12% cattle, 67.2% sheep, 2.7% goats, 2.36% equines and 15.62% are poultry. The number of livestock per household is about 3.85, 21.37, 0.86, 0.75 and 4.97 heads for cattle, sheep, goat, equines and poultry respectively.

Sampling methods and data collection

Informal survey. Before the main sampling was attempted, discussions were held with the district livestock experts and DAs to gather information about the study kebeles on farmers' husbandry practice of sheep, farming practice, livestock population, to clear on purpose of study and establish collaborations for the study.

Formal survey. Based on the informal survey result, questionnaires were prepared and pretested. After preliminary survey was conducted, prepared and pre tested questionnaires were applied to collect the data.

Data collection

Both primary and secondary data were used on various aspects of husbandry practices of sheep. The primary data were collected from sample respondents through semi-structured questioners, focus group discussion, key informants, field observation and formal survey. The semi structured questioners were held on the following parameters:- socio economic characteristics of household, feed and feed resources, housing, purpose of keeping sheep, health management, disease, breeding practice, opportunities of sheep production, constraints and reproductive performance, feeds and feed resource, labor requirement, composition of livestock mixture.

Focus Group Discussion (FGD): In each selected kebele, which was selected by stratified sampling method. The participants for focus group discussions were selected by using, simple random sampling method. From each selected kebele 12 households, which comprised male and female with equal proportion. Therefore, a total of 72 household were selected for group discussion.

Field observation: Field observation was done to enrich the data about husbandry practice. Key informant interview: the researcher conducted key informant interviews in each selected kebele with individuals who were knowledgeable about husbandry practices. These key informants were included:-male, female, youth, priest (religious father) and kebele administrators.

Sampling techniques

Hulet Eju Enesie district was purposively selected because of its highest sheep population (ARDP, 2014). Sheep production is one of the most important production systems for household asset building in the district. Formal as well as informal methods and multistage sampling technique (purposive, stratified, simple random sampling method)

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were used to gather information on husbandry practices. Agro-ecology of the district was used as stratification factor. Agro-ecology of the district was used as stratification factor. The study district was stratified in to three agro-ecologies (NRCD, 2013).

The sample size to was determined by using (Taro, 1967) formula as shown below;

$$n = \frac{N}{1+N(e2)}$$

Where

n = is the sample size

N = number of population

e = level of 8% error

The sampled households were 25, 75 and 50 from Dega, Weina Dega and Kolla respectively. To identify husbandry practices of lambs from six kebeles a total of 150 households were selected randomly.

Statistical analysis

Collected data were analyzed through SPSS version 20.0 (SPSS, 2011). Descriptive statistics, ANOVA, Tukey HSD test and Chi-square test were applied to summarize the data.

RESULTS AND DISCUSSIONS

Household characteristics

The average age of the respondents was 43.45 ± 0.84 years. This indicated that households are at productive age for proper eager good sheep management. The overall mean family size in the study area was 5.53. Majority respondents were male headed (93.3%) while only small proportions (6.7%) were female headed. Marital statuses of most of the respondents 90% married. Majority (51.3%) of the interviewed household heads were illiterate. And the remaining proportions (48.7%) were literate who were grade 1-12 (38.7%), university degree (0.7%) and religious education (9.3%) and there were higher literacy in Weina Dega (70.6%), followed by in Dega (56%) and Kolla (12%) respectively. According to field observation and interviewed key informant, lower number of literacy level in Kolla area was due to accessibility problem of school far from residential area and no immediate justice for the problem. The occupations of 98% households that included in the study were farmers. This indicated that the management system might be poor.

Purpose of keeping sheep

In Hulet Eju Enesie district, sheep are kept for various purposes as listed in (Table 1). In the district as the ranking index indicated that sale (income sources) was the first purpose of keeping sheep, meat as the second purpose and saving as the third purpose. This result is in line with many authors (Urgessa et al., 2013; Hailemariam et al., 2013; Mohammed et al., 2014) who indicated that the major purpose of keeping sheep is for income source. This implies that sale of sheep to generate cash constitute was the primary purpose among others.

Table 1 - Purpose of keeping sheep ranked by respondents in different agro-ecologies

Response of HH (N= 150) / Reasons	1st	2nd	3rd	Weight	Index	Rank
Sale (income source)	132	18	0	432	0.48	1
Meat	17	90	24	255	0.28	2
Saving	1	19	67	108	0.12	3
Social and cultural function	0	15	26	56	0.06	4
Distribute benefits / risks	0	3	24	30	0.03	5
Scarifies / rituals	1	5	2	15	0.02	6
Manure	0	0	3	3	0.003	7
Total	-	-	-	899	-	-

Index = sum of [3 * respondents for rank 1+2 * respondents for rank 2 + 1 * respondents for rank 3] given for an individual purpose of keeping sheep divided by sum of [3 * respondents for rank 1+2 * respondents for rank 2 + 1 * respondents for rank 3] summed for all purpose of keeping sheep. N = number of respondents

Feed resource availability and utilization

The different feed resources and their seasonal use presented in (Figure 1). Communal grazing, grazing aftermath, crop residues and private pasture were the major types of feed resource in the district. Communal (37.1%) grazing was found to be major feed resource from September-November. Grazing aftermath (47%) used as major

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feed resources from December-February. Private pasture (31.8%) was the major feed resource in the area especially from June - August because, during this time, other crops occupy other lands. This result is in line with (Abebe, 2013), who reported that 42.5% of the respondents feed crop residues to their sheep in Burie district, West Gojjam Zone. Communal grazing, private pasture, riverside grazing, grazing stubble, crop residues and road side grazing, respectively are the major feed resources for sheep in eastern Ethiopia reported (Nigussie, 2015).

In Hulet Eju Enesie all households feed crop residues. However, the types of crop residues various based on agro- ecologies of the district. In Dega area, the major crop residues used by households are wheat straw (80%), barley straw (40%) and bean and pea straw/chick pea straw (20%), respectively where in Weina Dega, major crop residues are vetch straw (73.3%), chickpeas straw (70.7%) and haricot bean straw (65%), respectively. Majority of the respondents (97.3%) offer supplementary feed for their sheep. Major of the households (97.3%) feed their sheep Atela (local brewery by-product), common salt (60%), and haricot bean (56%) respectively. About 64% of the respondents kept sheep alone, followed by 19.3% (sheep and goat) and 16.7% with cattle and equine. Majority of the farmers (57.3%) in the area reported feed shortage problem especially in dry season (54.62) majorly in Kolla (82.35%).

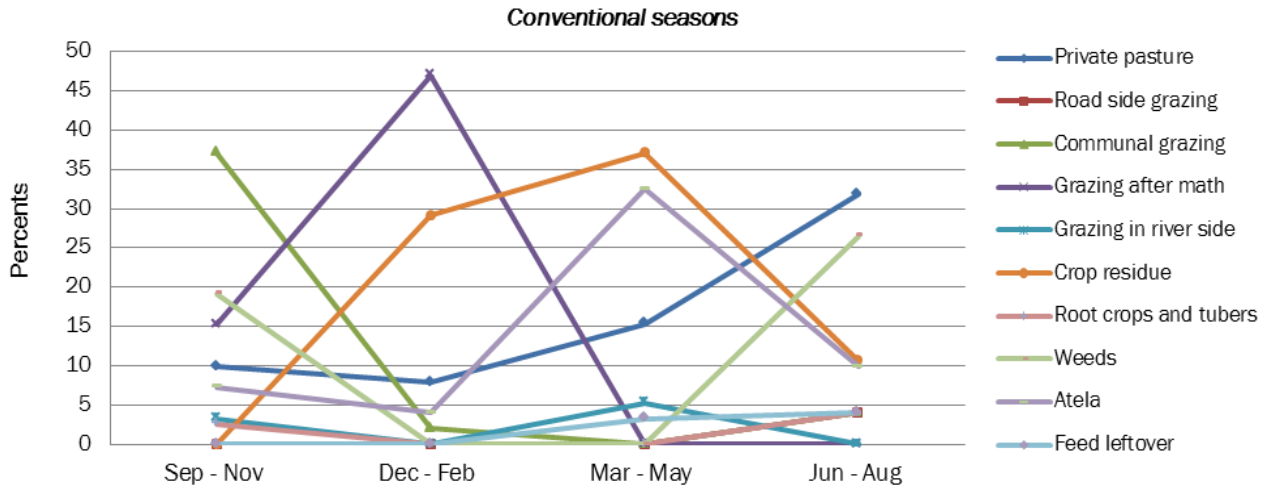

Figure 1 - -Feed resources and their seasonal availability

Water source and watering frequency

River (58.7%) was the major source of water in dry season. The result is in line with (Belet, 2014), who reported 96.3% in Bure, 84% in Atsbi-Womberta, 85.6% in Metema, 56.9% in Gomma, 51.3% in Fogera, 55.2% in Alaba, 44.7% in Alamata and 66.7% in Dale and 88.9% in Wolaita and Siltie zones that river is the major source of water. Rainwater used as the major water source in the rainy season. The result is in line with (Urgessa et al., 2013), who reported that 95.9% of households used rainwater in Ilu Abba Bora Zone of Oromia Regional State Ethiopia. In contrast to this, (Nigussie, 2015; Belet, 2014) found that river and ponds are the main water sources in Wolaita and Siltie Zones and Eastern part of Ethiopia respectively. In dry season, majority of the respondents provided water for their sheep once a day (70%). Focus group discussion indicated that the reason of providing water once a day in the current study was due to low availability of water. However, during the rainy season, 36.7% of households provide their sheep in any time needed. The reason for provision of water at any time needed might be due to plenty of water in the rainy season. In the study, area about 43.3% of the respondents reported, as there was water shortage problem. The reason of water shortage problems were drying of water sources, far distance of water sources and not allowed water source as ranked by respondents with index value 0.55, 0.25 and 0.14, respectively.

Sheep housing

All farmers in Hulet Eju Enesie district shelter their sheep during the night to protect them from predators and adverse climatic conditions. In Hulet Eju Enesie, district 57.65% of respondents sheltered their sheep in a house attached to the main house. With agree this result, (Urgessa, 2013; Nigussie, 2015) indicated that 46% and 55.9% of respondents used a house made adjacent to main family house and separate from family house in Ilu Abba Bora Zone of Oromia Regional State Ethiopia and in Eastern Ethiopia respectively. In contrast to this result, (Kocho, 2007; Abebe, 2013) reported that about 98.6% and 58% of respondents accommodate their sheep flocks in the main houses together with the family members in Alaba district and Burie district West Gojjam zone, respectively.

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Weaning practice of sheep

In Hulet Eju Enesie district, only 7.3% of the total respondents practiced weaning. According to focus group discussion the reason of less practicing of weaning in the district was due to their poor knowledge on weaning. In addition, from the interviewed respondents who practiced weaning, wean their sheep usually around 5 months. The current finding is not fit with the recommended weaning age of Ethiopian sheep reported 3 month is common (Abebe, 2008). About 83% of the respondents in the district practiced tail docking. The mean age of tail docking (female sheep) was 3.77 months which was not significantly different (P>0.05) between agro-ecologies. The reason of tail docking was to facilitate mating (Kocho, 2007).

Castrating of sheep

In the study area 100% of household respondents practiced castration of sheep. Majority of households (71.75%) castrate their sheep to fatten and sale. The average age to castrate sheep was 14.84 months. Here castration might become more difficult and painful with age and the chances of complications increase. The current finding might be increase unwanted breed and delay fattening time of sheep in the area. The current finding is quite higher than (Hamito, 2009), who reported castration should be practiced at early age as soon as possible (three weeks age if extended). Majority of the farmers (55.3%) use Burdizzo castration method.

Culling practice of sheep

Majority (82%) of farmers practiced culling of sheep. The reason of culling varied according to agro-ecologies. In Dega area, the major reason of culling sheep was old age. In Weina Dega, the major reason of culling sheep was health problem where in Kola area the major reason of culling sheep was old age.

Sheep breed and breeding management

In Hulet Eju Enesie district sheep were not characterized. However, according to (Gizaw et al., 2007; Awgichew and Abegaz, 2008) who reported that Washera sheep are found in Eastern and western Gojjam of Amhara region. In the district sheep types varied in different agro-ecologies. In Dega area, all households had 100% “local” sheep. In Weina Dega area, households have 69.3% of “local” sheep, 13.3% Washera crossbred, 17.3% both Washera crossbred and “local” sheep respectively. In Kola area, 84% households had “local” sheep and 16% Washera crossbred sheep. About 8.7% of farmers practiced cross breeding. 79.3%) of households have “local” sheep. The main reasons of having/choosing more “local” sheep in the area was unavailability of other breeds, disease resistance due to environmental adaptability and needless amount of feed per a day due to medium sized body relatively Washera cross. Washera crossbreed in the study area; this might be due to their better meat and milk production and nursing ability, large birth weight of lambs and reach slaughtering age within short period (Mekuriaw et al., 2012). The current finding is in line with (Abebe et al., 2013).

Intensive lambing season was observed in October months and November followed by May and June months (Figure 2). This result is in line with (Gemiyu, 2009), who reported that higher parturitions observed in April to June as well as October to December in Alaba, Southern Ethiopia. The major reason of high lambing intensity of sheep in October and November in the current finding was might be due to presence of plenty feeds then they easily become pregnant and give birth. In addition, high lambing intensity in May and June might be associated with the growing of grass due to beginning of small rain.

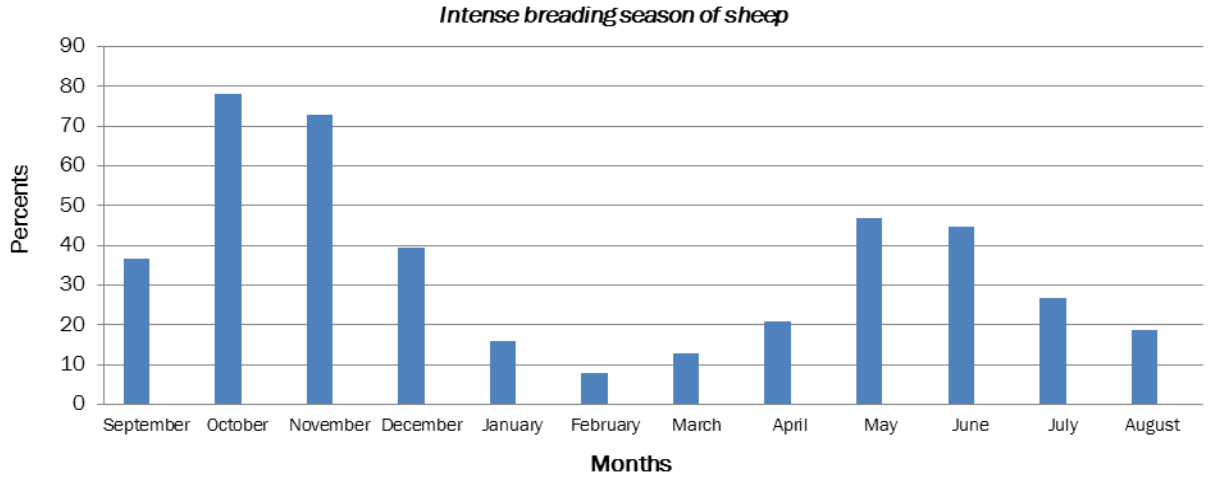

Figure 2 - Intense breeding season of sheep in the study area

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Sheep health management

Major diseases types that affect productivity of sheep in the study area were Berere (Faciolosis), Adfik (Pasteurolosis) and Fentata (Sheep pox) with the value of 65.3%, 36% and 32%, respectively in (Table 2). This result is in agreement with these authors (Nigussie et al., 2015; Belet, 2014).

About 90% of the households take sheep to veterinary clinics for treatment. The remaining households treat their sheep by using drug bought from markets (5.9%) and local traders (4.55%). Majority (52.1%) interviewed respondents located for veterinary center at (1-5km) distance. About 97% of interviewed household treat their sheep with payments in the district. This is in line with (Urgessa et al., 2013). About 69% of interviewed households get vaccine, which is given after outbreak (91.3%) of disease. This might be lack of awareness. About 14% of household respondents got vaccine from open market mainly due to its cheapness (76.7%) but this, types of vaccine is might not assured of its quality (might be expired), the seller might not told the correct dose.

Table 2 - Sheep diseases in the district

Reported symptoms	Expected disease type		Response of HH N (%)
	Local name	Common name	
Immediate death, lack of appetite, swell on neck and weight loss	*Berere*	Faciolosis	98(65.3)
Stand hair, lump, distressed breathing and watery discharge	*Fentata*	Sheep pox	49(32)
Cough, anorexia, bloody mucosa discharge and high fever	*Yesanebamech*	Pneumonia	20(13.3)
Hobble, unable to feed, blisters in their mouth painful	*Afemaze*	FMD	5(3.3)
High blood in urine faces and milk and fever	*Mante*	Anthrax	37(24.7)
Mucosa discharge from noise, animal go off feed, emaciated and have diarrhea	*Adifik*	Pasteurolosis	54(36)

HH= households, N = number and % = percentage

Labor allocation and gender role in sheep management

All household members involved in sheep management activities with a varied degree. About 48.4% of interviewed respondents indicated that wives and girls performed cleaning sheep barn. About 32% of the wives were responsible for taking care of lambs. Feeding (31.1%), taking care of sick animals (46.8%), fattening management (54.4%), house construction (60.4%) and selling of animals (76.7%) were performed by husbands. Husbands performed majority (83.4%) of decisions on use of income and benefits.

Reproductive performance of sheep

Reproductive performance of sheep in the area is presented in (Table 3). The overall age at first mating, age at first lambing, lambing interval, slaughtering age of sheep, marketing age of sheep obtained was 7.47 months, 12.46 months, 8.05 months, (5.96 months for male sheep and 6.25 months for female sheep) and 6.56 months respectively. The average litter size of sheep was 1.55.

Table 3 - Average productive and reproductive parameters of sheep

Parameters \ Agro-ecologies	Dega (N= 25) Mean ± S.E	Weina Dega (N= 75) Mean ± S.E	Kolla (N= 50) Mean ± S.E	Overall (N= 150) Mean ± S.E	P-Value
Age at first mating (month)	7.54 ± 0.19	7.50 ± 0.18	7.39 ± 0.14	7.47 ± 0.11	0.855
Age at first lambing (month)	12.56 ± 0.19	12.47 ± 0.19	12.39 ± 0.14	12.46 ± 0.11	0.868
Lambing interval (month)	8.28 ±0.17	8.03 ± 0.13	7.97 ± 0.13	8.05 ± 0.08	0.431
Average litter size	1.92 ± 0.05^{a}	1.49 ± 0.06^{b}	1.44 ± 0.07^{bc}	1.55 ± 0.04	0.000
Slaughter age (month) male	6.26 ±0.34	6.03 ± 0.19	5.70 ± 0.23	5.96 ± 0.13	0.333
Slaughter age (month) female	6.48 ± 0.32	6.28 ± 0.200	6.08 ± 0.22	6.25 ± 0.13	0.601
Marketing age (month)	7.06 ± 0.36	6.28 ± 0.24	6.54 ± 0.25	6.50 ± 0.16	0.225

a, b, c, means with the different superscripts across rows are significantly different (P<0.05), SE= standard error. N = number of respondent

Constraints

Major constraints for sheep production were disease and parasite, feed and grazing land shortage and water shortage with index value of 0.381, 357 and 0.063 respectively. This result is in agreements with (Urgessa et al., 2013; Hailemariam et al., 2013), who reported that the main limited sheep production in the study area, were disease and parasite in Ilu Abba Bora Zone of Oromia Regional State, Ethiopia.

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Opportunities of sheep production

In the study area, from total livestock population sheep accounts 67.2% but their production was least (ARDP, 2014). This number indicated that, as there is huge number of sheep flock in the district and it might be great opportunity to start sheep production. Key informant indicated in the district there was enough grazing land that used as communally and uncultivated lands that used for crop and animal forage production. If this grazing land properly managed, it could be a good source of good quality feed to boost sheep production in the area. In addition, presence of diverse agro-ecology is might be great opportunity for farmers in the area.

Key informants and focus group discussion indicated that the great opportunity now a days for farmers in the district was, the government (district agricultural office) supply Washera ram by importing from Dangla and Adiet. Washera sheep have been more preferred by the farmers for their large body size, smooth hair, fast growth, big fat tail and attractive coat color, so that this was be great opportunities for farmers.

The improvement in veterinary service from time to time, availability of improved forage seeds, the improvement in extension service from time to time and presence of NGOs (such as Sustainable Land Management) might be some opportunities to engage in sheep production tasks for farmer in the district.

The demand for mutton has increased due to an increase in income and increased population hence in the district and in the country. In addition, there is a growing demand for sheep in both the domestic and export markets. Young male flocks have huge demand by the export abattoir. Establishing of slaughtering and meat processing facilities like Ethiopian meat producer-export association, Abyssinia export abattoirs PLC, Ashraf. Sheep price is increasing in different part of the country this is due to increase mutton demand. These might be an opportunity for farmers to participate in sheep production in the district.

CONCLUSION AND RECOMMENDATIONS

In general, it concluded that the husbandry practices of sheep in Hulet Eju Enesie district observed was dominantly traditional production system. Even though sheep flock size was high, as sheep is the dominant farm animal, their expected role was low due to poor husbandry practice of sheep. Therefore to use this largest opportunity efficiently, health improvement program and market oriented production system should properly implemented. Since sheep in the study area were not characterized, characterization of the “local” sheep should be done. Treatment crop residue and adapted improved forages will alleviate the existing feed problems in the area.

DECLARATIONS

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Authors’ contribution

All authors contributed equally to this work from starting proposal writing up to preparation of manuscript.

Competing interests

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

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DIAGNOSIS OF SUBCLINICAL ENDOMETRITIS DURING POSTPARTUM PERIOD ON SUBSEQUENT PREGNANCY IN SMALL, MEDIUM AND LARGE SCALE DAIRY FARMS IN AND AROUND GONDAR, NORTH WEST ETHIOPIA

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Supporting Information

ORIGINAL ARTICLE

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ABSTRACT: During the study period 147 apparently healthy 3rd trimester pregnant cows were selected in smallholder, medium and large scale dairy farms in and around Gondar, North Western Ethiopia from January 2015 to September 2017. After calving, endometrial samples were collected from the uterus of apparently normal cows by using uterine lavage technique on postpartum dairy cows from 40-60 days. Collected samples were centrifuged and a drop of sediment was streaked onto a clean microscopic slide and stained with giemsa. The percentage of polymorphonuclear cells (neutrophils) was calculated. It was found that increase in the number of neutrophils correlated with decrease in pregnancy. The incidence of subclinical endometritis was different in small, medium and large scale dairy farms 25 (37.88%), 29 (43.94%) and 13 (18.18%), respectively. The mean number of services per conception was found as2.04 for subclinical endometritis positive cows. In the present study endometrial cytology revealed that the PMN count of 3% and above was suggestive for subclinical endometritis. In conclusion, subclinical endometritis diagnosed by endometrial cytology was associated with reduced rate of pregnancy.

Keywords: Endometrial Cytology, Neutrophiles, Pregnancy, Subclinical Endometritis

INTRODUCTION

Subclinical endometritis is a chronic, unapparent inflammatory process of endometrium with a relatively high proportion of polymorphonuclear cells (Neutrophils) cells in the uterus, which suppresses the fertility of affected cows. Proportion of polymorphonuclear cells (Neutrophils) cells considered to be “relatively high” depends on sampling technique as well as on the time from parturition (Sheldon et al., 2006). The key for excellent fertility in dairy herds is a healthy uterine environment, optimal estrus detection efficiency and ideal timing for breeding (LeBlancm et al., 2002). Subclinical endometritis in dairy cows and has a profound negative impact on pregnancy (Hammon et al., 2006).

Recent studies have focused on a more sophisticated diagnosis of endometrial alterations beyond clinical signs of endometritis. New techniques have been described for the diagnosis of subclinical endometritis (SE). The inflammation of the endometrium is characterized by the proportion of polymorph nuclear cells (PMN) in a cytological sample taken from clinically healthy cows. Cytological samples can be obtained by flushing the uterine lumen or by using the cytobrush technique (Sheldon et al., 2006). This latter technique uses a small brush that is inserted into the uterus to collect endometrial cells and to determine the proportions of PMN in the sample. Studies on SE found a prevalence of SE in the range between 12 % and 94 %. Different study designs and inconsistent definitions for SE hinder a valid comparison of the results of these studies. The time of examination in these studies varied from 21 to 60 day of postpartum (Gilbert et al., 2005).

Subclinical endometritis causes considerable infertility problems in the presence of uterine bacterial contaminations of disrupt the delicate hormonal milieu of the hypothalmia-pitutary ovarian axis and disrupt follicular growth and development of uterine infections have been reported to be associated with an increased incidence of cystic ovarian disease (Andrew et al., 2006).

Postpartum endometritis in cattle is a multifactorial disease with high economic impact. Inflammation of the bovine uterus has been demonstrated to decrease fertility. Both clinical and subclinical endometritis were associated with increased days to first service as well as decreased conception and pregnancy rates resulting in an increased risk of culling (Perea et al., 2005). The objective of this study was to diagnose subclinical endometritis and its effects on pregnancy in dairy cows.

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MATERIALS AND METHODS

Study area

The study was conducted in urban and peri urban areas of Gondar town dairy farms which are located North West part of Ethiopia in Amhara regional state. Gondar town is found about 727 km from the capital city Addis Ababa. It is located at latitude, longitude, altitude of 12.3-13.8^{o}N, 35.3-35.7^{o}E and 2200 m.s.l, respectively. The annual mean minimum and maximum temperature of the area vary between 12-17^{o}C and 22-30 ^{o}C, respectively. The area is located under woynadega, agro-climatic zone and receives a bimodal rainfall the average annual precipitation rate being 1000 mm that comes from the long and short rainy seasons. The short rainy season occur during the months of March, April and May while the long ones extend from June through September (CSA, 2008).

Study farms

The dairy farms considered for this study were categorized into defined strata based on cow herd size; these were small scale dairy farm (SSDF), medium scale dairy farm (MSDF) and large scale dairy farm (LSDF) having 1or 2, 3 to 10 and 11 to above as described by ILRI (1996), respectively. During the study period 147 apparently healthy 3rd trimester pregnant cows were selected.

Study design

Cows were selected in smallholder, medium and large scale dairy farms and the study was conducted from January 2012 to September 2013. The owners of the farms were informed about the relevant characteristics of the study and agreed with the design. The dairy farms were visited every 15 days. Enrolment of cows, clinical examination and evaluation were performed by the same investigator. The cows were examined by using lavage between 40 and 60 days postpartum for the presence of sub clinical endometritis. Endometrial cells were collected by uterine lavage technique.

Clinical examination

In each cow a clinical examination of the reproductive tract was performed by vaginal examination and transrectal palpation of the uterus and the ovaries. Cows with vaginal discharge were diagnosed as affected by clinical endometritis and excluded from the study. In addition, cows which had received systemic or intrauterine antibiotic therapy within 6 days prior to enrollment were not selected for the study. Pregnancy diagnosis was performed by transrectal palpation of the uterus and its contents post insemination.

Cytological samples

The cows were examined between 40 and 60 days after calving for the presence of subclinical endometritis by using the lavage technique. Collected samples were centrifuged and a drop of sediment was streaked onto a clean microscopic slide and stained with Giemsa. Subclinical endometritis was determined using endometrial cytology (Gilbert et al., 2005; Kasimanicham et al., 2005). To minimize contamination of the sample, the vulva and perineum were cleaned with water and soap properly. The uterus was lavaged by infusing 50 ml of 0.9% sterile sodium chloride solution with 50 ml syringe attached to a 52 cm sterile plastic infusion rod. The uterus was then manipulated and massaged through rectum for about 10 seconds, and some of the infused fluid was aspirated into the syringe via the same sterile plastic infusion rod by negative pressure aspiration and retracted to recover the fluid. No special effort was made to retrieve the fluid if it did not flow freely.

As much fluid as possible was recovered by negative pressure aspiration into the syringe and transferred to the 10 ml sterile test tube without any preservative. The uterine samples were put into the icebox and brought to the Faculty of Veterinary Medicine, Microbiology laboratory within 2 hours of collection and centrifuged at 800 rpm for 5 min. A drop of sediment was streaked on to a clean microscope slide and air-dried. Then the slide was fixed with methanol and stained with Geimsa for 45 min and examined under a microscope at 400× magnification. Initially the whole slide was assessed and a representative area was selected to determine the PMN % among all other cells was estimated. The percentage of neutrphils PMN % was determined by counting 80–100 cells on a representative field of vision. The threshold value for the proportion of PMN indicated samples with ≥3% neutrophils were categorized as subclinical endometritis and cows were characterized as suffering from subclinical endometritis. The counted cells contained epithelial cells, neutrophils, large mononuclear cells (Presumed to be macrophages) and small mononuclear cells (Presumed to be lymphocytes). The samples that did not contain epithelial cells were considered not taken from uterus and rejected for the study.

Data management and statistical methods

To measure the impact of subclinical endometritis on subsequent pregnancy descriptive statistics for the amount of neutrophils were used. The data was analyzed using statistical package for social science (SPSS) (Version

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18). The Generalized Linear Model was utilized to analysis the effect of selected factors on the amount of neutrophils. Multiple logistic regression and Kaplan-Meier survival analysis were applied to analysis the relationship between the amount of neutrophils and the conception rate in the first insemination after sampling. The Pearson correlation test and the Chi-square correlation test were used to analysis the impact of quantitative factors on each other and the impact of qualitative factors on each other respectively. The student T test was used to analysis the impact of quantitative factors on qualitative factors and vice versa. A probability of $P < 0.05$ was set as the significance level. The Receiver Operating Characteristic (ROC) analysis was applied to determine the most appropriate cutoff point for percentage of neutrophils in samples.

RESULTS AND DISCUSSION

The incidence of subclinical endometritis was different in small, medium and large scale farms 25 (37.88%), 29 (43.94%) and 13 (18.18%), respectively. Only 72 (48.98%) of the selected cows became pregnant in AI after sampling, and 75(51.02%) did not. The amount of neutrophils was lower in the cows that became pregnant in the first AI after sampling. With an increase in the number of neutrophils the likelihood of pregnancy decreased. The mean number of services per conception as 2.04 for sub clinical endometritis positive cows. The horizontal line in the box was median (The middle of the entire list of numbers). Down edge of the box was first quartile (The middle number in the first half of the data set) and up edge of the box was third quartile (The middle number in the second half of the data set). Median, first quartile, and third quartile of pregnant cows are lower than those of non-pregnant cows.

The descriptive statistics for pregnancy were shown in Table 2, separated by different amount of neutrophils. The receiver operating characteristics (ROC) analysis revealed that the best cut off point (based on likelihood of pregnancy) was as follows: cows with < 3% neutrophil considered normal and cows with > or =3% neutrophil considered to have SE. Based on this cutoff point, the overall incidence of SE indairy cows was 46% (67/147) in this study. Sensitivity and specificity are 81.3 and 97.2%, respectively, based on the selected cut off point for like likelihood of pregnancy. Subclinical endometritis had a negative impact on conception rate in the first AI after samplings, which were 10% for cows with SE and 55% for cows without SE.

In the present study endometrial cytology revealed that the PMN count of 3% and above was suggestive of subclinical endometritis. The samples which ranged from 3% to 15% of PMN cells could be correlated with subclinical cases of endometritis. Hence, the endometrial samples which contain PMN cells of 3% and above were considered as positive for subclinical endometritis.

In the present study on endometrial cytology has shown that the PMN count of 3% and above was indicative of subclinical endometritis. Similarly, in subclinical endometritis, the PMN cells were found to range from 4% to 18% (Barlund et al., 2008). Gabler et al. (2009) also reported that with ≥5 % PMN cells in the endometrial samples were considered as subclinical endometritis. Those earlier studies clearly indicated that 4% and 5% of PMN cells in endometrial cytological samples might be considered as "cytological marker" or "cytological indicator "for diagnosing subclinical endometritis, while in the present study PMN count of 3% and above may be considered as subclinical endometritis indicated.

Table 1 - Descriptive statistics for the number of neutrophil.

Number of neutrophil	Frequency	Percentages
0	81	55.11
1	2	1.36
2	1	0.68
3	8	5.44
4	9	6.12
5	3	2.04
6	5	3.40
7	2	1.36
8	6	4.08
9	4	2.72
10	3	2.04
11	2	1.36
12	5	3.40
13	6	4.08
14	7	4.77
15	3	2.04
Total	147	100

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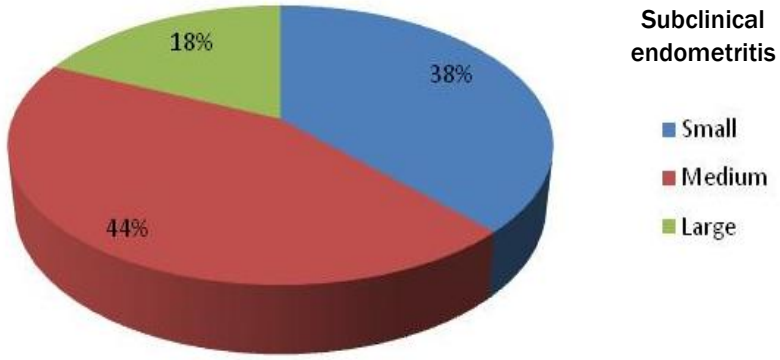

Figure 1 - Percentage of subclinical endometritis in different scale of farms.

Table 2 - The descriptive statistics for pregnancy, separated by neutrophil percentages

Amount of neutrophil	Pregnancy		
	-	+	Total
0	13	68	81
1	1	1	2
2	-	1	1
3	7	1	8
4	8	1	9
5	3	0	3
6	5	0	5
7	2	0	2
8	6	0	6
9	4	0	4
10	3	0	3
11	2	0	2
12	5	0	5
13	6	0	6
14	7	0	7
15	3	0	3
Total	75	72	147

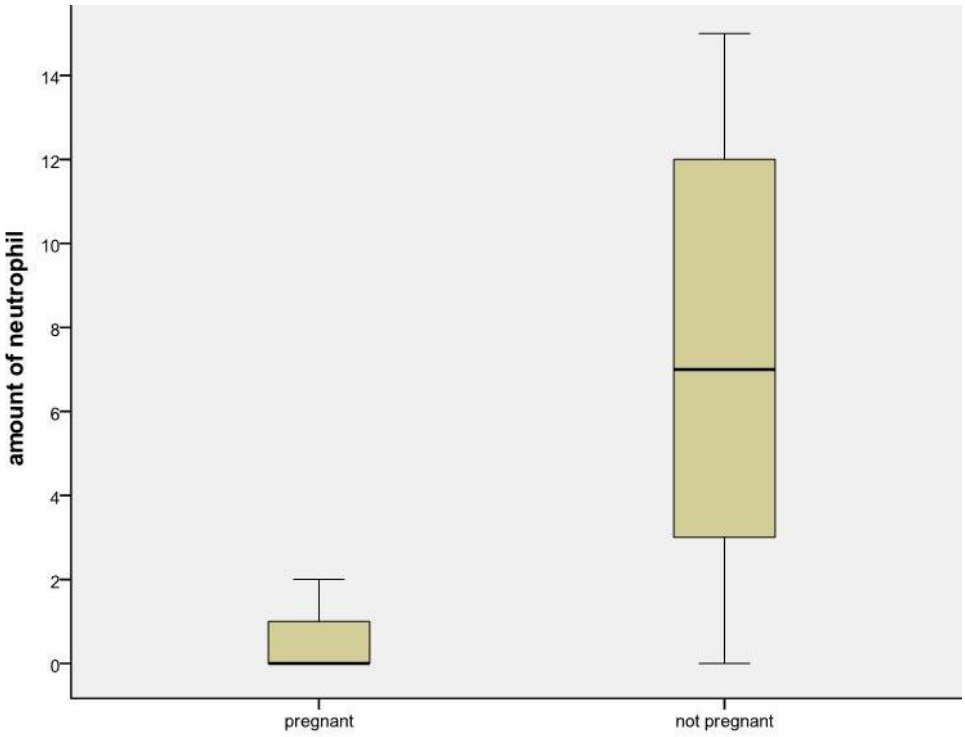

Figure 1 - The correlation between pregnancy and the amount of neutrophils.

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The current study revealed an overall incidence of 46% (67/147) of subclinical endometritis infection in dairy cows with a PMN level of ≥3 neutrophiles in the uterine sample which is set as a threshold value indicative for SCE which was in accordance with the earlier studies by Belachew and Fekadu (2009) in DebreZeit when prevalence of 47.5% and 30.5%. However, in the cited study samples were taken 4 and 8 weeks postpartum period separately whereas samples in this study were taken 40-60 days postpartum cows together. Gilbert (2006) in USA reported a prevalence of subclinical endometritis of 53% at 40 to 60 days postpartum and Couto et al. (2009) in Québec which was the prevalence of subclinical endometritis of 56%. In other studies, subclinical endometritis has been reported as 43% for cows between 20 and 33 days in milk, 45% for cows between 34 and 47 days in milk (Kasimanicham et al., 2005). The reason for the difference in the prevalence of SCE observed in the current study and earlier studies could be due to the difference in the management system of dairy cows.

The prevalence of subclinical endometritis is very variable and depends on the diagnosis technique; the DIM of the genital examination and the statistical method used to determine the cut-off point of the neutrophils ratio obtained from endometrial cytology (Guidry, 1976). The incidence of SCE in this study was 46% also higher than the prevalence of 13.4% SCE reported by Kaufmann et al. (2010) in Germany. However, samples in this study were taken 4 up to 8 weeks postpartum period. The higher incidence of SCE in this study compared to the above cited study could be the difference in the time of sampling. The incidence of SCE in primiparous dairy cows was 40.38% which is lower than multiparous dairy cows of 48.42%. This disagreed with Belachew and Fekadu (2009) who have reported that in DebreZeit in which first calf heifers seemed to have a tendency for SCE more often than multiparous cows at week 8 postpartum. Drilich (2006) has also reported a higher prevalence in primiparous cows which may be due to less exposure of their uterine environment to microorganism. Kaufmann et al. (2010) reported that in which the prevalence of SCE was in primiparous cows 7.8% than in multiparous cows 15.2%.

This study also shows a negative effect of subclinical endometritis on pregnancy; out of 67 subclinical endometritis positive dairy cows only 7(9.72%) cows were pregnant. This is in agreement with Belachew and Fekadu (2009) who reported 15.3% were pregnant from DebreZeit.

CONCLUSION AND RECOMMENDATIONS

This study revealed that subclinical endometritis was more prevalent in MSDF followed by LSDF and SSDF. The percentage of neutrophils was lower in the cows that became pregnant in the first AI. An increase in the percentage of neutrophils decreased the likelihood of pregnancy. The best cut off point (based on likelihood of pregnancy) of healthy cows was found to be < 3% neutrophil and cows with > or =3% neutrophils had subclinical endometritis.

Subclinical endometritis subsequently decrease pregnancy in cows. So, herds should be managed properly after postpartum. The results of this study indicate that endometrial cytology can be a useful technique in identification of cows with subclinical endometritis. Subclinical endometritis in postpartum dairy cows resulting in substantial economic losses due to decreases in both milk production and fertility. Make sure the place where an animal gives birth is clean and dry. Do not always use the same place without cleaning it up. Wash your hands and arms carefully with soap or disinfectant before putting them into an animal to help with a birth. You can cause infection if your hands and arms are not clean.

DECLARATIONS

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Author's contribution
Planning and preparing the research design, performed the literature review, collected and analyzed the data drafted and finalized the manuscript. Eventually, the author read and approved the final manuscript.

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Conflict of interest
The author declare that there is no conflict of interest.

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RELATIONSHIP BETWEEN EGGS SHAPE INDEX AND EMBRYONIC MORTALITY

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✉*Supporting Information*

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ABSTRACT: **The study was conducted to assess the effect of eggs shape on hatchery parameters. The eggs shape (SI) is a critical tool to investigate the outcome from eggs during incubation. In this experiment three groups of good quality intact eggs (each n= 500) having thick shell without any kind of contamination were collected from three different broiler breeders' farms SP117 (Ross), SSF (Ross) and SP 118 (Ross). The manage mental and incubation conditions were same for all three groups. The SI was measured and maximum deviation from standard was found for SP117 (80.94±0.04^a, 78.46±0.07^b, 76.57±0.04^c) then SSF and SP118 respectively. Due to SI deviation hatchability % (78.25±0.01^a, 81.17±0.09^b, 91.35±0.07^c), candling% (8.67±0.02^a, 9.36±0.06^b, 4.71±0.09^c), dead in shell % (13.08±0.10^a, 6.94±0.03^b, 3.94±0.07^c), chick yield % (67.31±0.09^a, 68.24±0.01^b, 69.10±0.05^c), hatch window hrs (28-30±0.03^a, 24-26±0.07^b, 22-24±0.03^c) were significantly different for SP117, SSF and SP118 respectively. Water loss was significantly higher (P<0.05) for SP117 (12.01±0.03^a) as compare to SSF and SP118 (11.89±0.04^b, 11.87±0.04^b). The effect of eggs shape index was also found on mal-position and mal-formations. The maximum dead and cull chicks 0.5% were found for SP117 as compare to SSF or SP118. Similarly mal-position head in small of eggs and feet over head were found maximum for SP117 0.3% and 0.8% respectively. The maximum mal-formation ectopic viscera 0.7 % and excess albumin 0.5% was found for SP 117 as compare to SSF or SP118. The maximum dead in shell, mal-position and mal-formation were found for SP 117 due to maximum deviation from SI as compare to SSF or SP118. Eggs shape Index is a good tool to access the quality of eggs.**

Keywords: **Dead in shell, Hatchability, Mal-Position, Mal-Formation, Shape Index**

INTRODUCTION

Several studies have been conducted to investigate the effect of egg quality characteristics on hatchability parameters and significant relationship between fertility rate and late embryonic mortality was found in the shape index of different group's eggs (Aci et al., 2015). Eggs shape depends upon anatomical structure of hen, particularly of the oviduct, internal organ distribution and shape of pelvic bones (King'ori, 2012). The egg shape index is the ratio betweenmaximum egg width with maximum egg length (Narushin and Romanov, 2002), and represents a numeric value of egg shape (Alasahan and Copur, 2016) conducted experiment to investigate the effect of egg shape index on hatchability and found that egg shape index has effect on early embryonic mortality and there is no influence of egg shape index on mid or late embryonic mortality, chick weight and body weight during 1-5 weeks. There is no influence of egg shape index on embryonic mortalities (middle and late), chick weight, and body weight during 1-5 weeks. King'ori (2012) suggested that hatchability parameters are achieved when normal shape eggs are greater than abnormal shape eggs. This is due to change of axial position of embryo in normal shape eggs during advance stages of embryonic development. In chicken eggs, the head of embryo moves towards the blunt end of the egg on day 14 and acquire a position parallel to the egg axis. According to Duman et al. (2015) the eggs can be classified with respect to shape index (SI) namely as sharp egg (SI<71), a normal (standard) eggs (SI= 72-76) or a round eggs (SI>76). The present study aimed to evaluate the effect of egg shape index (SI) on mal-position, mal-formation including hatchability parameters.

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MATERIALS AND METHOD

Ethical approval

This experiment was a routine field work in hatchery considering all rules and regulations regarding animal rights and ethic, university of veterinary and animal sciences, Lahore, Pakistan.

Eggs Collection

Fertile eggs from three different breeders farms SP117 (Salman Poultry Flock no.117 Ross n=500), SSF1 (salmansadiq Flock no.1 Ross n=500) and SP 118 (Sadiq Poultry Flock no.118 Ross n=500) were collected.

Measurement of Eggs Shape Index

Eggs shape index (SI) was measured as described by Duman et al. (2015) and Measurements of egg length *(L)* and width (W) were taken with a Vernier Caliper to the nearest 0.01 mm. The eggs shape index (SI) was determined from these measurements according to Reddy et al. (1979) and Anderson et al. (2004) as given with the following formula,

$$SI = \left(\frac{W}{L}\right) x100$$

According to this formula eggs were classified with respect to shape index (SI), namely as a sharp egg (SI < 72), a normal (standard) egg (SI = 72–76) or a round egg (SI > 76).

Incubation Profiles

Eggs from all three flocks were incubated separately in single stage incubator with age wise incubation profile. Similar incubation conditions were provided to all eggs in hatchery to minimize the effects of hatchery conditions (Jabbar et al., 2017).

Dead in Shell Analysis

The incubation duration and hatch pulling and dead in shell analysis were performed as described by Jabbar et al. (2017). The unhatched eggs were broken initially dead embryo were classified into early, mid or late embryonic mortality then further classified to mal-position and mal-formation according to (Jabbar et al., 2017; Aviagen).

Data Assessment and Statistical Analysis

Hatching parameter data of the egg shape index groups were analyzed using the Chi-square test.

RESULT AND DISCUSSION

The egg shape index for three flocks were significantly ($P<0.05$) different. The highest SI was found for SP117 that means it contain round or misshape eggs as compare to SSF1 or SP118. The hatchery parameters were affected. The hatchability, candling, dead in shell, chick yield and hatch window were significantly ($P<0.05$) better for SP118 which has standard SI then SSF1 as compare to SP117 (Table 1). The water loss was also significant different for SP117 as compared to SSF1 and SP118.

Narushin et al. (2002) conducted experiment to investigate the effect of eggs physical characteristics on hatchability and found that eggs with normal shape index hatches more as compare to abnormal shape index. This probably results from the fact that the embryo changes its axial orientation in the egg at the later stages of embryonic development. Due to eggs abnormal shape it's difficult for embryo to change its axial orientation in the egg results in more dead in shell. That's why SP117 has more dead in shell as compare to SSF and SP118. The maximum late embryonic mortality was found for SP117 as compared to SSF or SP118 (Figure 1). The effects of egg shape index on hatching parameters are presented in Table 1. The egg shape index affected the hatchability of fertile eggs ($P<0.01$) and early embryonic mortality rate ($P<0.05$).

Deviation from standard shape index was also responsible for mal-position and malformation during late embryonic growth. The maximum dead and cull chicks 0.5% were found for SP117 as compare to SSF or SP118. Similarly mal-position head in small of eggs and feet over head were found maximum for SP117 0.3% and 0.8% respectively (Figure 2). There are lot of reasons for mal-position like eggs were set upright, with small end up, advance breeder hen age and shell quality problem, eggs turning frequency and angle were not adequate, inadequate humidity, insufficient ventilation, feed mycotoxins, exposure to lower temperature during later stages of incubation and round shape or overly large eggs (Sumi et al., 2014). That's why maximum mal- positions were found for SP117 due to maximum deviation from standard SI Table 1. Studies have found that the incidence of embryos unable to hatch due to mal-positions varies from 1.2 to 1.8%, with an average of 1.5%.

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Table 1 - Effect of Eggs shape Index on Hatchery Parameters

Parameters	SP117	SSF1	SP118
SI %	80.94±0.04[a]	78.46±0.07[b]	76.57±0.04[c]
Hatchability %	78.25±0.01[a]	81.17±0.09[b]	91.35±0.07[c]
Candling %	8.67±0.02[a]	9.36±0.06[b]	4.71±0.09[c]
Water loss %	12.01±0.03[a]	11.89±0.04[b]	11.87±0.04[b]
Dead in shell %	13.08±0.10[a]	6.94±0.03[b]	3.94±0.07[c]
Chick yield %	67.31±0.09[a]	68.24±0.01[b]	69.10±0.05[c]
Hatch window hrs	28-30±0.03[a]	24-26±0.07[b]	22-24±0.03[c]

a-bdenote difference significant difference within rows for three groups (P < 0.05)

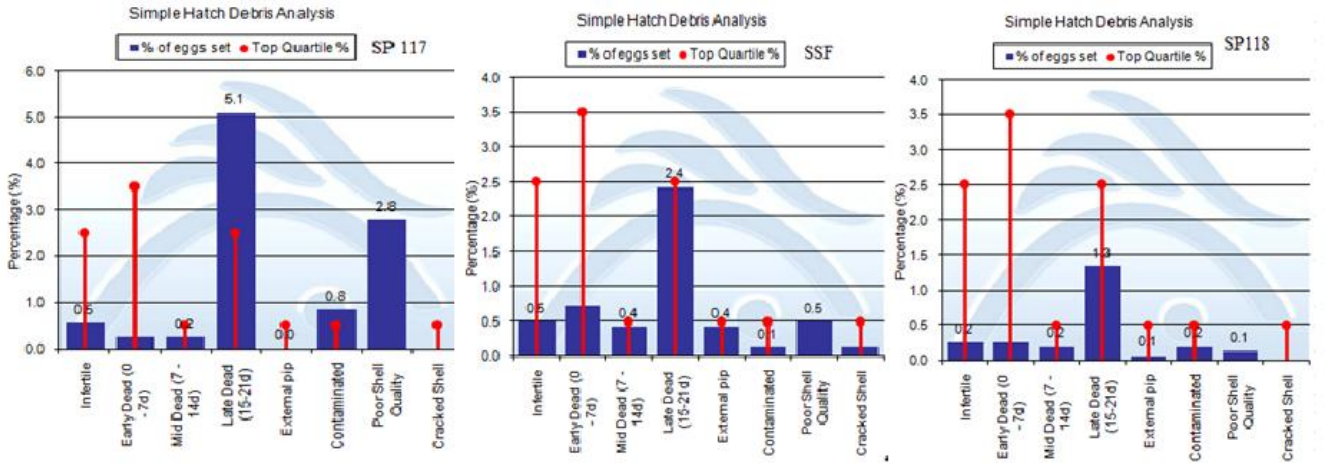

Figure 1. Effect of Shape Index on Early Mid and Late Embryonic Mortality

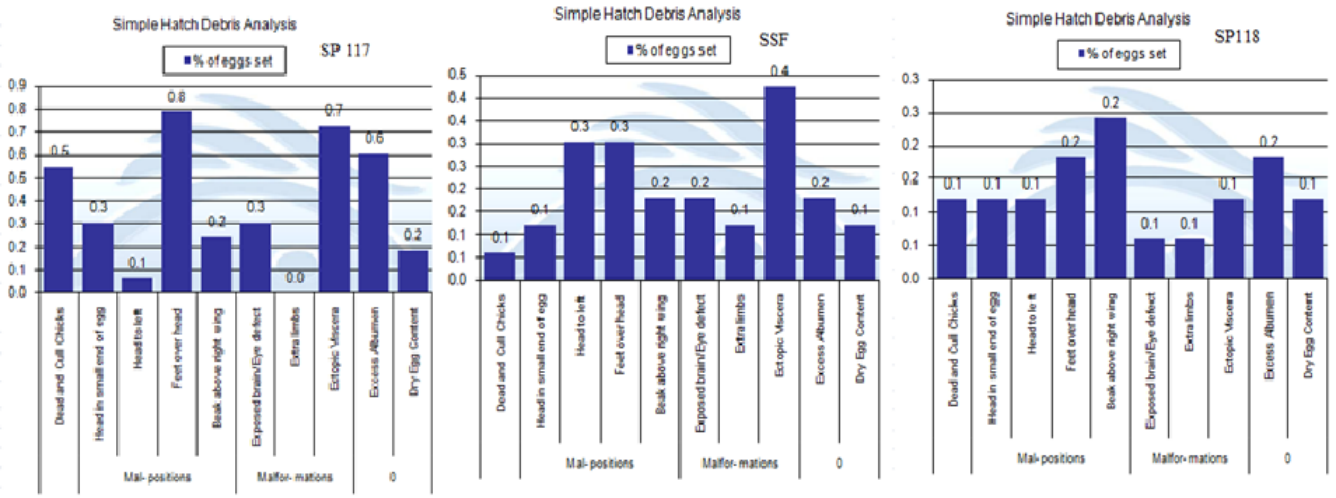

Figure 2. Effect of Shape Index on Mal-position and Mal-formation

During embryonic development there is a predictable incidence of embryo that die or not able to hatch due to mal-formation or deformities. The percent of deformed embryos ranged from 0.22 to 0.30% of the total hatch (Butcher et al., 2002). The common mal-formation or deformities are exposed brain/eyes defects, extra limbs, ectopic viscera, excess albumin and dry eggs content (Figure 1) which are mostly due to improper incubation temperature or due to certain contaminations (Jabbar et al., 2017). The maximum mal-formation ectopic viscera 0.7 % and excess albumin 0.5% was found for SP 117 as compare to SSF or SP118. The maximum dead in shell, mal-position and mal-

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formation were found for SP 117 due to maximum deviation from SI as compare to SSF or SP118. So, deviation from standard SI may result in increase of dead in shell, mal-position and mal-formation.

CONCLUSION AND RECOMMENDATION

Eggs shape index is a critical factor to achieve standard hatchery parameters. Deviation from standard SI, may results decrease in hatchability and increase in dead in shell along mal-position and mal-formations.

DECLARATIONS

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Author's contribution

Dr. Adnan Jabbar Ansari was main author responsible for tabulation of experimental data and article writing. Dr. Yasir Allah Ditta, Dr. Abdul Hameed and Dr. Amjad Riaz helped in data collection and statistical application.

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Conflict of interest

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

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REVIEW ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF INDIGENOUS DAIRY CATTLE BREEDS UNDER FARMER'S MANAGEMENT PRACTICES IN ETHIOPIA

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ABSTRACT: **The aim of the review is to summarize the Productive and reproductive performance of different indigenous dairy cattle breeds under farmer's management practices. Ethiopia is the home of large numbers of livestock due to having varied and extensive agro-ecological zones. From the total annual milk produced cattle milk, is the most prominent compared to other livestock species in Ethiopia. Numerous finding showed that calving interval, daily milk yield, lactation length and age at first calving are one of the major measures of productive and reproductive performance parameters for dairy cattle production. Different report indicated that productive and reproductive performances of cattle are very poor due to varied factors; the causes for low performances of dairy cattle were genetic and environmental factors like feeding, housing and health care. In Ethiopia most of (98.20%) cattle breeds are local breeds the remaining (1.8%) are hybrid and exotic breeds. Then, the genetic performances of these breeds are poor, even though they have good adaptation in harsh environmental conditions. So, training and awareness creation should be given particularly to the farmers on major management practices like feeding, housing and health care and genetic improvement strategies should planned and practiced.**

Keywords: **Dairy, Ethiopia, Productive performance, Management, Reproductive performance**

INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa (CSA, 2017). The varied and extensive agro-ecological zones and the importance of livestock in livelihood strategies make Ethiopia home to large numbers of livestock. Indeed, Ethiopia has the largest livestock inventory in Africa, 59,486,667 cattle (CSA, 2017). Out of this total cattle population, the female cattle constitute about 55.5 percent and the remaining 44.5 percent are male cattle. Eighty-three percent of all milk produced in Ethiopia comes from cattle with the remainder coming from goats and camels (MoARD, 2007). Which is lower than the report of CSA (2011) and CSA (2017) cows contribute to about 95% and 94.6 % of the total annual milk produced compared to other livestock species, respectively.

Despite the largest cattle population in Ethiopia productive and reproductive performances are very poor (Yosefe et al., 2003; Belay et al., 2012 and Melku et al., 2016). Similarly, Niraj et al. (2014b) and Nibret et al. (2014) reported that reproductive performance of dairy cows was found to be less than the optimum values desirable for profitable milk production in different parts of Ethiopia. According to Belay et al., (2012) the cause for low performances of dairy cattle might be genetic and environmental factors like feed shortage, low level of management, lack of access to land, disease, lack of proper poor breeding management such as lack of accurate heat detection and timely insemination might have contributed considerably to long days open (postpartum anestrous), late age at first calving, long calving interval, short lactation length and low milk production. This is in line with ILCA, 1990; Perera, 1999 and Zegeye, 2003 revealed that productive and reproductive performance of dairy cattle is influenced by genetics, disease feed and other management practices.

Productive and reproductive traits are crucial factors determining the profitability of dairy production (Fikire Lobago et al., 2007). Similarly, production and reproductive performance traits are mattered for being successful or bankruptcy of dairy farm enterprises as these traits are major importance in dairy production (Saeed et al., 1987). Which is similar with the report of Cavestany et al., 2001 and Pursley et al., 1997 that showed calving interval, daily milk yield, lactation length and age at first calving are one of the major numerous measures of production and reproductive performance parameters for dairy cattle production. However, there is limited information on regarding to reproductive and productive performance of local cattle in Ethiopia. Therefore, having information on performances productive and reproductive of local cows in Ethiopia would help to suggest the future genetic and non genetic improvement options for the producers to enhance profit.

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Production performance of indigenous dairy cattle

Daily milk yield. According to Zereu and Lijalem, 2016 reported that the average daily milk yield per cow in rural community of Wolaita Zone, Southern Ethiopia was 1.989 ± 0.063 liters. Which was in approximate to the results of studies conducted by Dessalegn (2015), Brokken and Senaite (1992), Mugerwa et al., (1983), Azage et al., (2003), Kebede (2006), CSA (2013) and CSA (2017) from different part of the country who had reported that 2.06 ± 0.5, 2.0, 2.19, 2 ± 0.07, 1.8, 1.32 and 1.37 litres/cow per day, respectively. However, their finding is less than the report of Merha (2006) that indicated the daily average milk yield of Abergele cattle to be 0.75 liters. The value of average daily milk yield obtained from the study of Zereu and Lijalem (2016) was significantly lower than values obtained from Minale and Yilkal (2015) in southern Ethiopia who reported that consecutively 2.4, 3.0, 2.6 for 1st, 2nd, and 3rd lactations in Chencha and 2.07, 2.6, 2.6 for 1st, 2nd, and 3rd lactations in average milk yield per day per cow in liters for local breeds in kucha areas. Generally, the local or indigenous cattle have different milk yield performance under different production systems. The difference in different finding may be attributed to difference in location and management practices.

Dairy production is a critical issue in Ethiopia livestock-based society where livestock and its products are more important sources of food and income, and dairying has not been fully exploited and promoted. The daily milk yield of local breeds has been recorded by Zewdu, (2004) that revealed one Fogera cow gives 1.39 liters minimum and 4.63 liters maximum in a day. In contrary to this the average daily milk yield of exotic cows was 8.78 ±2.76 and 5.83 ±0.57 for the urban and peri-urban areas respectively. In addition to this, the average daily milk yield of local cows was 2.56±1.12 and 1.87±0.79 for the urban and peri-urban areas respectively (Gebrekidan et al., 2012). The milk production levels also vary between different dairy breeds. On average, crossbreed cows produces 8 liters per day per cow and the indigenous one produces 2 liters per day per cow (Zewdu, 2004; Adebabay, 2009). Another study conducted in North Showa zone indicates that 50% crossbreeds (1511.5 L) produce more amount of milk than local breeds (457.89 L) per lactation (Belay et al., 2012). Mulugeta and Belayneh (2013) reported that mean milk production per lactation between Horro and Holstein Friesian was 2333.63 L. This could be either due to complementary or heterosis effect to the achievable environment. A number of production constraints are seriously affecting smallholder dairy production. In addition to already highlighted lack of capital to acquire the crossbreeds, many farmers face difficulties in getting full information on the breeds they are going to buy. Other factor hampering milk production include inadequate feed base, high cost of bought-in feeds, shortage of cash to buy concentrate feeds (Zewdu, 2004; Anteneh, 2006). Milk yield performance of cows as reported by farmers varies across the different dairy production systems in the study area, mainly due to differences in breed and management (Azage et al., 2013).

Reproductive performance of indigenous dairy cattle

The reproductive performance of the breeding female is probably the single most important factor that is a prerequisite for sustainable dairy production system and influencing the productivity. Number of services per conception, days opens till conception and calving interval are important reproductive traits which are crucial for determining the profitability of dairy production (Nibret and Tadele, 2014). The reproductive efficiency of a dairy herd can be measured in several ways, such as by measuring pregnancy rate, percentage of cows calving each year, average calving interval, average number of days dry, and number of live calves born each year. Although each of these measures affects the profitability of the dairy business in a slightly different way, the calving interval affects both the total milk production of the dairy herd and the number of calves born. In most modern dairies, the general practice is to breed cows early, with the aim of establishing a calving interval of 12 to 13 months, which is considered optimum; hence, calving interval is considered an important index of reproductive performance (Roberts, 1986; Arbel et al., 2001).

Lactation length

The lactation performance of dairy cattle is usually measured by determining the total milk yield per lactation or per year, average daily milk yield, lactation length, lactation persistency, and milk composition. Generally, the reproductive performance and lactation performance of dairy cattle are closely associated with each other. Breeding failure has a clear negative influence on milk production and farm income and determines the future sustainability of a dairy farming operation. Milk production level and lactation persistency are crucial factors determining the appropriate calving interval (Arbel et al., 2001). On the other hand, the costs of fertility depend on the stage of lactation and the shape of the lactation curve. Cows normally have a lactation curve that loses 8 to 10% per month after the peak, but those rare animals whose production declines by only 4% or so may make a longer calving interval justified (Esslemont, 2003).

Gestation length, which is more or less constant, varying slightly due to breed, calf sex, litter size, dam age, year, and month of calving and little can be done to significantly manipulate the gestation length (Fikre et al., 2007).

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Lactation length of indigenous cattle increased when crossed exotic blood level. For example, the average lactation length of indigenous Arsi, Zebu and Boran breeds was 203.75 days while the average lactation 9 length of their 50, 75 and 87.5% cross were 262.25, 284.25, and 294.25 days respectively. Similarly, another study conducted in North Showa zone indicated that local breeds (273.9 days) had shorter lactation length than crossbreeds (333.9 days) (Mulugeta and Belayneh, 2013). In most dairy units, a lactation length of 305 days (10 months) is commonly accepted as a standard. However, such a standard lactation length might not work for dairy cows in the urban and peri urban areas of East Africa. Both (Msanga et al., 2000) in Tanga and (Yoseph et al., 2003) in Addis Ababa reported shorter (8.8 to 9.7 months) and longer (11.1 months) lactation lengths in urban and peri urban dairy units respectively. However, Ayenew et al., (2009) had different observations in which dairy cows in urban dairy units had longer (11.2 months) lactation lengths compared to cows kept in peri urban dairy units (7.5 months). Average lactation lengths in months (Mean ±SD) of local, cross and exotic breed were 6.5±1.63, 7.48±1.69, 8.82±1.97 and 7.20±2.50, 7.89±2.05 and 6.60±3.20 urban and peri urban areas, respectively (Gebrekidan et al., 2012). The overall average lactation length in months for crossbred cows in urban and secondary town farms in the Adama milk shed was 10.9 ± 0.1 and 11.0 ± 0.1, respectively(Nigusu and Yoseph, 2014). An extended lactation period has practical implications to the dairy farmer as it provides compensation for the extended calving interval (Fikre et al., 2007). Nevertheless, the profitability of short or extended lactation length depends on lactation persistency.

Calving interval

CI has two components: 1) calving-to-conception interval (CCI) or days open, which is considered to be the most important component determining the length of the calving interval, and 2) gestation length, which is more or less constant, varying slightly due to breed, calf sex, litter size, dam age, year and month of calving, and little can be done to significantly manipulate the gestation length (Mukasa-Mugerwa et al., 1991). The CCI itself is influenced by cow and management/environment-related factors, such as method and efficiency of heat detection, type and efficiency of breeding service and the ability of the cow to resume regular ovarian cyclicity after calving, display an overt heat signs, and conceive with the given service. The gap between two successive calving is called calving interval (Mulugeta and Belayeneh, 2013). The overall mean calving interval of local and crossbreed dairy cows place of work was found to be 23 ± 4.3 months of which for local cows 24.94 ± 4.1 13 months and for crossbred 22 ± 4.4 months, the overall calving interval was prolonged, and on the other hand, crossbreed cows calving interval was shorter and better than local cows (Mulugeta and Belayeneh, 2013) local cow in North Shoa zone. Calving interval is an important factor in measuring the breeding efficiency and directly correlates with the economics of milk production. Reproduction in dairy cows with regular and shorter calving interval (365-420 days) is a key feature for the rapid multiplication of the breeding stocks. However, studies in urban and peri urban areas of East Africa have reported long calving intervals (406 to 562) for dairy cattle. Long calving interval is a common problem in urban and peri urban areas and it is linked to poor body condition score and mineral deficiency especially inorganic phosphorus (Swai et al., 2005b). The long mean calving intervals result into low calf crop and low level of production.

Age at first service

According to Gidey (2001), age at first service (AFS) is the age at which heifers attain body condition and sexual maturity for accepting service for the first time. Age at first service signals the beginning of the heifer's reproduction and production and influences both the productive and reproductive life of the female through its effect on her life time calf crop. Age at first service is influenced by genotype, nutrition and other environmental factors (Zewdie, 2010). This reported an earlier age at puberty for F1 Friesian crosses than for indigenous zebu breeds. Age at first service was reported to be 44.8 months for Fogera breeds (Giday, 2001); In addition, age at first service reported in Ethiopia include about 53 months for highland Zebu (Zewdie wondatir, 2010), 55 months for Horro cattle (Zewdie wondatir, 2010), 53.9 months for Boran cattle inseminated artificially (Ababu, 2002) and 34.4 months for Ogaden cattle (Getinet, 2005). AFS crossbreed cow was reported by (Nibret, 2012) 15.3±0.23 and 15.5±0.24 urban and periurban respectively in Gondar and higher was recorded 24.9±3.8 Asella Towen (Hunduma, 2013).The desirable age at first calving in local breeds is 3 years and 2 years in crossbreed cattle. Prolonged age at first calving will have high production in the first lactation but the life time production will be decreased due to less no of calving. If the age at first calving is below optimum, the calves born are weak, difficulty in calving and less milk production in first lactation (Nerja and Kbrom, 2014).

Age at first calving

It determines the beginning of the cow's productive life and influences her life time productivity (Ojango and Pollott, 2001). The beginning of productive life the heifer is called age at first calving. The overall estimated average age at first calving was found to be 40.9 ± 6.6 months, of which 47.16 ± 8.7months for local cows, and 37.95 ± 9.4 months for crossbreed cows, which was higher than the expected to be achieved (Mulugeta and Belayeneh, 2013).

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Several studies carried out in East African cities revealed AFC to have ranged from 29.7 to 46.0 months. Age at first calving is affected by factors such as breed, nutritional status and management differences of dairy cows. Pure exotic and cross bred cows attain AFC differently. For instance, crossbreed cows in Addis Ababa (Ayenew et al., 2009) had lower (29.7 months) and higher (46.months) AFC, respectively. This indicates that pure exotic heifers reach puberty earlier than cross bred cows. Since the results were reported from different cities then management and feeding differences could be the reasons. Farm size has been indicated to affect AFC in dairy animals. According to (Lemma Abate and Kebede, 2011) small and large dairy farms in Addis Ababa had longer (34.2 months) and shorter (32.6 months) AFC respectively. Another report by Addisu, (1999) indicated that the AFC of Fogera breed was 47.6 ±0.77 months at Metekel Ranch. The AFC of 50% Fogera-Friesian crosses was reported to be 40.46 ±0.93 years (Addisu, 1999). However, farmers strongly emphasized that AFC is highly influenced by the nutritional status.

CONCLUSION AND RECOMMENDATIONS

Generally, productive and reproductive performances of indigenous dairy cows were affected by different factors like genetic, production systems and management practices. From the above conclusion the following recommendation were forwarded:

- Indigenous dairy cattle breeds had the ability of better adaptability of environments; there should be a controlled crossbreeding and selection strategy in line with conservation of the local adaptive traits of the breeds.
- Training and awareness creation should be given particularly to the farmers to increase the reproductive performance of the dairy cattle and livelihood of the dairy farmers through improved management practices.

DECLARATIONS

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Author's contribution
All authors are equally contributing for this review process like data collection, manuscript preparation and editorial works.

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Competing Interests
The authors declare that it has no any competing interests.

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EFFECT OF FEEDING UREA-MOLASSES TREATED TEFF STRAW ON MILK YIELD AND COMPOSITION OF CROSS BRED DAIRY COWS

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ABSTRACT: **An experimental work was conducted on crossbred lactating dairy cows in University of Gondar dairy farm with the objective of investigating the effect of urea-molasses treated teff straw feeds on milk yield and its composition. Six Holstein-Friesian crossbred experimental animals with the blood level of 75%, the first stage of lactation and all on fourth parity were purposively selected. Experimental animals were assigned to the three treatments by lottery system using completely randomized design. Treatments were prepared with the protocol of low protein concentrates mix + untreated straw (T1) as a control group, low protein concentrates mix + urea molasses treated straw (T2) and high protein concentrates mix + untreated straw (T3). The straw was sprayed with 5kg of urea, 50 liters of water and 5 kg of molasses solution per 100 kg of Teff straw incubated for 14 days in a pit silo. About 250 ml of milk was taken every week for milk composition analysis during the study. The result of this study indicated that statistically significant (P<0.05) difference on daily milk yield between cows fed on low protein concentrates mix plus urea molasses treated straw (T_2) and cows fed on low protein concentrates mix (LPCM) + untreated straw (US) (T_1). Similarly, there was statistically significant (P<0.05) difference on daily milk yield between cows fed on low protein concentrates mix plus urea molasses treated straw (T_2) and cows fed on high protein concentrates mix (HPCM) + untreated straw (US) (T3). But there was no statistically significant (P>0.05) difference among treatments for fat, protein, lactose and ash contents of milk. The result also showed no statistically significant (P>0.05) difference among treatments for dry matter intake. From this result, it can be concluded that treating crop residues like straw with urea and molasses can improve milk yield of dairy cows but has less impact on milk composition. The statistically non significant differences of milk yield between cows fed on low protein concentrate and high protein concentrate invites researchers to investigate the nutritional qualities of ingredients used in the high protein concentrate mixture.**

Keywords: **Composition, Milk Yield, Molasses, Treatment, Urea**

INTRODUCTION

Livestock production is an important part of the farming practice in Ethiopia and it plays an important role in the livelihoods of the majority of people in the country. Livestock has serving in providing milk, meat, draught power, manure, hides and skins. The livestock population of Ethiopia is estimated to be 56.70 million cattle, 29.33 million sheep, 23.11 million goats, 2.03 million horses, 0.40 million mules, 7.42 million donkeys, 1.16 million camels and 56.86 million chicken and 5.88 million beehives (CSA, 2015).

In Ethiopia about 3.07 billion liters of milk produced from 11.8 million milking cows, an average of 1.35 liters per cow per day over a lactation period of six months (CSA, 2015). Per capita milk consumption of Ethiopia is estimated to be 14.6 kg (Speedy, 2003) and 32% of the total milk produced, is estimated to be consumed by calf (Getachew and Gashaw, 2001). The nutritional importance of Dairy products such as whole milk, cheese butter, whey, skimmed milk, cream and ghee is very high in human diet by providing nutrients such as Vitamin A, carbohydrates, protein and calcium. Genetic makeup and nutrition are the main factors that affect milk yield and composition. Nutrition has a direct impact on milk composition. Level of milk production has also some influence on milk constituents (Tripathi, 2014).

Currently, the feeding habit and preference of milk protein of Ethiopian people in common with people in other regions of the globe are becoming changed and increase rapidly both in quality and quantity (Delgado, 2003). Especially the demand of animal protein source diets such as milk, meat and eggs is being reasonably increased from time to time. Though the demand is rising, Per capita milk consumption in Ethiopia is estimated to be 20 litters which is still much lower than the recommendations of world health organization that is 200 liters of per capita consumption. This is due to the dairy sector in Ethiopia is highly constrained by different factors. Feed and weak animal health service are the leading factors affecting the production potential of the country (Tassew and Seifu, 2009). The main source of feed for dairy cows are natural grass hay, elephant grass, purchased concentrate feeds (soya bean, wheat, grass pea and maize) and brewery grain. However the fluctuation in the supply of these concentrate feed sources is becoming a common tragedy for dairy producers in the area. Moreover, low quality hay

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and crop residues which are the basal feed of our farm induces big fluctuation in milk production when concentrate feed sources are in short supply. Looking for different feeding strategies may be a solution so as to sustain the production in the farm to provide the product to the community in a sustainable manner. Feed treatment and supplementation are considered as feeding strategies in dairy feeding. However feed treatment technologies to improve feeding value of poor quality hay and crop residues used in the farm are not yet being practiced in the farm as well as in the study area. This study was therefore initiated with the general objective of investigating the effect of feeding urea- molasses treated teff straw on milk yield and composition of a crossbred dairy cow as one feeding strategy.

MATERIALS AND METHODS

Description of the study area

The study was conducted in the University of Gondar dairy farm found in Gondar town of North Gondar Administrative Zone, Amhara Region, Ethiopia. Gondar is located 738km and 180km northwest of the capital, Addis Ababa and regional city of Bahir Dar respectively. The area is located between geographical coordinates 12.3º to 13.38 north latitudes and 35.5º to 38.3º east longitudes and the altitude ranges from 550 to 4620 meters above sea level. The average annual rainfall varies from 880mm to 1772 mm, which is characterized by Bimodal type of distribution. Minimum and maximum temperatures are 10ºC and 44.5ºC respectively.

Sampling techniques and sample size

Six Holstein Friesian crossed experimental animals with a 75% of blood level, fourth parity and up to 6 weeks (first stage) of lactation were purposively selected. Experimental animals were assigned to the three treatments by lottery system using completely randomized design method.

Feed preparation

All the feeds required was cheeked for their availability in the farm first and no external source was needed. Urea-molasses treated straw was prepared by treating the 100kg Teff straw with a solution of the ratio 5kg urea to 50 liter water to 5kg molasses. A pit silo (3m×4m×1m volume) was prepared and covered with 22 µm plastic sheet. The straw was sprayed with the solution prepared and compacted layer by layer to exclude the entrance of oxygen. Then after the silo was covered with the plastic sheet and incubated for 14 days. Two different concentrate feed mix for treatment were prepared from different types of feed on the basis of their protein content as high protein concentrate mix and low protein concentrate mix. Urea Molasses treated and untreated straw was given to experimental animals as a basal diet for the entire six experiment and two adaptation weeks. Two adaptation weeks (14 days) to the test feeds was given to introduce the feed to the animals and avoid effect of previous feed on milk yield (Broster, 1984) .

Experimental design and treatments

Six Holstein Friesian and Fogera cross bred dairy cows with the same parity(fourth parity) and stage of lactation (first stage of lactation) was selected to make the experimental animals homogenous and assigned to the three different treatments with a complete randomized design. The treatments employed were the following; Treatment one (T1) = Low protein concentrates mix (LPCM) + untreated straw (US), Treatment two (T2) = Low protein concentrates mix (LPCM) + urea molasses treated straw (UMTS), Treatment three (T3) = High protein concentrates mix (HPCM) + untreated straw (US). Employing such treatments seems odd but, it was designed to evaluate the effect of urea molasses treatment of teff straw by comparing T1 and T2 means. Along with that, effect of high protein concentrate mix was evaluated by comparing group of animals received high protein concentrate mix (T3) with the group of animals received low protein concentrate mix (T1) where both of the treatments received the same basal diet, untreated teff straw.

The model used in CRD was $Y_{ij}= \mu + t_i + \varepsilon_{ij}$

Where: Yij is the j^{th} observation of the i^{th} treatment, µ= is the population mean, t_i= is the treatment effect of the i^{th} treatment, and $\varepsilon_{ij=}$ is the random error

Data collection and analysis

The primary data on milk yield was recorded daily in the morning and afternoon and 250 ml milk was taken for milk composition analysis every week of the experimental period. A total of forty two days milk yield were collected at morning and evening from selected experimental animals by using recording sheet. Statistical analysis system (SAS version 9.2) was used to analyze the quantitative data collected and presented with tables.

Table 1 - High proteins concentrate mix formulated

S.N	Ingredient	Proportion in the concentrate mix (%)
1	Full fatted soya bean	16
2	Grass pea/ guaya	15
3	Maize	43.8
4	Wheat bran	22
5	Salt	1
6	Limestone	2.2
Total		100

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Table 2 - Low proteins concentrate mix

S.N	Ingredient	Proportion in the concentrate mix (%)
1	Wheat	44
2	Wheat bran	12
3	Maize	40.7
4	salt	1
5	Limestone	2.3
Total		100

RESULTS AND DISCUSSION

Dry matter intake

Due to the limitation of facilities, only dry matter and crude protein contents of the feed ingredients were analyzed (Table 3). The result of this study showed that there were no statistically significant difference (P>0.05) among treatments in the dry matter intake. But, cows fed on low protein concentrate plus urea molasses treated straw (T2) consumed numerically higher dry matter than cows fed on low concentrate mix plus untreated straw (T1) and cows fed on high protein concentrate mix plus untreated straw (T3).

Research reports showed that urea treatment of straw resulted in saving the amount of the expensive protein supplement incorporated into the concentrate mixture and increase of straw intake leading to enhanced animal performance (Al-Shami and Al-Sultan, 2006). But, the result of this study did not bring significance difference in the dry matter intake of treated and untreated straw. Since roughage diets are poor in their nutritional value the bioavailability of nutrients will be affected which in turn affects the intake. Though there is no statistically significant difference (P>0.05), cows fed on high concentrate mixture consumes numerically more dry matter of the straw than cows fed on low protein concentrate mixture. This result was supported by reports indicating that feeding concentrates can improve dry matter intake of straw (Mesfin and Ledin, 2004).

Contrary to this result; increment in the voluntary dry matter intake of the urea treated roughage component of the ration was reported by (Dejene et al., 2009). In line with the result of this study, other researchers reported that urea treated straw to be superior to untreated straw in terms of crude protein content (Saadullah et al., 1981). The nitrogen posed on the treated straw improves the microbial protein synthesis which was shown to improve milk yield (Table 4). As a result of increase in milk yield, the amount of concentrate was increased. This is because provision of concentrate was based on milk yield as recommended by Harrington and Kellaway (2004) so that the total DM intake was numerically higher.

Table 3 - Chemical composition of feed ingredients used in the experiment

Feed ingredient	Dry matter content (%)	CP content (% DM basis)
Full fatted soya bean	87.8	38.9
Grass pea	91.4	29.8
Maize	87.6	9.7
Wheat bran	89.1	17.9
Wheat	88.2	11.5
Un treated teff straw	94.7	3.6
Urea-molasses treated teff straw	45.3	8.5

Cp= crude protein, DM= dry matter

Table 4 - Dry mater intake of experimental animals

S.N	Treatment \ Dry Matter Intake (kg/day; mean ±SD)	Concentrate mix	Straw	Total
1	T1 (LPC+US)	5.25±0.31[a]	8.48±0.35[a]	13.73±0.66[a]
2	T2 (LPC+ UMTS)	6.00 ±0.00[a]	8.58±0.47[a]	14.58±0.47[a]
3	T3 (HPC +US)	4.25±1.06[a]	8.81±0.15[a]	13.06±1.21[a]
Least significant difference (LSD)		2.05	1.07	2.68

LPC= low protein concentrate mix; HPL= high protein concentrate mix; US= untreated straw; UMTS= urea molasses treated straw;

Milk yield of dairy cows

There was statistically significant (P<0.05) difference in the milk yield per day between cows fed on low protein concentrate plus urea molasses treated straw (T2) and cows fed on low concentrate mix plus untreated straw (T1). Similarly, cows fed on low protein concentrate plus urea molasses treated straw (T2) and cows fed on high protein concentrate mix plus untreated straw (T3) showed statistically significant (P<0.05) difference in the daily milk yield. In line with the result of this study the Substantial increase in milk yield of crossbred dairy cows fed on urea treated Teff straw supplemented with a concentrate mixture was reported (Dejene et al., 2009). But, there was no statistically significant difference (P> 0.05) between cows fed on low concentrate mix plus untreated straw (T1) and cows fed on

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high protein concentrate plus untreated straw (T3). But; there was numerical differences between the cows fed on low concentrate mix plus untreated straw (T1) and cows fed on high protein concentrate plus untreated straw (T3). In fact; the high protein concentrate mixture should bring high milk yield than low protein concentrate mix received the same basal diet. But the result of this study is contradictory to the fact. This might be attributed by the anti-nutritional factors contained in full-fat soybean in high protein concentrate mixtures. There are evidences that many kinds of anti-nutritional factors, such as trypsin inhibitor, lectin, α-amylase inhibiting factor, goitrin, and soybean antigen are contained in soybean (Grant, 1989). The existence of these anti-nutritional factors affects the nutritional value, utilization and digestibility of soybean protein (Gilani et al., 2012)

The milk yield curve (Figure 1) showed the experimental animals about to end the first stage of lactation and entered in to second stage of lactation where the yield remains nearly constant. In a research reported, supplementation of heifers in early lactation build rapid response over the first two weeks of supplementation and further developed till the eighth week (Broster et al., 1975). That means supplementation response will remain nearly constant after the eighth week.

Chemical composition of milk

The protein, lactose, fat and ash content of the milk recorded in this study showed statistically non significance difference (P>0.05) among treatments. But, the result showed numerical difference between Cows fed on high protein concentrate plus untreated straw (T3) and cows fed on low concentrate mix plus untreated straw (T1) as well as T2. Lactose plays a vital role in determining the volume of milk secreted. Insignificance difference in concentration of lactose among treatments in this study is therefore expected. There are reports that concentrations of lactose and minerals constituents of milk do not respond predictably to adjustments in diet (Looper, 2012) which supports the results of this study. Contrary to this result fat concentration is reported to be the most sensitive to dietary changes and can vary over a range of nearly 3.0 percentage units (Looper, 2012).

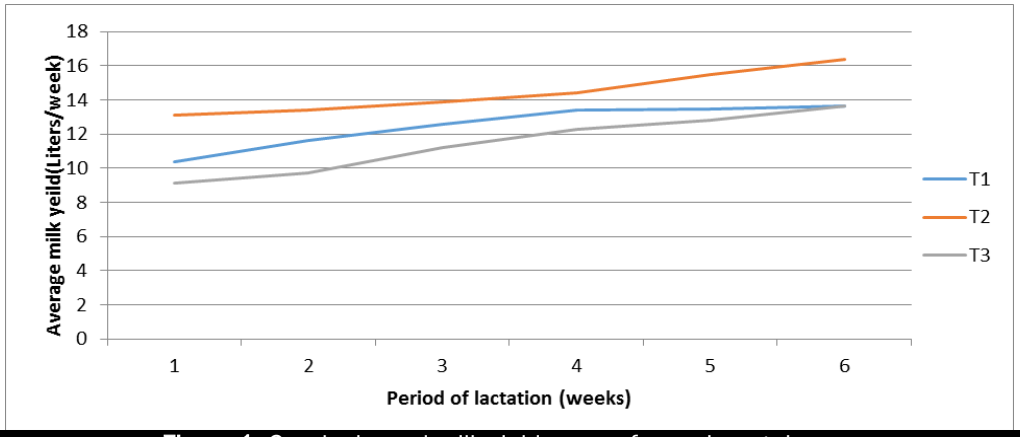

Figure 1. Graph showed milk yield curve of experimental cows

Table 5. Milk yield of dairy cows during the experiment

S.N	Milk Yield (mean ± SD) / Treatment	Morning(l/milking)	Evening(l/milking)	Total Milk yiel(l/d)
1	T1 (LPC+US)	6.84 ±1.0[b]	5.68 ±1.34 [b]	12.52 ± 2.13 [b]
2	T2 (LPC+ UMTS)	7.84 ± 0.85[a]	6.61± 1.42 [a]	14.45 ±1.96 [a]
3	T3 (HPC +US)	6.05± 0.86[c]	5.41± 1.55 [b]	11.46± 2.16 [b]
Least significant difference (LSD)		0.48	0.76	1.11

[a,b,c,] means with different superscripts in a row are significantly different (p<0.05); LPC= low protein concentrate mix; HPL= high protein concentrate mix; US= untreated straw; UMTS= urea molasses treated straw; l= liter

Table 6. Milk composition of dairy cows during the experiment

S.N	Milk Composition (Mean±SD) / Treatment	Protein	Lactose	Fat	Ash
1	T1 (LPC+US)	3.2± 0.24[a]	4.71± 0.29[a]	3.32±0.18[a]	0.59±0.01[a]
2	T2 (LPC+ UMTS)	3.2±0.16[a]	4.77±0.18[a]	3.56±0.65[a]	0.61±0.04[a]
3	T3 (HPC +US)	3.4±0.54[a]	4.85±1.05[a]	3.59±0.97[a]	0.64±0.13[a]
Least significant difference (LSD)		0.32	0.59	0.62	0.07

[a,] means with same superscripts in a row are not significantly different (p>0.05); LPC= low protein concentrate mix; HPL= high protein concentrate mix; US= untreated straw; UMTS= urea molasses treated straw.

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CONCLUSION AND RECOMMENDATION

From the results obtained in this study, It can be concluded that treating crop residues like straw with urea and molasses can improve milk production. Urea molasses treatment of straws did not bring difference in the milk composition rather supplementation with high protein concentrate has numerically better results in altering milk composition. From this result it can be recommended that milk yield can be improved through feed treatment of poor quality roughages than adding the highly expensive protein concentrates. Moreover, the statistically nonsignificant differences of milk yield between cows fed on low protein concentrate and high protein concentrate invites researchers to investigate the nutritional qualities of ingredients used in the high protein concentrate mixture.

DECLARATIONS

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Ethical approval

The ethical review board of the Department of Animal production and extension, University of Gondar evaluate and approved the protocols followed in the study

Authors' contributions

YD, AA and KE participated in the design of study, conducted the experiment and wrote the manuscript. AA revised the manuscript for important intellectual contents.

Competing interests

The authors read the final version of the manuscript and declare that they have no competing interests.

Consent to publish

Not applicable

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DAIRY CATTLE PRODUCTION, PROCESSING AND HANDLING OF MILK AND MILK PRODUCTS IN ENEMAY DISTRICT, AMHARA, ETHIOPIA

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✉*Supporting Information*

ORIGINAL ARTICLE

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ABSTRACT: **The objective of the study was to assess dairy cattle production systems, processing and handling systems of cow milk and milk products in the highlands of Ethiopia. The study was conducted from 2017 to 2018 in Enemay district, Amhara, Ethiopia. The sample kebeles and household for the study were selected based on stratification and purposive sampling techniques. Three rural and two urban and pre urban kebeles were selected. From each kebele 30 households (total of 150 households) were selected randomly from those have at least two lactating cows. Dairy cooperatives and private farms were included during the study. Descriptive statistics was employed for data analysis using Statistical Procedures for Social Sciences (SPSS) version 20.0. Dairy cattle production systems that identified in the study areas were rural smallholder or mixed crop- livestock production which accounts 98% and the rest 2% were urban and pre urban system. Out of the total milk produced per households per day 0.42±1.8 liters was used for traditional milk processing. The study also revealed that 40.2% of the respondents were process milk into different milk products. The three most prioritized milk and milk products in the area were butter, ghee and whole milk with their ascending ranking order. The finding revealed that most of respondents (89.4 %) did not use udder washing before milking. The majority of the respondents were practiced washing of their hands (73.6%) and milk utensils (90.6%) before milking. There should be training for farmers and dairy cooperatives about milking hygienic practices, feeding and health care managements for their dairy cattle animals. The study is also recommend that improved and appropriate milk processing technologies like churner and cram separator should be accessible in place to improve milk processing for sustainable dairy production.**

Keywords: **Dairy cattle production, East Gojjam, Enemay, Milk handling, Milk processing**

INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa (CSA, 2017). The varied and extensive agro-ecological zones and the importance of livestock in livelihood strategies make Ethiopia home to large numbers of livestock. Indeed, Ethiopia has the largest livestock inventory in Africa, 59,486,667 cattle, 30,697,942 sheep and 30,200, 226 goats, 8,439, 220 donkeys, 409, 877 mules, 2,158, 176 horses and 59,495, 026 chickens (CSA, 2017). Out of this total cattle population, the female cattle constitute about 55.5 percent and the remaining 44.5 percent are male cattle. Eighty-three percent of all milk produced in Ethiopia comes from cattle with the remainder coming from goats and camels (MoARD, 2007).

Dairy sector is a major contributor to economic development especially among the developing countries. As an engine of growth, it provides increased income, employment, food and foreign exchange earnings as well as better nutrition (Yilma et al., 2011). As income increases with economic development, the share of animal products in total food budget increases faster than that of cereals. This occurs because of the relatively high-income elasticity of demand for animal products (Yigrem et al., 2008). According to CSA, 2017 the estimate of total cow milk production for the rural sedentary areas of the country is about 3.1 billion liters. The average lactation period per cow is estimated to be about six months, and average milk yield per cow per day is about 1.37 liters.

Despite its huge number, the livestock sub-sector in Ethiopia is less productive in general, and compared to its potential, the direct contribution to the national economy is limited. The poor genetic potential for productive traits, in combination with the sub-standard feeding, health care and management practices that animals are exposed to are the main contributors to the low productivity (Zegeye, 2003). Milk and milk products play an important role in human nutrition throughout the world. Milk is also highly perishable and can easily be adulterated whilst the quality of the milk is highly dependent on farm management. The safety of dairy products with respect to food-borne diseases is a great concern around the world. This is especially true in developing countries where production of milk and various dairy products take place under rather unsanitary conditions and poor production practices (Mogesse, 1990; Zelalem and Faye, 2006)

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Dairy products are manufactured and consumed in many parts of the country. Fresh whole milk, butter, Arera (defatted sour milk), whole sour milk (*Ergo*), and Ayib (a traditional cottage cheese) are the major dairy products produced and consumed in many parts of the Ethiopia (Fekadu, 1994; Tola, 2002; Fita, 2004, Eyassu and Asaminew, 2014 and Belay and Janssens, 2014). Many of these products are produced using artisanal technologies on-farm and the types and processing steps of these dairy products can vary considerably from one area to the other. So, identification and understanding of dairy products, handling and processing methods are essential in order to devise appropriate development interventions that would result in improved production and quality of dairy products.

MATERIALS AND METHODS

Study area description

Enemay district is found in east Gojjam zone, Amhara region, Ethiopia and which is located 265 km northeast of Addis Ababa, capital city of Ethiopia. The district is geographically located 10º 39' 59.99" N latitude and 38º 00' 0.00" E longitudes. The district has an average altitude of 2541 m a.s.l. (WAO, 2016). The district consists of 27 rural and 7 urban Kebeles (WAO, 2016). Agro ecologically, the district is classified as 88% of *"Weinadega"*(midland*),* 7% of *"Dega" (*highland*),* 5% of *"Kola"* (lowland*)*. The mean annual rainfall is 1100 mm ranging from 997 mm to 1203 mm. It is unimodal, falling during "*Kiremt"* (June-September), however, there is small rain falling between April and May ("B*elge*"). The mean annual temperature is 18.5ºC and the range is from mean minimum of 10 ºC to mean maximum 27ºC (WAO, 2016).

Sampling Techniques and Methods

District was selected purposively based on cattle population, potential of milk production, and access of the road. Secondly, *kebele* was selected based on stratification methods and 3 rural and 2 urban *kebele*s were selected. Bichena and Yetemen were purposely selected and classified as urban and peri-urban dairy production systems. According to this study farms located at a distance greater than five kilometers from the main town of the district was considered as peri-urban farms. From the total 26 rural kebeles 3 kebeles were selected purposively based on agro ecology. From each *kebele* 30 households were selected randomly from those have lactating cow. During the study dairy cooperatives and private farms that found in the selected kebeles were included.

A rapid survey with veterinarian, animal production expert in the district and focused group discussion was made with key informants after designing check lists of issues to be covered. Semi structured questionnaire was prepared in a way it can address the aim of the research. Questionnaire having open-ended and closed-ended were developed with main focus on dairy cattle production system, milk handling, processing techniques and types of dairy products that has to be manufactured and consumed in the area. In addition to this, field observation was made to enrich the collected data. Descriptive statistics was employed for data analysis using Statistical Procedures for Social Sciences (SPSS) version 20.0 (SPSS, 2011).

RESULTS AND DISCUSSION

Socio economic characteristics of household

Sex, family size and education background of the respondents in the two farming systems are presented in Table 1. The overall mean family size in the study area was 5.6 ± 2.45. The current findings are similar with results reported by Belay and Janssens (2014) on average family size of households in Jimma town that was 6.02±2.52. The survey also revealed that the majority of the households in the study area were headed by males which accounted 97% and the remaining proportion of the households was headed by females. Female headed household in this particular study would indicate either the husband has died or they are divorce. Similarly, Kassa and Dekamo (2016) reported that in southern Ethiopia out of the total interviewed respondents (N = 140), 95% were male and the rest (5%) were female household members of different age and educational status. The study also revealed that the majority of religion of HH (87.42%) was Orthodox and the rest were Muslim and protestant 11.52% and 1.06%, respectively. Similarly Kassa and Dekamo (2016) reported that regarding the religion of the respondents, the majorities (65.7%) were orthodox followers, 30.1% were protestant, 3.5% were Muslim and 0.7% was catholic followers in the southern parts of Ethiopia. The majorities (67.4%) of the household heads in Enemay districts were illiterates and the remaining proportions (32.6%) were literate, who can read and write.

Dairy Cattle Production Systems

Based on this finding the production system that identified in the study areas were rural smallholder or mixed crop- livestock production (98%) and the rest 2% were urban and pre urban system. Rural smallholder production system is characterized by land scarcity and the major livestock feed resources include grazing on marginal lands,

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crop aftermath and crop residues. Which is in line with the finding of Kassa and Dekamo (2016) those reported that in Kaffa and Sheka Zones, Southern Ethiopia the major production system were mixed crop livestock production system in which cereal crops predominantly produced in the study areas were maize, barley, wheat, vetch, bean, pea, teff and chickpea which used for livestock feed resources as a crop residues. The smallholder farmers in this system predominantly raise indigenous zebu cattle breeds and farming is subsistence in nature. In the mixed crop-livestock production system, milk produced is retained for home consumption and seldom for sale.

Milk processing and handling

In the study area the total annual cow milk produced was estimated to be about 2000 thousand liters from 150 households and dairy cooperatives those having more than 2 indigenous (zebu) and cross breed lactating cows. In the study area, out of the total milk produced per farm per day 0.42±1.8 liters was used for traditional milk processing. The finding also revealed that 40.2% of the respondents were process milk into different milk products. This result is lower than the findings of Debrah and Berhanu (1991), Sintayehu et al. (2008) and Belay and Janssens (2014) who reported that 50.6%, 54.5% and 46.3% of respondents in different parts of Ethiopia process their milk into different milk products, respectively. The major products of the traditional milk processing were naturally fermented milk, butter, whey, cheese and ghee (Table 2).

Cleaning the udder of cows before milking is important since it could have direct contact with the ground, urine, dung and feed refusals while resting. The finding revealed that the majority of respondents (89.4 %) did not use udder washing before milking but lack of washing udder before milking can impart possible contaminants into the milk. Contrary to the current finding, Negash (2012) reported that 82.5% of households in Hawassa city are practicing milking by washing udder. It also disagree with the report of Gezu and Kebede (2015) who reported that all respondents (100%) practices udder washing before milking in urban and peri urban area of Hadya Zone, Southern Ethiopia. Production of milk of good hygienic quality for consumers requires good hygienic practices (clean milking utensils, washing milker's hands, washing the udder and use of individual towels) during milking and handling, before delivery to consumers or processors (Getachew, 2003). In the study area, the majority of the respondents practiced washing of their milk utensils (90.6%) and milker's hands (73.6%) before milking. This is in line with results of Abebe et al. (2013) that reported the majority of the respondents practiced washing of their milk utensils (87.5%) and milker's hands (71.6%) before milking in Ezha district of the Gurage zone, Southern Ethiopia. This finding revealed that containers used for milking and traditional milk processing were used 62.7%, 30.3% and 7% plastic material, gourd and stainless steel, respectively. The current result in line with results of Gezu and Kebede (2015) who reported all respondents (100%) used clay pot, Gourd, Plastic material and Stainless steel as handling and traditional milk processing materials in Hosanna Town, Hadya Zone, Southern parts of Ethiopia. It also similar with the report Gezu and Kebede (2015) who revealed that the milking material used in the Dangila zone western part of Amhara region were gourd, plastic material and stainless steel.

Milk and milk products

In Enemay district milk is consumed either in its raw state or after processing to various products (Table 2). The common dairy products that have to be consumed in the area were fresh whole milk, naturally fermented sour milk, butter, whey, ghee and cheese. Which is in line with reports of Eyassu and Asaminew (2014) and Gezu and Kebede (2015) that they revealed fresh whole milk, Ergo (naturally fermented sour milk), Arera (defatted sour milk), butter, ghee, Ayib (a traditional cottage cheese), Metata Ayib (a traditional fermented cottage cheese) and Zure are the common dairy products produced and consumed in different part of Ethiopia. From these products, the three most prioritized milk and milk products in the area were butter, ghee and whole milk with their ascending ranking order. The naturally fermented sour milk and whey were used as rarely consumed in the area. In rural and urban and pre urban strata milk and milk products consuming pattern of households were not similar. In rural area of Enemay district butter, ghee and whole milk were ranked 1st, 2nd and 3rd, respectively whereas in urban and pre urban kebeles whole milk, butter and ghee were ranked 1st, 2nd and 3rd, respectively. The results of the current study are in contrast with the report of Debrah and Berhanu (1999) who indicated butter and cheese were not sold by intra-urban producers in Addis Ababa.

Table 1 - Socio-economic characteristics of households in Enemay district

Descriptor		Rural kebeles	Urban and pre urban kebeles	Overall
		N=90; Mean± SD	N= 60; Mean ± SD	N= 150; Mean ± SD
Family size		5.7± 2.51	5.6 ± 2.44	5.6 ± 2.45
Sex of household (%)	Male	100	95.6	97
	Female	_	4.4	3
Educational level	Illiterate	62.2	70	67.4
	literate	37.8	30	32.6
The religion of HH heads	Muslim	1033	12.7	11.52
	Orthodox	88.55	86. 3	87.42
	Protestant	1.12	1	1.06

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Table 2 - Milk and processed milk products in Enemay district

Milk and Milk products	Urban and pre urban kebeles (HH=60)						Rural Kebles (HH=90)						Overall (HH=150)		
	Number of HH ranking						Number of HH ranking								
	1st	2nd	3 rd	Total N	Index	Rank	1st	2nd	3 rd	Total N	Index	Rank	Total N	Index	Rank
Whole milk	35	15	9	144	0.30	1	8	15	25	79	0.13	3	223	0.20	3
Butter	22	14	20	114	0.24	2	47	36	6	219	0.35	1	333	0.30	1
Whey	-	33	9	75	0.16	4	-	3	-	6	0.01	6	81	0.07	6
Ghee	19	10	23	100	0.21	3	43	19	28	195	0.31	2	295	0.27	2
Sour milk (Ergo)	-	7	9	23	0.05	6	6	13	17	61	0.10	5	84	0.08	5
Cheese	-	11	5	27	0.06	5	3	18	24	69	0.11	4	96	0.09	4
Total	483						629						1112		

Index= [(3 for rank 1) + (2 for rank 2) + (1 for rank 3)] divided by sum of all weighed reasons mentioned by respondent

Table 3 - The major constrains of dairy production in the study areas

Constraints of dairy production	Urban and pre urban (HHN=60)						Rural (HHN=90)					
	1st	2nd	3 rd	Total N	Index	Rank	1st	2nd	3 rd	Total N	Index	Rank
Feed related problems	30	7	12	116	0.23	1	30	37	14	174	0.23	1
AI service problems	-	4	4	12	0.020	8	13	19	8	140	0.18	2
Market problems	-	1	2	4	0.01	9	5	2	-	19	0.025	8
Lack of improved dairy cow	10	9	11	59	0.09	5	13	20	3	82	0.11	4
Health problem	22	17	10	110	0.16	3	23	13	17	112	0.15	3
Lack of access of credit	-	6	2	14	0.021	7	13	20	9	88	0.12	5
Lack of shelter	49	1	3	151	0.17	2	2	-	-	6	0.01	9
Lack of extension service	2	28	5	67	0.10	4	11	22	-	77	0.10	6
Water scarcity	2	14	11	45	0.07	6	7	6	22	55	0.07	7
Total	578						753					

Index= [(3 for rank 1) + (2 for rank 2) + (1 for rank 3)] divided by sum of all weighed reasons mentioned by respondent

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Constraints of dairy cattle production

As indicated the table below the majority of respondents in both stratification of the study area feed shortage was ranked first, as the first most significant problem responsible for low productivity yield and low milk of dairy cows. This is in line with the finding of Fayo 2006; Derese (2008); Bekele et al. (2015) and Gezu and Kebede (2015) those reported that feed shortage as the most important constraint that donated to the low production and productivity of dairy cattle in different place of Ethiopia. The reason for this might be due to changing of rangelands to crop cultivation land and the crop residues utilization and treatment habits are low. The current finding revealed that the second and the third major constraints of dairy production in rural areas were AI service problem and health problems, respectively where as in urban areas lack of shelter and health problems were ranked second and third respectively. Which were similar with the finding of Gezu and Kebede (2015) who reported that disease problems is the top third constraint of dairy production in urban and pre urban area of hossan, Ethiopia.

CONCLUSION AND RECOMMENDATION

The current study can be concluded that rural smallholder or mixed crop- livestock production and urban and pre urban dairy production system were identified but the major were the first production system. Majority of respondents were not practiced udder washing and teat sanitizing before milking. Milk processing and handling methods were found traditional type. The milk and milk products which are common used in the study area were butter, ghee and whole milk. The major dairy cattle production constraints in the area were feed scarcity in quantity and quality, health problems and access and effectiveness of artificial insemination for their dairy cow. There should be training for farmers and dairy cooperatives about milking hygienic practices, feeding and health care managements for their dairy cattle animals. The study also suggests that improved and appropriate milk processing technologies like churner and cram separator should be accessible in place to improve milk processing for sustainable dairy production.

DECLARATIONS

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Author's contribution

All authors are contributed equally to this work from starting proposal writing up to preparation of manuscript.

Competing Interests

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

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REVIEW ON EFFECTS OF CLIMATE CHANGE ON LIVESTOCK PRODUCTION IN ETHIOPIA

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Supporting Information

REVIEW

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ABSTRACT: The main aim of this review is to assess the effects of climate change on livestock production in Ethiopia. Climate disruptions cause a huge impact on the agricultural production system. It is a primary factor for agriculture productivity. Livestock and climate change have a close relationship. Climate change could affect the costs and returns of livestock production. It has a significant effect on growth and production of animals. Climate change impairs feed intake and performance in the lactating period. Mid lactating dairy cows showed a higher decline in milk production (-38%) when the animals were exposed to heat. The higher production animals are the most affected. Heat stress increases the loss of body fluids due to sweating and panting and results in an altered water balance of the body and the osmolarity of cells. Global warming will also alter the distribution of animal diseases and the vectors. Warmer and wetter weather will increase the risk and occurrence of animal diseases, because species that serve as disease vectors, such as biting flies and ticks, are more likely to survive year-round. The most important effects of climate change on livestock production are changing the animal feed resources. It impact on rangeland biodiversity which influences livestock production. Change in precipitation patterns and intensity, increasing atmospheric water vapor, evaporation, water temperatures and changes in soil moisture and runoff. An increase in uterine temperature of 0.5°c above average is associated with a decline in conception rate of 12.8%. Heat stress compromises oocyte growth in cows by altering progesterone secretion.

Keywords: Climate, Climate Change effect, Disease, Livestock and Production

INTRODUCTION

Climate change caused an increment of weather-related disasters and extreme weather events (Addis Ababa, 2015). It increased dryness and higher temperatures, land use changes and changing animal disease distributions (Ayantunde et al., 2011).

African countries are more affected by climate change (Signgh and Purohit, 2014; Rose, 2015).Climate change harms developing countries that generate a major portion of their GDP from climate-sensitive sectors (Mesfin, 2012). Agriculture is the backbone of the Ethiopian economy (World Bank, 2012). Agricultural sector remains a key source of growth in Ethiopia but it continues to face major challenges (IMF, 2012). It is amongst the climate sensitive sectors in Ethiopia (Addis Ababa, 2015). Crop yield reduction, shortage of grazing land, and loss of livestock are the most frequently affecting negative effects of climate change.

The livestock sector has a significant contribution to Ethiopian economy (Funk et al., 2012).The subsector contributes 16.5% the national GDP, 47% of the agricultural GDP, 15% of export earnings, 30% of agricultural employment and 80% support and sustain livelihoods of all rural population. Even though the largest GDP of Ethiopia is covered by livestock, climate change has a negative impact on their product in different ways (Kassahun, 2016). It affects their health, product, carrying capacity of rangelands; livestock feed, heighten and reinforce the susceptibility of livestock (Addis Ababa, 2015). Therefore, the objective of this paper is to review the effects of climate change on livestock production.

MAIN ITEMS OF REVIEW

Climate change and agricultural production

Climate is one of the basic inputs in agriculture and its disruption cause a huge impact on the agricultural production system (Lemmi, 2013). Climate is a primary factor for agriculture productivity (Shongwe et al., 2014). More than 85% of the Ethiopian people depend mainly on agriculture (Yohannes, 2009). Though, agriculture is the backbone of Ethiopia's economy. It has been adversely impacted by various extreme weather events. Droughts,

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floods, diseases, and pests are among the prevalent disaster risks related to climate change in the lowlands of Sothern Ethiopia (Zelalem et al., 2009).

Livestock production and climate change

Ethiopia is believed to have the largest livestock population in Africa (CSA, 2013). Livestock provides many benefits in the form of Milk, Meat, Hides, Manure, and Socio-cultural capital (Nkedianye et al., 2009). Livestock and climate change have a close relationship (Iqubal, 2013). Climate change could affect the costs and returns of livestock production (Key and Sneeringer, 2011). It has a significant effect on the growth and production of animals (Padodara and Ninan, 2013). It also has maximum impact on vulnerable pastoral communities (Saidu and Omedo, 2010).

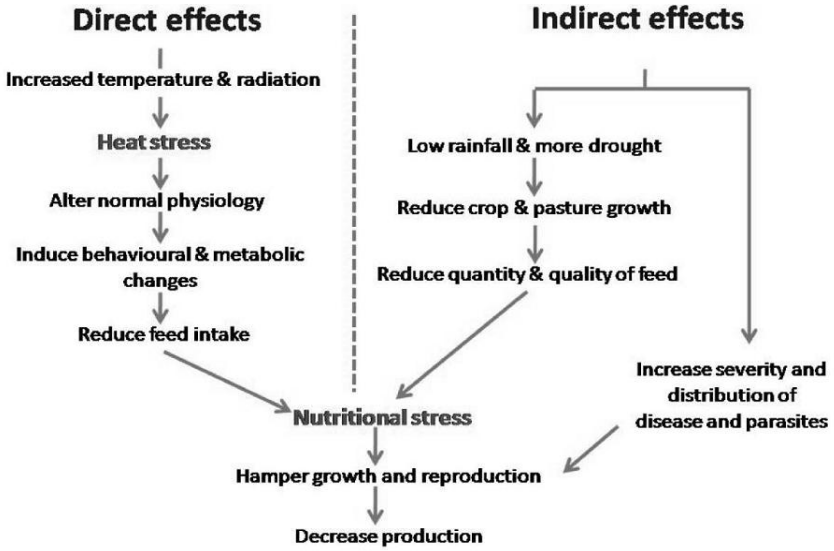

Figure 1 - Effects of climatic change on livestock production (Abebe, 2013)

Effect of climate change on milk production

Climate change impairs feed intake and performance in the lactating period (Savsani et al., 2015). Heat stress in dairy cows leads to a decline in milk production and fertility (Sere et al., 2012). The increase in milk yield increase sensitivity of animals to thermal stress (Kassahun, 2016). Mid lactating dairy cows showed a higher decline in milk production (-38%) when the animals were exposed to heat (Bernabucci et al., 2010). Because the higher production animals are the most affected (Veerasamy et al., 2016). Milk yield is very sensitive to increased temperatures, with measurable declines in yield occurring in high producing cows at 24˚C (Moreki and Tsopito, 2013).

Heat stress increases the loss of body fluids due to sweating and panting and results in an altered water balance of the body and the osmolarity of cells (Rhoads et al., 2009). Dairy herds decrease in milk production of 5 to 15 pounds per cow per day (Larry, 2014). Milk yield decline by 0.2kg per unit increase temperature humidity index (THI), when it exceeded 72 (Shambel, 2017).

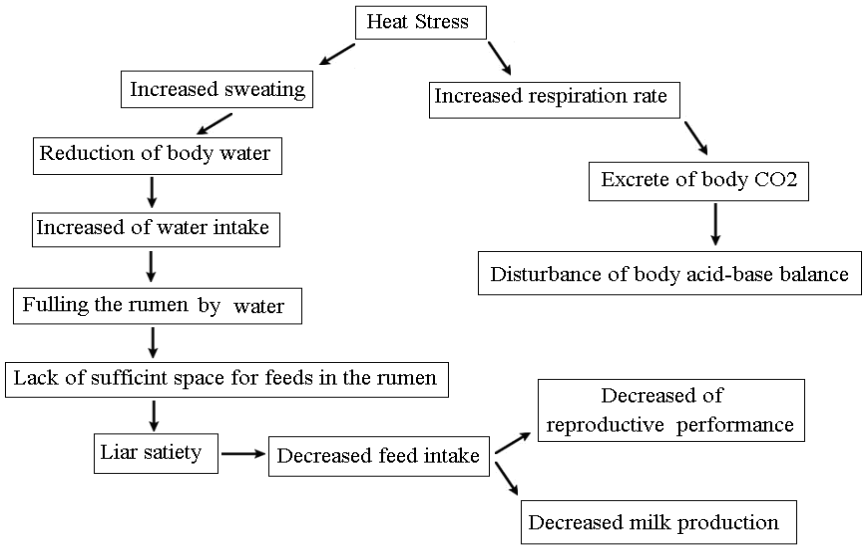

Figure 2 - Effects of heat stress on milk production (Pejman and Aghdam, 2012)

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Effects of climate change on livestock disease distribution

Global warming will also alter the distribution of animal diseases and the vectors (Scholtz et al., 2013). Among identified disease about 58% are climate sensitive (FCC, 2014). Higher temperatures results in development of pathogens or parasites (Nejash and Kula, 2016). Warmer and wetter weather will increase the risk and occurrence of animal diseases, because species that serve as disease vectors, such as biting flies and ticks, are more likely to survive year-round (Veerasamy et al., 2016). Livestock diseases can cause indirect losses (additional costs for drugs and vaccines, added labor costs and profit losses due to denied access to better markets and use of suboptimal production technology) (Getachew, 2016).

Climate change on livestock feed and fodder availability

The most important effects of climate change on livestock production is changing the animal feed resources (Addis Ababa, 2015). It impact on rangeland biodiversity which influence livestock production (Savsani et al., 2015). Decline in rainfall, reduced length of rain season and increased temp which has directly affected animal fodders (Never, 2014). Change in temperature compromise the quantity and quality of forage by increase lignifications of plant tissues and reducing digestibility and rate of degradation (Mulata, 2016). Frequent drought and a decrease in annual rainfall affect yield of pasture and crop residues (Gray and Muller, 2011).

Effects of climate change on water resources

Arid and semiarid areas of Africa where water resources are very sensitive to climate variability, particularly rainfall (Solomon, 2016). Climate change intensifying the water cycle (FAO, 2011), changes in precipitation patterns and intensity, increasing atmospheric water vapor, evaporation, water temperatures and changes in soil moisture and runoff. Climate change increased surface temperatures, melting of snow and glaciers, rise in sea level and an increase in extreme weather events. The response of livestock to climate change is increasing e.g. Bos indicus weight index (WI) increases from about 3 kg per kg DM intake at 10 °C ambient temperature, to 5 kg at 30°C, and to about 10 kg at 35°C (Mulata, 2016).

Climate change on livestock reproduction

Thermal stress leads reproductive inefficiency (Naqvi et al., 2012). An increase in uterine temperature of 0.5°c above average is associated with a decline in conception rate of 12.8% (Funk et al., 2012). Heat stress compromises oocyte growth in cows by altering progesterone secretion (Veerasamy et al., 2016). Heat stress causes infertility in most of farm animals (Kassahun, 2016). Animals exhibit sexual activities during cooler part of the year when the THI generally remains <72 (Upadhayay et al., 2009).

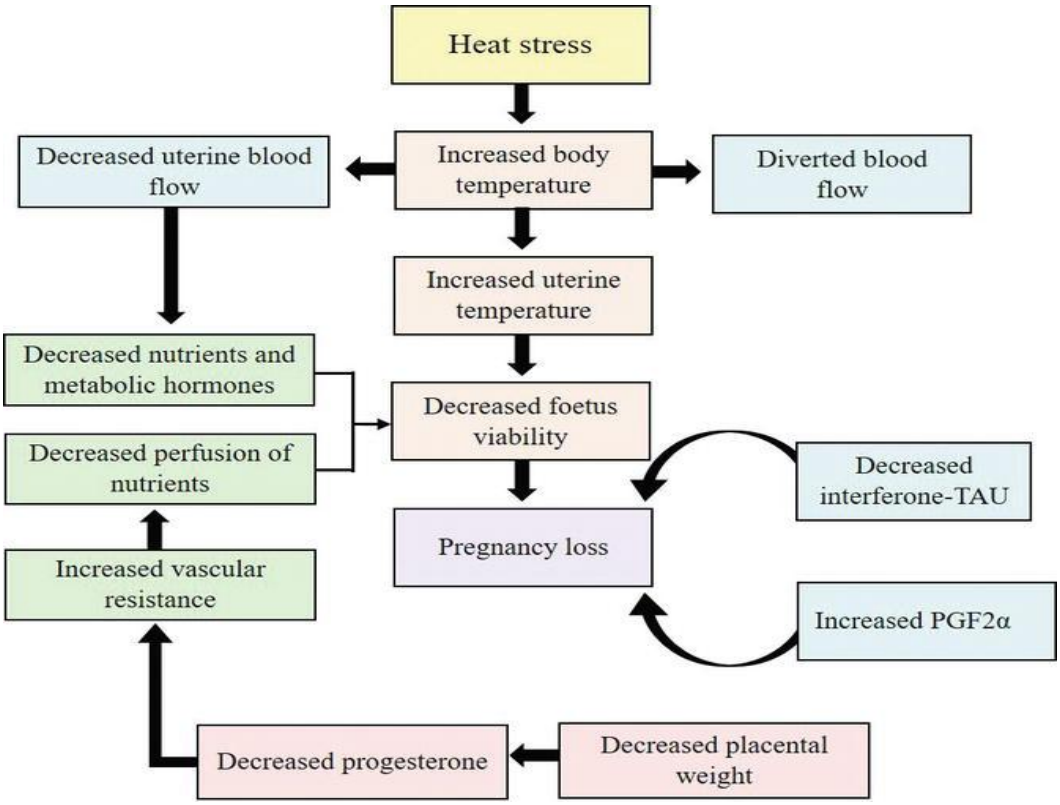

Figure 3 - Effects of heat stress on pregnancy loss of dairy cow

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CONCLUSION AND RECOMMENDATIONS

From the point of this review, climate change is major driver effect on livestock production. Climate change has direct and indirect impact on livestock production. Ethiopia is the primary producer and export of livestock production in Africa. However, their production is affected by climate change by direct effect and indirect effect. Dairy cattle milk is affected by climate change. Mid lactating dairy are more sensitive than other phase. Emergence of new diseases and changes the prevalence of diseases caused by climate change. Climate change compromises the quantity and quality of forage by increase lignifications of plant tissues and reducing digestibility and rate of degradation. In addition, it aggravates water scarcity. Environmental education and awareness creation to bring change through adaptation and mitigation options. Practice ban grazing and intensive livestock production system also used to prevent global warming.

DECLARATIONS

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Authors' contribution

The author contributed alone to this work from starting searching up to preparation of this review.

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Competing interests

The authors declare that they have no competing interests.

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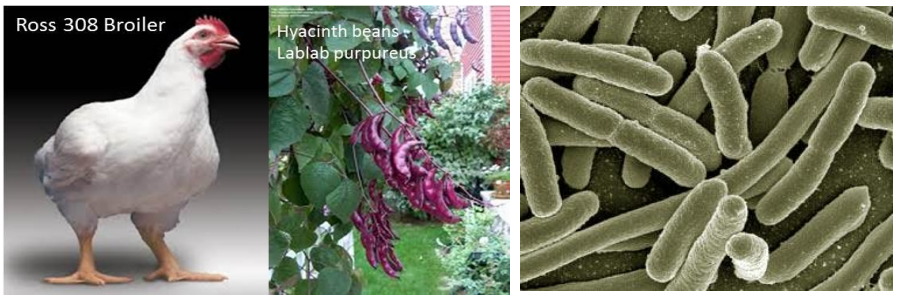

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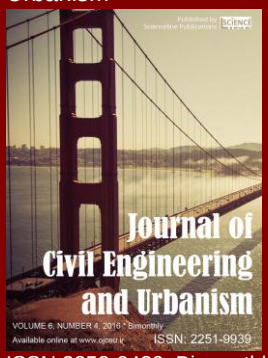

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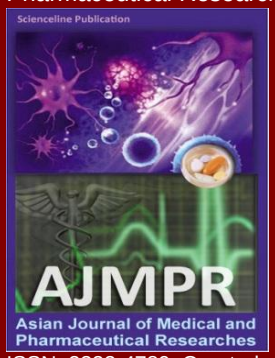

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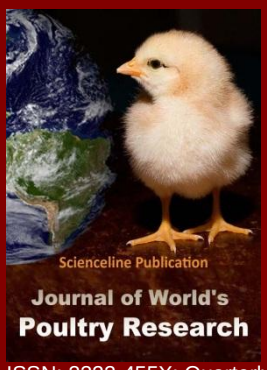

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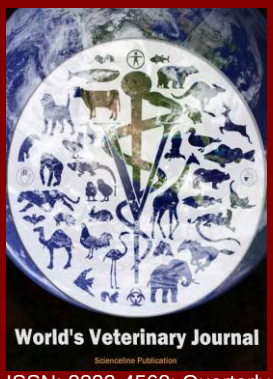

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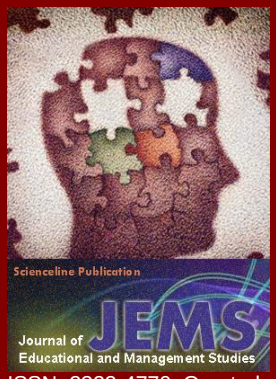

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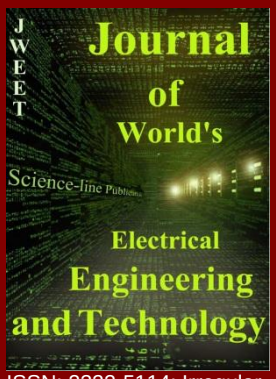

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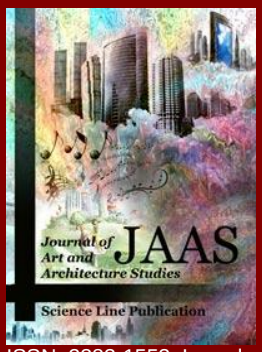

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