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Volume 7 (6); 25 November 2017

Research Paper

Prevalence and Risk Factors of Gastrointestinal Nematode Parasites of Shoat in Andabet District, North West Ethiopia.

Demewez G, Birhan M and Awoke T.

Online J. Anim. Feed Res., 7(6): 134-137, 2017; pii: S222877011700020-7

Abstract

A cross sectional study on gastrointestinal parasite of small ruminants was conducted from September, 2013 to January, 2014 in Andabet district. The objective this studies to determine the prevalence of infestation in sheep and goats. The overall prevalence of gastrointestinal helminthes parasite infestation in sheep and goat were 72.5%. The prevalence of gastrointestinal helimenth in sheep and goats were 78.4% and 63.3% respectively. Sheep was more commonly affected than goat this showed that statistically significant difference ($P < 0.05$) between species. Different prevalence was observed between female (78.0%) and male (71.8%), but there was no statistically significant difference ($x2=0.83$, $P > 0.05$). Based on age higher prevalence (82.3%) observed in animals of below 5 years old while the lowest prevalence (66.4%) observed in greater than ten years old and the difference between the prevalence among the different age groups was statistically significant ($x2=6.9$, $P < 0.05$). The study shows that gastrointestinal (GIT) parasite was a major problem of small ruminant in the study area. Therefore, comprehensive study on GIT parasite, cost effective strategic treatment and awareness creation to the smallholder should be instituted in the study area.

Keywords: Gastrointestinal, Goat, Risk factor, Prevalence and Sheep

[Full text-PDF]

Research Paper

Effects of *Trichanthera gigantea* leaf meal on the growth and production of quails supplemented with Aloe vera extract and acid cheese whey.

Bejar F.R.

Online J. Anim. Feed Res., 7(6): 138-144, 2017; pii: S222877011700021-7

Abstract

This study was conducted to evaluate the effects of *Trichanthera gigantea* leaf meal on the growth and egg production of quails supplemented with Aloe vera extract and acid cheese whey in drinking water. A total of 300 quails distributed to 15 treatments with four replications using randomized complete block design (RCBD). Levels of TGLM were T0 (0%), T1 (15%) and T2 (25%), while the water supplements included; 0, 15 and 25 ml per gallon of water of AVE and ACW respectively. Results revealed that birds fed 15% (T1) *T. gigantea* leaf meal in the diet performed well in terms of final weight gain and productions. Feed consumption, feed conversion ratio values and water consumption increased in birds fed with 15% *T. gigantea* than the control. Birds with 15% and 25% *T. gigantea* in their feed have delayed point of lay than those in the control. The economic analysis showed that birds fed 15% *T. gigantea* leaf meal with 25 ml ACW had higher return on investment and higher net benefits than other treatments. Results suggests that 15% *T. gigantea* leaf meal in the diet of quail with aloe extract and acid cheese whey supplementation can improve growth and egg production performance in quails.

Keywords: Quail, T. gigantea leaf meal, Aloe vera extract, Acid cheese whey, Plant proteins.

[Full text-PDF]

Research Paper

Assessment of major livestock feed resources and feeding systems in Bench-Maji zone; South Western part of Ethiopia.

Feyisa T and Dejen M.

Online J. Anim. Feed Res., 7(6): 145-153, 2017; pii: S222877011700022-7

Abstract

The study was conducted with the objectives of assessing major livestock feed resources and its utilization practices in Bench-Maji Zone, South Nations, Nationalities, Peoples Region (S.N.N.P.R). The average farm size owned per household (hh) in Surma (3.03 ha) were significantly higher ($P < 0.001$) than the average farm size owned by Shey-Bench (2.48ha) and Semen Bench (1.95ha). Farm size allocation to crop production in Surma, Shey-Bench and Semen Bench was 2.49, 1.96 and 1.15 ha, respectively. Out of the total land owned per household; about 0.56, 0.18 and 0.29, and 0.00, 0.21 and 0.07 hectares were allocated for grazing and forage, respectively in Surma, Shey-bench and Semen Bench. The number of cattle and goats reared per hh in Surma Woreda was significantly higher ($P < 0.05$) than that of Shey-bench and Semen Bench. Similarly, there was significantly large number of chickens in Surma woreda than Shey-bench. But, there were no significance difference for chicken's production in Surma and Semen Bench woredas. Contrast to chickens; there were significantly higher sheep and equine production in Shey-Bench than Semen Bench and Surma woredas. Moreover, there was no Equine production in Surma woreda might be due to the feeding habit of Equines in addition to prevalence of disease. The major feed resources to livestock in the study area were: natural pasture, crop residues, cultivated pasture, hay, left over of banana and/enset and taro leaf. Out of these, Natural pasture was the primary source of feed to animals in the study area. The most limiting constraint to livestock was shortage of grazing land and healthy problems.

Keywords: Livestock, Feed resource, Feeding system, Bench-Maji zone

[Full text-PDF]

Review

A review on milk production and reproductive performance of dairy cattle in Ethiopia.

Endris M.

Online J. Anim. Feed Res., 7(6): 154-160, 2017; pii: S222877011700023-7

Abstract

This review was conducted to review the information on milk production (lactation milk yield, lactation length and milk composition) and reproductive performance (age at first calving, calving interval and number of service per conception) of dairy cattle in Ethiopia. The mean values of lactation milk yield (LMY) ranges between 494 to 809 kg with lactation length (LL) of 128 to 353 days for indigenous breeds, 2343 to 1583 kg with lactation length of 275 to 448 days for crossbreed cows, and 1583 to 3796 kg with lactation length (LL) of 276 to 362 days for exotic breeds respectively. Both LMY and LL were significantly affected by breed, parity and year of calving. In general, F1 crosses produce more milk compared to F2 crosses and indigenous breeds. Milk from Boran cows had high percentage of milk fat, protein and total solids than Frisian cross breed cows. However, milk from Friesian crossbreed dairy cows had high content of milk lactose than Boran cows. Mean values of AFC for indigenous breed's ranges between 30.3 to 50.0 months while Calving interval (CL) ranges between 11.8 to 15.6 months respectively. The mean values of AFC range from 29.1 to 55.4 months for Holstein Friesian crosses and 38.8 to 46.9 months for Jersey crosses. The second filial generation (F2) had longer AFC and CI than those from first filial generation (F1) crosses. From this review it can be concluded that crossing local cattle with exotic breeds improved milk production but long calving intervals were observed as exotic blood increase.

Keywords: Crossbred, Milk production, Reproductive, Ethiopia

[Full text-PDF]

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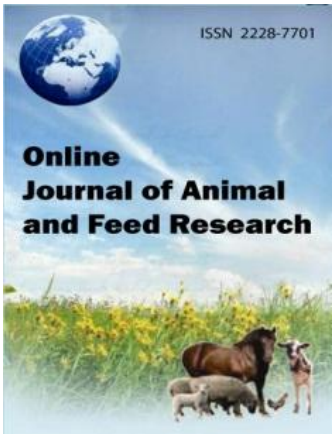

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PREVALENCE AND RISK FACTORS OF GASTROINTESTINAL NEMATODE PARASITES OF SHOAT IN ANDABET DISTRICT, NORTH WEST ETHIOPIA

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ABSTRACT: A cross sectional study on gastrointestinal parasite of small ruminants was conducted from September, 2013 to January, 2014 in Andabet district. The objective this studies to determine the prevalence of infestation in sheep and goats. The overall prevalence of gastrointestinal helminthes parasite infestation in sheep and goat were 72.5%. The prevalence of gastrointestinal helimenth in sheep and goats were 78.4% and 63.3% respectively. Sheep was more commonly affected than goat this showed that statistically significant difference ($P<0.05$) between species. Different prevalence was observed between female (78.0%) and male (71.8%), but there was no statistically significant difference ($x^2=0.83$, $P>0.05$). Based on age higher prevalence (82.3%) observed in animals of below 5 years old while the lowest prevalence (66.4%) observed in greater than ten years old and the difference between the prevalence among the different age groups was statistically significant ($x^2=6.9$, $P<0.05$). The study shows that gastrointestinal (GIT) parasite was a major problem of small ruminant in the study area. Therefore, comprehensive study on GIT parasite, cost effective strategic treatment and awareness creation to the smallholder should be instituted in the study area.

Keywords: Gastrointestinal, Goat, Risk factor, Prevalence and Sheep

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INTRODUCTION

Sheep and goat are mainly found in arid and semiarid areas of sub-Sahara Africa. They play a vital economics role through provision of meat and milk. They contribute more to household income, manure and skin compared to cattle and camels. Small ruminants contribute a large proportion of readily available meat in the diet of pastoralist. They have been estimated to provide up to 30% of the meat, and 15% milk supply in sub-Sahara Africa where they thrived in wide range of ecological region better than cattle. small ruminants have survive better under drought conditions than cattle due to their low body mass and low metabolic requirement, and maintenance needed in arid and semi-arid areas (Wesongh et al., 2003).

Sheep and goat rearing provides livelihood to millions of people, especially to the poor and downtrodden population in the developing and under developed countries. Parasitic diseases have got unique importance as they cause high morbidity and huge economic losses (ranging from 20 to 25 %) in the form of low wool, meat and milk production, retarded growth, morbidity and mortalities (Gupta, 2006). Among parasitic diseases, helminthes are the major constraint in survival and productivity of these animals. Gastrointestinal (GI) nematodes rank highest on global index with *Haemonchus contortus* on top (Perry et al., 2002).

Small ruminants are widely distributed and are of great importance as a major source of income for small and the landless farmers in rural areas. Helminthiasis, especially parasitic gastro enteritis, pose a serious health threat and a limitation to the productivity of small ruminants due to the associated morbidity, mortality, cost of treatment and control measures (Nwosu et al., 2007). In addition to these threats, infestation with helminthes

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lowers the animal's immunity and renders it more susceptible to other pathogenic infections; finally this may result in heavy economic losses (Garedaghi, 2011). The problem is however much more severe in tropical countries due to very favourable environmental conditions for helminthes transmission (Mohanta et al., 2007). The objective of this study was to determine the prevalence and risk factors of Gastrointestinal Nematode Parasites on small ruminate.

MATERIAL AND METHODS

Study areas

The study was conducted in Andabet district since September, 2013 to January, 2014. Andabet is found in south Gondar admistrative zone, Amhara regional state, Ethiopia. It is located at 720 km North of Addis Ababa. The minimum and maximum annual rain fall and daily temperature ranges are between 1000 to 1500 mm and 20 to 25°C, respectively (AWAO, 2012).

Study population and study animals

The study animals were sheep and goat randomly selected from randomly selected three peasant associations (kebeles) The study animals were indigenous breed sheep and goat both sexes (male and female) and all ages groups. A cross-sectional study was conducted on 232 sheep and 150 goats. The study animals were healthy and not treated with anithelmintic during the study period.

Sampling strategy

The sampling method employed to select the study animals was systematic random sampling where a sample of randomly selected sheep and goat. Sample size was determined by taking the expected prevalence of 50% and absolute precision of 5% with 95% confidence level were used and the total sample size was estimated at 384.

Study methodology

Fecal samples were collected directly from the rectum with strict sanitation and placed in air and water tight sample vials. Information about the age, sex, and species was recorded. The age of selected shoat was determined by dentition. A total of 382 fresh faecal samples were collected from the selected sheep and goat flocks. The faecal samples were examined for helminthes eggs using Direct, Sedimentation, Floatation techniques (Foriet, 1999).

Data management and analysis

The data collected from the study area were entered in to Microsoft Excel spread sheet and the data were coded appropriately and analyzed using SPSS version 16 statistical software. Chi-square tests were applied to test the statistical association exists among the risk factor such as species, sex and age with the presence of the infection.

RESULT

A total of 382 fecal samples from small ruminants (232 sheep and 150 goats) were examined. The overall prevalence of gastrointestinal helminthes parasite infestation in sheep and goat was 72.5% (277/382). The prevalence of gastrointestinal helimenth was 78.4% and 63.3 % in sheep and goat respectively. This study showed sheep were more commonly affected than goat this showed that statistically significant difference ($P<0.05$) between species (Table 1). Different prevalence was observed between female (78.0%) and male (71.8%), but there was no statistically significant difference ($x^2=0.83$, $P>0.05$) (Table 2).

Age was also considered as a risk factor and higher prevalence (82.3%) observed in animals of below 5 years old while the lowest prevalence (66.4%) observed in greater than ten years old and the difference between the prevalence among the different age groups was statistically significant ($x^2=6.9$, $P<0.05$) (Table 3).

Table 1 - Parasitic infestation in relation to sheep and goats

Species	No. of animals examined	No. of animals positive	Prevalence (%)	X^2	P-value
Sheep	150	95	63.3	10.35	0.001
Goat	232	182	78.4		

X^2 = Pearson chi-square, (P > 0.05); *P < 0.05; **P < 0.01

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Table 2 - Parasitic infestation in relation to sheep and goats by sex

Sex	No. of animals examined	No. of animals positive	Prevalence (%)	X^2	P-value
Male	341	245	71.8	0.82	0.362
Female	41	32	78		

X^2 = Pearson chi-square, (P > 0.05);*P < 0.05; **P < 0.01

Table 3 - Parasitic infestation in relation to sheep and goats by age group

Age	No. of animals examined	No. of animals positive	Prevalence (%)	X^2	P-value
<5 years	79	65	82.3	6.9	0.043
5-10 years	172	125	72.7		
>10 years	87	87	66.4		

X^2 = Pearson chi-square, (P > 0.05);*P < 0.05; **P < 0.01

DISSCUSION

The coprological examination revealed that the overall prevalence of gastrointestinal parasite was 72.5% of which sheep and goat showed 78.5 and 63.7%, respectively. This result lower than the result of Mulugeta et al. (2011) reported 91.32 and 93.29% in and around Bedelle (south western), Bayou (1992) reported 90.23 and 88.13% in Buno province (illubabor), Tesfalem (1989) reported 92.33 and 93.33% in Bale, Gebreyesus (1986) reported 90.41 and 82.13% in Gondar and Genene (1997), Amenu (2005) who reported a prevalence of 97% in sheep in three different agro ecological areas of southern Ethiopia. The overall prevalence of this finding is greater than the overall prevalence of Tesfaheywet (2012) reported 61.4% in sheep and in goats in and around Haramaya. This difference in prevalence could be related with variation like season of study, age and stage of infestation and treatment of animals (Donald and Waller, 1982). Additional factors like sample size, management system (that is, overstocking of the animals, grazing of young and adult animals together with poorly drained land) could also contribute to the different prevalence.

This study showed statistically significant difference (P<0.05) between species. This findings are agree with the report of Samuel et al. (2012) who described that sheep appeared to be more susceptible to helminthes because they predominantly grazed on grass which harbor infective larvae while goat mostly consume browse which is uncontaminated with parasite larvae. Different prevalence was observed between female (78.0%) and male (71.8%), but there was no statistically significant difference (x^2=0.83, P>0.05). The study findings are similar with the report of Assefa and Sisay (1998), gastrointestinal parasite affects both sexes equally. In similar agro ecological area, there is equal exposure of both sexes to parasite (Armour, 1980).

Age was also considered as a risk factor and higher prevalence (82.3%) observed in animals of below four years old while the lowest prevalence (66.4%) observed in greater than ten years old and the difference between the prevalence among the different age groups was statistically significant (x^2=6.8, P<0.05). According to Asnaji and Williams (1987), young animals are highly susceptible due to immunological immaturity and unresponsiveness.

CONCLUSION AND RECOMMENDATION

The study shows that gastrointestinal (GIT) parasite was a major problem of small ruminant in the study area. GIT nematode infection was highly prevalent in sheep and young age group. Public awareness creation to shoat owners on proper deworming, sufficient feed supply and minimizing extensive open grazing is important.

Acknowledgment

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Author's contribution

Gedefaw performed the data collection; laboratory works and writes up of the manuscript. Tadlo revised the manuscript and sending to publishers. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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EFFECTS OF *Trichanthera gigantea* LEAF MEAL ON THE GROWTH AND PRODUCTION OF QUAILS SUPPLEMENTED WITH ALOE VERA EXTRACT AND ACID CHEESE WHEY

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ABSTRACT: This study was conducted to evaluate the effects of *Trichanthera gigantea* leaf meal on the growth and egg production of quails supplemented with Aloe vera extract (AVE) and acid cheese whey (ACW) in drinking water. A total of 300 quails distributed to 15 treatments with four replications using randomized complete block design (RCBD). Levels of TGLM were T_0 (0%), T_1 (15%) and T_2 (25%), while the water supplements included; 0, 15 and 25 ml per gallon of water of AVE and ACW, respectively. Results revealed that birds fed 15% (T_1) *T. gigantea* leaf meal in the diet performed well in terms of final weight gain and productions. Feed consumption, feed conversion ratio values and water consumption increased in birds fed with 15% *T. gigantea* than the control. Birds with 15% and 25% *T. gigantea* in their feed have delayed point of lay than those in the control. The economic analysis showed that birds fed 15% *T. gigantea* leaf meal with 25 ml ACW had higher return on investment and higher net benefits than other treatments. Results suggests that 15% *T. gigantea* leaf meal in the diet of quail with aloe extract and acid cheese whey supplementation can improve growth and egg production performance in quails.

Keywords: Quail, *T. gigantea* leaf meal, Aloe vera extract, Acid cheese whey, Plant proteins.

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INTRODUCTION

The use of growth-promoting substances to farm animals is now recognized and has been part of the production system management to effect faster growth of fowls. Farmers are getting aware of the production of organic and low cost animal products utilizing indigenous feed ingredients. Thus, new product preparations out of local and indigenous herbs, shrubs, enzymes and probiotics are being investigated to test their efficacy and profitability when fed or supplemented to farm animals. Plant proteins are abundantly available somewhere in the environment. One of the potential sources is the *Trichanthera gigantea* which contain proteins, fibers, calcium and saponins in their leaves (Rosales, 1997). This multi-purpose tree *Trichantera gigantea* (Madre de agua) contains high crude protein content of the foliage particularly the leaves and the thin stems, which are also consumed by the animals and apparently most of that is true protein and has a good amino acid balance, Hong Nhan (1997) cited by Lacayanga (2015). A potential source of protein, its leaves contain 18-22% crude protein in dry matter form (De la Cruz, 2001).

Likewise in the area of vitamins and mineral supplementation, Aloe Vera (*Aloe barbadensis*) extract, cheese whey, lactic acids, probiotics and other natural growth promoters are also gaining importance when added to the drinking water of poultry and livestock (Desmazeaud, 1996).

Acid cheese whey on the other hand, is estimated to contain 42-44% solid milk, These solids includes over 90% milk sugar, a portion of the mineral matter and fat, as well as very high percentage of water-soluble vitamins of the original milk. Typically, cheese whey is composed of 93.4% water, 35% fat, 85% protein, 4.8% milk sugar and 0.6% ash (Fox, 2004; Schingoethe, 1975).

Commercial feeds for growing and laying quails are very limited in the market, in fact most, quail raisers in the locality where the researcher obtained his stock are just using commercial feeds for broilers and layer chickens.

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Hence, to make use of the abundance of the identified feed sources in the community, this study was conducted to ascertain effect of feeding varying levels of locally formulated *T. gigantea*-based diets and supplementing *aloe vera* extract and *cheese whey* on the growth and egg production in quails.

MATERIALS AND METHODS

The Experimental Diets

Experimental diet was formulated by mixing the *Trichanthera* leaf meal with other feed ingredients (Table 1) following the treatment levels and nutrient requirements of quails. Preparations for the experimental diets were made every two weeks while adjusting the CP, Ca, ME and other mineral contents based on growth stages.

Table 1 - Composition of the formulated grower and layer mash for quail

Ingredients	Brooding & Growing Period			Laying Period		
	To	T_1	T_2	T_0	T_2	T_3
Yellow corn	34.02	29.25	25.49	37.14	32.27	28.50
Rice bran	17.00	14.63	12.75	18.76	15.46	14.50
Fish meal	8.80	6.30	5.86	6.75	5.67	4.10
Soybean meal	26.00	22.68	19.54	20.23	18.00	16.30
Copra meal	9.20	7.23	6.66	6.74	5.60	4.90
T. gigantea	0.0	15.00	25.00	0.0	15.00	25.00
Dicaphos	0.60	0.20	0.15	1.18	0.80	0.50
Limestone	0.80	0.40	0.20	4.88	3.50	2.50
Lysine	1.30	1.30	1.30	1.00	1.00	1.00
DL Methionine	0.50	0.50	0.50	0.45	0.45	0.45
Oil	1.50	1.50	1.50	1.50	1.50	1.50
Vit. Premix	1.50	0.86	0.80	0.50	0.50	0.50
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated Composition						
CP %	24.00	24.00	24.00	20.00	20.00	20.00
Ca %	0.87	0.92	1.39	2.53	2.62	2.75
Available P %	0.33	0.24	0.25	0.38	0.33	0.29
Lysine %	1.30	1.30	1.30	1.15	1.15	1.15
Methionine %	0.50	0.50	0.50	0.45	0.45	0.45
ME (kcal/kg)	3032	2961	2816	2993	2835	2798

Preparation and Application of *Aloe Vera* extract

Leaves were collected from the Aloe vera plant (*Aloe barbadensis*), weighed, washed to remove dirt's, sliced/chopped into pieces, and crushed using an electric blender or by hands. The gel from the solid materials was separated by straining with the use of cheese cloth or fine screen, then kept in container and preserved in a refrigerator to further use and analysis.

Preparation of the acid cheese whey

Acid cheese whey used in this study was secured as by-product in white cheese project of the university. The cheese whey was, strained, refrigerated and used as additive in the drinking water for the quails.

Experimental Birds, Design and Treatments

A total of 300 quail birds were randomly divided into 15 treatment combinations with four replications and arranged using randomized complete block design (RCBD). Five females and 1 male both growing and laying periods were subjected to the treatment levels of T. *gigantea* leaf meal, AV, and cheese whey. The feeding and supplementation took place from 7-45 days old of the birds at growing period and 1st to 3rd months of the laying period of the quails.

Factor T (Amount of *T. gigantea* leaf meal)

T_0 = 0% *T. gigantea* leaf meal
T_1 = 15% *T. gigantea* leaf meal
T_2 = 25% *T. gigantea* leaf meal

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Factor 1- 5 (Amount of *Aloe Vera* and acid cheese whey)

1 = No *Aloe Vera* and no acid cheese whey
2 = 15 ml. *Aloe Vera* extract
3 = 25 ml. *Aloe Vera* extract
4 = 15 ml. acid cheese whey
5 = 25 ml. acid cheese whey

General Management Practices

Quails were raised in a plastic screen - floored cage. Feeding the birds with the *Trichanthera*-based diets was regularly undertaken and access to drinking water with supplementation was strictly followed, cleaning and renewal of water in each treatment. Lighting, ventilation, proper health program and sanitation practices were strictly considered for the birds to be protected and comfortable.

Data Collection and Analysis

Growth and laying performance data were collected every week, while economic analysis of the project was taken after 3 months of lay. All observations in each parameter were subjected to Analysis of Variance (ANOVA) and treatment means were compared based on Tukey's Honestly Significant difference Test (HSD).

RESULTS AND DISCUSSION

Final and Gain Weights

As presented in Table 2, the final/gain weights of the quails were significantly affected by the experimental diets. The result showed the final weights of quails fed with 25% *TGLM* irrespective of supplementation have significantly lowered final and gain weights than those birds with 15% *TGLM*. The result implies that regardless of supplementation, the 15% *TGLM* in the diet is the minimum inclusion rate since it also showed higher final and gain weights over the birds without *TGLM* while decreasing its weight when *T. gigantea* was increased to 25%. The result conformed with the findings of Bitancor (2008) who revealed that quails fed with 10-20% *TGLM* had higher final and gain weights than those with 0% and with 30-40% *TGLM* in their diets.

For the AVE and ACW in drinking water of quails the supplementation did not significantly influence the final and gain weights of the quails. However, numerical data indicated a little and gradual increase in the weights of those birds supplemented with 15-25 ml of both AVE and ACW as compared to the birds without supplementation. This result is supported by the study of Alcantara et al. (2004) and Bejar (2005) on *AVE* supplementation which showed significant increase of final weights of broiler as inclusion rate was increased from 5-20 ml. per gallon of water. While the effects of ACW in this study could be associated with the nutritional attributes of *cheese whey* as revealed by Ahmed (2001). It is also noted in the interaction of the two factors, although not significant, that quails supplemented with both AVE and ACW showed a gradual increase of final and gain weights in all levels of *TGLM* in the diets. The treatment combination of 15% *TGLM* in the diet and 25 ml ACW in the drinking water showed the highest weights of the birds.

Feed Consumption

Feed consumption of the quail varied significantly among treatments Table 2. The result indicated that the quail fed diet without *T. gigantea* had significantly lower feed consumption than the birds with 25% *T. gigantea* leaf meal in their diets. However, birds without *T. gigantea* and those with 15% *T. gigantea* are not significantly different from each other, which mean that birds fed 15% levels of *T. gigantea* also have comparably lowered feed consumption. It can be observed that an increase of *T. gigantea* in their diets from 15% to 25% also have an increased feed intake as compared to those without *T. gigantea* in their diets. There was an increase of feed consumption in the treatments that received 25% level of *T. gigantea* leaf meal but resulted to lower gain weights, which was probably attributed to a certain decrease in nutrient digestibility due to high fiber content of the feeds with higher level of *T. gigantea*. This study conformed with the findings of Jaya et al., 2007 which revealed highest feed consumption of pigs fed 10% *T. gigantea* leaf meal in the ration, and the study of Schingoethe (1975) claiming that, if birds are being fed a low energy diet, they will tend to eat more of that diet than if they were fed a higher energy diet.

Feed Conversion Ratio

As indicated in Table 2, the feed conversion ratio of the quail in this study showed that treatment means are significantly differed based on Tukey's HSD Test. As indicated, birds fed with 15% *T. gigantea* leaf meal had

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significantly higher feed conversion ratio than those birds with 25% *T. gigantea* in the diet. This result implies that, the lower the FCR value, the more efficient the birds are, in converting their feed consumed into live body weight gain or egg produced. Thus, the birds without *T. gigantea* and those with 15% *T. gigantea* are more efficient than those with 25%. This study corroborates with the results obtained in the study of Jaya et al. (2007).

Water Consumption

Result showed that the mean water consumption of birds without *T. gigantea* significantly lowered than the birds with 15% and 25% *T. gigantea* in their diets. The data on water consumption (Table 2) of the birds seemed to show a definite trend, it correlated with the feed consumption because birds having consumed more feeds and higher FCR values are also the birds with higher water consumption. The water and feed consumption correlation in this study corroborate in the study on growing chicken by Sharma (1990). However, it showed inverse effects in terms of final and gain in weights. The data also reflects the absence of significant effects of *aloe vera* and acid cheese whey supplementation regardless of *T. gigantea* leaf meal in the diet.

Table 2 - Effect on growth performance of the quail for 1 month period.

Factors	Initial Weight	Final weight	Gain in weight	Feed consumption	Feed Conversion Ratio	Water consumption
Factor T						
T_0 (0% T. gigantea)	21.85	102.80^{b}	80.95^{b}	365.55^{b}	4.53^{b}	36.45^{c}
T_1 (15% T. gigantea)	21.60	108.70^{a}	86.95^{a}	401.25^{ab}	4.63^{b}	42.85^{b}
T_2 (25% T. gigantea)	21.70	99.20^{b}	77.50^{b}	409.45^{a}	5.31^{a}	45.51^{a}
Factor 1-5						
1 (0 ml Aloe vera & cheese whey)	21.17	100.75	79.58	389.33	4.92^{a}	41.75
2 (15 ml Aloe vera)	22.58	103.08	80.50	394.75	4.93^{a}	41.98
3 (25 ml Aloe vera)	22.25	103.33	80.67	389.25	4.85^{ab}	41.30
4 (15 ml cheese whey)	21.08	103.50	82.42	396.50	4.83^{ab}	41.88
5 (25 ml cheese whey)	21.33	107.17	85.83	390.58	4.58^{b}	41.10

Means followed by different letters. ^{abc} in the column is significantly different ($P<0.05$). Factor T (Levels of *T. gigantea* leaf meal). Factor 1-5 (Levels of *Aloe vera* and *cheese whey)*.

Point of Lay

The mean point of lay of birds without *T. gigantea* leaf meal in the diet was significantly lower than those quails with 15-25% *T. gigantea* leaf meal in their diets. The two levels of *T. gigantea* feeds for quail did not vary significantly among treatments (15% and 25%). The point of lay of birds in this study revealed that birds fed without *T. gigantea* leaf meal in their diets laid eggs earlier than those with *T. gigantea* leaf meal. The result implies that the sexual maturity of the birds was adversely affected by the experimental diets (Dozier and Bramwell, 2002). The result on the point of lay of the birds with 0% *T. gigantea* leaf meal can be compared with the study of Bitancor (2008); Dozier and Bramwell, (2002) which revealed 6-7 weeks or 42-56 days normal point of lay for the quail. The point of lay of quails were not affected by the levels of *aloe vera* extract and acid cheese whey supplementation. However, significant interaction was noted due to the longer point of lay of birds fed with 25% *T. gigantea* leaf meal and with 15 mL acid cheese whey as compared to the quails fed without *T. gigantea* and without supplementation.

Egg Production

The egg production of quails was significantly affected by the levels of *T. gigantea* leaf meal during the first and second month of egg production. Data showed that birds with 15% *T. gigantea* had significantly higher egg production percentage than the birds with 25% *T. gigantea* leaf meal in the diet. Quails fed with 15% *T. gigantea* and those without *T. gigantea* did not vary significantly on egg production. The result also revealed no significant difference on egg production among birds on the third month of lay.

There was no significant effects of *Aloe extract* and acid cheese whey supplementation on the egg production of quails throughout the 3-month laying periods. Likewise, interaction effects were not observed between levels of *T. gigantea* in the diets and levels of the two supplements in drinking water of quails. The percentage of egg production ranges from 33.92% to 46.34% in the first month of 40.34-54.17% in the second month lay, and 53.17-62.50% in the third month. However, numerical data showed that birds with *T. gigantea* in their diets (25% *T. gigantea*) showed lower percentage of egg production as compared to treatments without *T. gigantea* and with 15% *T. gigantea* in their diets at first and second months of lay.

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Table 3 - The laying performance of quail fed T. gigantea leaf meal for 3 months period.

Factors	Point of Lay	Egg Weight	Egg Production (1st month)	Egg Production (2nd month)	Egg Production (3rd month)
Factor T					
T_0 (0% T. gigantea)	56.60[b]	9.27[b]	43.65[a]	51.30[a]	57.40
T_1 (15% T. gigantea)	59.95[a]	9.41[ab]	44.16[a]	50.05[a]	59.25
T_2 (25% T. gigantea)	60.90[a]	9.58[a]	36.82[b]	43.66[b]	55.89
Factor 1-5					
1 (0 ml Aloe vera & cheese whey)	58.08	9.38	42.11	49.50	56.36
2 (15 ml Aloe vera)	59.83	9.46	42.57	47.53	57.53
3 (25 ml Aloe vera)	59.08	9.40	41.33	47.61	55.86
4 (15 ml cheese whey)	59.33	9.40	40.45	48.53	58.31
5 (25 ml cheese whey)	59.42	9.45	41.25	48.52	59.51

Means followed by different letters. abc in the column is significantly different (P<0.05). Factor T (Levels of *T. gigantea* leaf meal). Factor 1-5 (Levels of *Aloe vera* and *cheese whey).*

Financial Profitability

Among the dietary treatments evaluated, birds fed 15% *T. gigantea* leaf meal showed the highest net income and return on investment (Table 4). It can be observed that birds fed without *T. gigantea* and with 15% *T. gigantea* are the ones that showed positive earnings. However, the 0% *T. gigantea* fed birds with 15 ml. *aloe vera* and the birds fed 15% *T. gigantea* with 15-25 ml *cheese whey* are the most profitable considering its return on investment reached beyond 10%. Birds fed 25% *T. gigantea* regardless of supplementation appeared to have negative and the lowest earnings among treatments. The result can be associated with the effects of the treatments on the growth and point of lay of the birds, which resulted to lower gain in weights and delayed sexual maturity of the birds, and thus lower egg production.

The viability of the project is more justified by the result of the project worth measures which indicated worthwhile NPV, IRR and BCR values for the birds with 15% *T. gigantea* leaf meal and with 25 ml *cheese whey* supplementation as well as those birds without *T. gigantea* leaf meal and without supplementation. It appeared that birds with 15% *T. gigantea* leaf meal and without *T. gigantea* are the two projects said to be economically profitable since both obtained a desirable and positive worth measures. While birds fed 25% *T. gigantea* and 25 ml *aloe vera* supplement is no longer economical due to its negative NPV, lower IRR than the interest rate of 22% and a BCR value of less than one.

Table 5 also shows the consequence of the three levels of *T. gigantea* leaf meal fed quails if continued for a periods of 5 years with an assumption of 10% increase of total costs annually, while maintaining its total benefits within five years. It is expected that birds fed 15% *T. gigantea* with the supplementation of 25 ml cheese whey can be profitable within 5 years period without change of benefits while increasing total costs by 10% every year.

Table 4 - Cost and return analysis for 4-months egg production of the quails

Treatments	Total Operating Costs[1]	Egg Produced[2]	Sales of Eggs[3]	Net Income[4]	Return on Investment[5]
$T_{0\text{-}1}$ (0% *T. g* & 0 ml AV & ACW)	84.00	48.22	96.44	12.44	14.81
$T_{0\text{-}2}$ (0% *T. g* & 15 ml Aloe vera)	84.00	47.89	95.78	11.78	14.02
$T_{0\text{-}3}$ (0% *T. g* & 25 ml Aloe vera)	84.09	44.78	89.56	5.47	6.50
$T_{0\text{-}4}$ (0% *T. g* & 15 ml Cheese whey)	84.01	45.22	90.44	6.43	7.65
$T_{0\text{-}5}$ (0% *T. g* & 25 ml Cheese whey)	84.04	44.78	89.56	5.52	6.57
$T_{1\text{-}1}$ (15% *T. g* & 0 ml AV & ACW)	82.58	44.34	88.68	6.10	7.39
$T_{1\text{-}2}$ (15% *T. g* & 15 ml Aloe vera)	82.79	45.38	90.76	7.97	9.63
$T_{1\text{-}3}$ (15% *T. g* & 25 ml Aloe vera)	82.70	43.00	86.18	6.16	7.55
$T_{1\text{-}4}$ (15% *T. g* & 15 ml Cheese whey)	83.13	47.38	94.76	11.63	13.99
$T_{1\text{-}5}$ (15% *T. g* & 25 ml Cheese whey)	82.72	48.38	96.76	14.04	16.97
$T_{2\text{-}1}$ (25% *T. g* & 0 ml AV & ACW)	81.60	43.88	87.76	3.48	4.21
$T_{2\text{-}2}$ (25% *T. g* & 15 ml Aloe vera)	81.75	38.33	76.66	-5.09	6.23
$T_{2\text{-}3}$ (25% *T. g* & 25 ml Aloe vera)	81.40	41.47	82.94	1.54	1.89
$T_{2\text{-}4}$ (25% *T. g* & 15 ml Cheese whey)	81.52	40.60	81.20	-0.32	-0.39
$T_{2\text{-}5}$ (25% *T. g* & 25 ml Cheese whey)	81.51	38.80	77.60	-3.91	-4.80

[1]Include cost of quail chicks, feeds, labor, water and electric bill. [2]Egg produced of the quail for 3 months. [3]. Derived from multiplying the number of eggs produced by 2.00 pesos each. [4]Gross income (total sales) minus total operating cost. [5]Net income expressed as a percentage of total operating costs.

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Table 4 - Five years egg production analysis of quail fed with levels of *t. gigantea* and supplementation.

Treatment Combinations	Year 1		Year 2		Year 3		Year 4		Year 5		Total
	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost	
T0-1 (0% T.g & 0 ml A.V/ACW)	60057.17	40,689.34	60057.17	44,758.27	60057.17	49,234.10	60057.17	54,157.51	60057.17	59573.26	
Net Benefit	19,367.83		15,298.90		10,823.07		5,899.66		483.91		51,873.36
T1-5 (15% T. g & 25 ml ACW)	62156.28	40,114.21	62156.28	44125.63	62156.28	48538.19	62156.28	53392.01	62156.28	58731.21	
Net Benefit	22,042.07		18030.65		13618.09		8764.27		3425.07		65,880.13
T2-3 (25% T. g & 25 ml A.V)	56296.74	39,581.63	56296.74	43,539.79	56296.74	47,893.77	56296.74	52,683.15	56296.74	57,951.46	
Net Benefit	16,715.12		12756.96		8402.98		3613.60		-1654.71		39,833.94

CONCLUSION

The above findings indicate that growth and egg production performance of quail is affected with different percentage levels of *Trichanthera gigantea* leaf meal (TGLM) in terms of final and gain weights, feed consumption, feed conversion, water consumption, point of lay, percent egg production, return of investment and project viability. The 15% TGLM and 25 ml. ACW is the treatment combinations considered the optimum level that can provide an increase in the growth and egg production of quails.

DECLARATIONS

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Author's contribution

F.R. Bejar was the sole author of the study and the only one performed the experiments.

Competing interest

The author declared that no competing interests exist.

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ASSESSMENT OF MAJOR LIVESTOCK FEED RESOURCES AND FEEDING SYSTEMS IN BENCH-MAJI ZONE; SOUTH WESTERN PART OF ETHIOPIA

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ABSTRACT: The study was conducted with the objectives of assessing major livestock feed resources and its utilization practices in Bench-Maji Zone, South Nations, Nationalities, Peoples Region (S.N.N.P.R). The average farm size owned per household (hh) in Surma (3.03 ha) were significantly higher (P<0.001) than the average farm size owned by Shey-Bench (2.48ha) and Semen Bench (1.95ha). Farm size allocation to crop production in Surma, Shey-Bench and Semen Bench was 2.49, 1.96 and 1.15 ha, respectively. Out of the total land owned per household; about 0.56, 0.18 and 0.29, and 0.00, 0.21 and 0.07 hectares were allocated for grazing and forage, respectively in Surma, Shey-bench and Semen Bench. The number of cattle and goats reared per hh in Surma Woreda was significantly higher (P<0.05) than that of Shey-bench and Semen Bench. Similarly, there was significantly large number of chickens in Surma woreda than Shey-bench. But, there were no significance difference for chicken's production in Surma and Semen Bench woredas. Contrast to chickens; there were significantly higher sheep and equine production in Shey-Bench than Semen Bench and Surma woredas. Moreover, there was no Equine production in Surma woreda might be due to the feeding habit of Equines in addition to prevalence of disease. The major feed resources to livestock in the study area were: natural pasture, crop residues, cultivated pasture, hay, left over of banana and/enset and taro leaf. Out of these, Natural pasture was the primary source of feed to animals in the study area. The most limiting constraint to livestock was shortage of grazing land and healthy problems.

Keywords: Livestock, Feed resource, Feeding system, Bench-Maji zone

ORIGINAL ARTICLE

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INTRODUCTION

In the smallholder production systems of Ethiopia, food crops are produced for subsistence and livestock are raised to provide mainly draught power for crop cultivation and other secondary outputs like milk, meat, hide/skin, dung and manure. Livestock production is an integral part of the farming systems in all parts of Ethiopia indicating its large contribution to the country's economy in the livelihoods of many Ethiopians (Helina and Schmidt, 2012). However, rate of livestock productivity is very slow and lag behind the growth of the population mainly due to insufficient supply of feeds (both quantity and quality) and poor management practices (Tsegay et al., 2015). From all, poor nutrition is the corner stone in limiting the productivity and reproductive performance of livestock. A majority of Ethiopia's livestock production depend mainly on natural pastures for their feed requirements. Natural pastures which provide more than 90% of the livestock feed are generally very poorly managed and its availability depends on rainy season (Alemayehu, 2005). There is abundant natural pasture during rainy season but at the dry season there is scarcity of natural pasture both in quality and quantity. Seyoum et al. (2001) noted that pasture growth is a reflection of the annual rainfall distribution pattern. In the mixed farming areas, better soils are used for cropping and the main permanent natural pasturelands are found on the upper slopes of hills and seasonally water logged areas in which overstocking taking place which result severe land degradation. A majority of Ethiopia's livestock production is focused in the highlands due to availability of crop residues for feed (Gizaw et al. 2010) and

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less risk of disease (Knips, 2004). However, crop residues are restricted to harvesting period and also low in nutritive value. Agro-industrial by products is mainly restricted to urban and per-urban areas where agro-industry (factory) distributed. Improved forages were not well established in the country. In this respect, Bench Maji Zone is not an exception and the same trend was observed by prioritizing better lands for cultivation to compete for grazing lands. There is no agro-industry (factory) which has the ability to process different grains to different by products which will be used as livestock feed. The farmers were not knowledgeable to treat low quality feeds such as crop residues and others. There is no well establishment of improved forage crops, and conserving forages are not well known. Low feed supply both in terms of quality and quantity results in retarded reproductive and growth performance of animals (Sisay, 2006). Poor nutrition in addition to causing low rates of production and reproduction also increases susceptibility of livestock to diseases and subsequently mortality. It is recognized that animal performance and especially milk production is much more dependent on the quantity and quality of feed eaten rather than on the genetic makeup of the animal (Tsegay et al., 2015). Biologically, about two-thirds of the improvement in livestock productivity is often attributed to nutrition since animal production is basically a conversion of feed into animal products. In economic terms, feed cost can account for up to 70% of the total cost of production of an animal product (Makkar, 2016). Therefore, efficient use of the feed resource by producing more productivity with less feed decreases the costs of feed and increases the profitability of the livestock operation (Makkar and Beever, 2013).

Regardless of all of these, there is no documented information about livestock feed resource and utilization practices in the Bench Maji zone in which this study was conducted. Therefore, documenting the livestock feed resources and utilization practices are important to exactly address the problem and so as to find the solution. Therefore, this study was conducted to assess the major livestock feed resources and its utilization practices in selected Woredas of Bench- Maji zone.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Bench Maji Zone of the South Nations, Nationalities, Peoples Regional state (S.N.N.P.R). Mizan is the town of Bench Maji Zone located between 06059 '27.4" north south latitude and 035o35'9" east west longitude. It is located at an altitude of 1430 m.a.s.l and found at distance of 561km south west of Addis Ababa and 842 km from the regional capital Hawassa (BWRDO, 2005).

The amount and distribution of rain fall ranges between 300 mm to 2800 mm, about ten months rainfall per year. The average minimum and maximum temperature is 22 ^{o}C and 27 ^{o}C, respectively, (BMZBOFED, 2005). The common agricultural systems practiced in the zone are pastoralism, Silvo-pastoralism and mixed farming activities. The dominant crop grown in the area are cash crop (coffee, tea and spices), vegetables (cabbages), root and tuber crops (taro, cassava, yam, and sweet potato), cereal crops (maize, barely, rice, and wheat) and fruits (mango, avocado, papaya, anannas, and banana), all grown for household consumption and income generation.

Assessment of livestock feed resources and its utilization practices

Feed resources and its utilization practices were conducted by interviewing 180 randomly selected households (HHs), 60 households from Surma, 60 from Shey-bench and 60 from Semen Bench woredas. A semi-structured questionnaire was used for the interview. Farmers who reared at least one animal and were willing to participate in the survey were selected. The survey was conducted between September 2013 and July, 2014. Livestock holders were interviewed with a pre-tested questionnaire. Secondary data were also collected from the Woredas and Zonal Agricultural and Rural Development Offices on the issue related to livestock feed resources and its utilization practices, such as livestock population, land holding, livestock production constraints, income of household, feed resource, utilization practices, water availability, and feed conservation mechanisms in the area.

Statistical Analysis

The collected data was organized and analyzed using the Statistical Package for the Social Sciences (SPSS, 2003) and descriptive statistics such as frequency, means, and percentages.

RESULTS AND DISCUSSIONS

Household Characteristics

Educational levels of the respondents (%) in selected woredas of Bench Maji zone was presented in Table 1. The studied households had an average total family size of 7.1 (Semen Bench = 6.2; Shey Bench = 7.3 and Surma = 7.9) which was higher than the average family size reported by Ahmed et al. (2010) and less than the result

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reported by Dawit et al. (2013). The age of respondents varied between 25 and 70 years with an average of 39.3 years. The educational level attended by the household heads was very low (Table 1) especially in the Shey-Bench and Surma woredas. The low level of education can adversely affect the use of modern technologies which in turn decrease the income of household.

Land Holding per Household

The mean land holding per house hold in the study area were 2.48; which were very high compared to the findings of Ahmed et al. (2010) in the central highlands of Ethiopia. The average farm size owned per household (hh) in Surma was about 3.03 hectares, which were significantly higher (P<0.001) than the average farm size (2.48 hectares) owned by Shey-Bench or Semen Bench (1.95) (Table 2). Farm size allocation to crop production was 2.49, 1.96 and 1.15 hectares in Surma, Shey-Bench and Semen Bench, respectively with the total mean of 1.86ha indicated that large proportion of farm size was allocated to crop production which was in agreement with the reports of Tesfaye (2008) and CSA (2013). The crop land in Surma was significantly higher (P<0.001) than Shey-Bench and Semen Bench woredas. Similarly, the land allocated for grazing in Surma woreda was significantly larger (P<0.001) than in Shey-bench and Semen Bench woreda indicated its pastoral area. But, the land allocated for grazing in Shey-bench and Semen Bench was similar statistically. The land used for forage production in Shey-bench was significantly higher (P<0.01) as compared to Surma and Semen Bench woreda. However, there was no forage development in Surma woreda.

Purpose of Keeping the Cattle

Greater than half of the contacted house hold in Semen Bench and Shey-Bench woreda keep cattle for milk, traction and saving. Milk, saving and marriage contribute the major purpose of keeping cattle in Surma woreda. Even though the banks were developed now at the Mizan-Aman sub city, during the past times there were no banks to save their money. This trend also continued with the farmers and most farmers put their money on cattle rather than saving in the bank to sale and use it as an immediate cash income in the case of difficulty in addition to the selling of milk for house hold commodities. Similarly, the oxen kept in the Shey-Bench and Semen Bench woreda were used for traction to produce food crops. Generally, the livestock in the study area were not reared for single purpose rather for multi-purpose.

Table 1 - Educational levels of the respondents (%) in different woredas of Bench Maji zone

Woredas	Illiterate	Basic Education	Primary	Secondary
Semen Bench	32.5	32.5	25	10
Shey-Bench	47.5	30	7.5	15
Surma	100	-	-	-

- = not available (Respondents; Semen Bench = 60, Shey-Bench = 60, and Surma = 60)

Table 2 - Land holding per household in the study Area

Variable	Surma Mean± SE N= 60	Shey-Bench Mean ± SE N=60	Semen Bench Mean ± SE N=60	Total Mean ± SE
Total (ha)	3.03+0.13^{a}	2.48+0.24^{b}	1.95+0.17^{c}	2.48+0.11
Cropland (ha)	2.49+0.14^{a}	1.96+0.19^{b}	1.15+0.13^{c}	1.86+0.10
Fallow (ha)	0.00+0.00	0.02+0.01	0.09+0.04	0.04+0.01
Grazing (ha)	0.56+0.06^{a}	0.18+0.048^{b}	0.29+0.05^{b}	0.34+0.03
Forage (ha)	0.00+0.00^{b}	0.21+0.06^{a}	0.07+0.03^{b}	0.09+0.02
Other (ha)	0.00+0.00^{b}	0.13+0.04^{b}	0.36+0.09^{a}	0.16+0.03

Means with different letters within a raw are significantly different (P<0.05); N = number of respondents; SE =standard error

Table 3 - Purpose of keeping cattle in the Study Area

Woredas	Milk and saving	Milk and traction	Traction and saving	Milk, traction and saving	Milk, saving and marriage
Semen Bench	17.5%	2.5%	5%	75%	-
Shey-Bench	-	45%	-	55%	-
Surma	-	-	-	-	100%

- = not available

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Livestock Holding per Household

Cattle, sheep, goats, poultry and equines were reared by the local community of the three woredas. The number of cattle and goats reared per house hold in Surma woreda was significantly higher (P<0.05) than that of Shey-bench and Semen Bench (Table 4). Similarly, there was significantly large number of chickens in Surma woreda than Shey-bench. But, there were no significance difference for chicken's production in Surma and Semen Bench woredas. In general, there were high number of cattle, goat and chickens in Surma woreda might be due to its pastoral area which was comfortable for livestock production. There was no sheep population among the contacted respondents in Surma woreda might be due to pastoral areas were more comfortable for the production of goat, cattle and camel than sheep probably due to adaptability of these species to the hot climatic conditions. There was significantly higher sheep and equine production in Shey- Bench than Semen Bench and Surma woredas. There was no Equine production in Surma woreda might be due to the feeding habit of Equines (Equines needed around rivers to graze which was not mostly found in pastoral area) in addition to prevalence of disease. Variation in size of herd per house hold from place to place with the availability of water and grazing lands, prevalence of diseases and parasites as well as the management of the livestock owner have also been reported earlier researcher (Tessema et al., 2003).

The number of cows, Heifers and bulls per house hold in Surma woreda were significantly higher than in Shey-bench and Semen bench woredas. But, there was no significance difference between Shey-bench and Semen Bench woredas. Similarly, the number of Oxen and Calves per household in Surma woreda was significantly higher (P<0.05) than in Shey-Bench and Semen Bench woredas. The number of cows, Oxen and calves in Shey-Bench were also significantly higher than in Semen Bench. Higher number of cattle herd structure was registered in Surma woreda might be due pastoralist keep large number of livestock for the sake of drought.

Table 4 – Number of livestock owned and cattle herd composition per household in different woredas of Bench Maji zone

Livestock species	**Surma** (N=60) Mean + SE	**Shey-B.** (N=60) Mean + SE	**Semen B.** (N=60) Mean + SE	Total mean +SE
Cattle (No)	30.65+1.51^{a}	10.88+0.88^{b}	7.53+0.48^{c}	16.35+1.11
Sheep (No)	0.0 ^{c}	6.15+0.67^{a}	1.98+0.26^{b}	2.71+0.33
Goat (No)	9.40+1.17^{a}	3.15+0.51^{b}	1.93+0.33^{b}	4.83+0.53
Chickens (No)	13.30+1.26^{a}	10.03+0.75^{b}	12.28+1.15^{ab}	11.87+0.63
Equines (No)	0.00+0.00^{b}	2.70+0.46^{a}	0.15+0.06^{b}	0.95+0.19
Cattle herd Composition				
Calves	5.05+0.45^{a}	2.53+0.26^{b}	1.60+0.16^{c}	3.06+0.22
Heifers	5.43+0.35^{a}	1.05+0.19^{b}	0.73+0.11^{b}	2.40+0.24
Bull	5.40+0.42^{a}	1.13+0.18^{b}	0.80+0.16^{b}	2.44+0.25
Oxen	5.88+0.39^{a}	2.58+0.20^{b}	1.48+0.15^{c}	3.31+0.23
Cow	8.90+0.59^{a}	3.60+0.31^{b}	2.93+0.22^{b}	5.14+0.34

Means with different letters within a raw are significantly different (P<0.05); N = number of respondents; SE =standard error

Major Constraints of Livestock Production

The most limiting constraint to production of cattle, small ruminant and equine in Shey-Bench and Semen Bench woredas were shortage of grazing land. Reduction in pastureland and expansion of farm land were more prominent in Semen Bench and Shey-Bench than Surma woredas. This might have been caused by the high human population density that demanded more land for crop production leading to a reduction in grazing areas as a result overstocking of communal grazing lands. Thus, communal grazing lands are not any more productive to supply livestock with adequate quantity of quality forages. Similar finding also indicated by Dawit et al. (2013) who indicated that increment in crop land at the expense of grazing land, shortage of land for forage production, renting and allocation of open grazing lands around Lake Zeway for investors which has resulted in a decrease grazing land. Similarly, Healthy problem, feed problem and cultural practices (use of blood as a food) were the major constraints which hindered livestock production in Surma woreda. Shortage of feed in Surma woreda might be due to the invasion of the communal grazing land by less palatable species of forages like Hyparrhenia, which have bushy nature and hinders development of other species resulting in feed deficit. Disease and parasites problem in the Surma woreda might be due to high infestation of tsetse fly that causes trypanosomiasis and cross border movement of cattle from the Sudan also causes the transmission of livestock diseases of economic importance like blacklegs and pastuerollosis.

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Table 5 - Major constraints of livestock production in the study area

Major constraints	Woredas		
	Semen Bench (%)	Shey Bench (%)	Surma (%)
Feed problem	62.5	45	100
Healthy problem	52.5	22.5	100
Breed problem	45	20	-
Shortage of grazing land	70	82.5	-
Lack of forage seed	10	47.5	-
Lack of awareness	-	42.5	-
Lack of knowledge (skilled man power)	-	35	-
cultural practices (use of blood as food)	-		100

Major Livestock Feed Resources

The main feed resources to livestock in the study area were natural pasture, crop residues, cultivated pasture, hay, left over of banana and/enset and taro leaf which was similar to the finding of Ahmed (2006) and Tesfaye (2008).

Natural pasture

Natural pasture was the primary source of feed to animals in all study areas as it was ranked first (Table 6) which is in agreement with the finding of Tesfaye (2008). Of the sampled households, 100% in the Semen Bench and Surma woreda, and 90% in the Shey-Bench woreda ranked natural pasture as the primary source of feed to their animals (Table 6). In Surma woreda, natural pasture is the only main feed resource used by livestock throughout the year might be due to the mode of life in Surma woreda which was pastoral production system. This is in agreement with the study conducted by Malede and Takele (2014) who reported natural grazing land as a predominant feed source for livestock in pastoral and agro-pastoral areas. Grazing occurs on permanent area, fallow land and a land following harvest. In the study area, there are two type of grazing land which was private grazing land and communal grazing land. The communal grazing land was digging out (ploughed) for the sake of cultivation. This indicated that, the communal grazing land was now the days changed to cultivated land which decreases the livestock feed resource for the livestock. So after it was cultivated, the pasture land was invaded by less palatable species of forages, which have bushy nature and hinders development of other species resulting in feed deficit. The result is similar to the report of Ahmed (2006) in Basona Worana Wereda of North Shoa.

Crop Residues

Crop residues were the second major feed resource next to natural pasture in both Shey-Bench and Semen Bench woreda. The known crop residues in the study area were maize and sorghum stover, rice and teff straw. Rice straw was the most important livestock feed followed by sorghum stover and teff straw in both Semen Bench and Shey-Bench woreda. This was mainly due to the suitability of the area for cereal crops that provide straws and stovers for the animal feeding. The feeding of crop residue mostly begins soon after threshing crops in both woredas. In general, crop residues and natural pasture are the major feed resources of the area which agree with the report of Dawit et al, (2013) who reported natural pasture and crop residues as a major feed resource for highlands of Ethiopia. Even if they are using crop-residues as animal feed, improving the crop-residues like chemical treatment was not well known in the study area.

Table 6 - Percentage of respondents using Grazing Lands as an animal feed in different woredas of the study area

No	Woredas	Grazing lands (natural pasture) ranked		
		1st	2nd	3rd
1	Semen Bench	100	-	-
2	Shey- Bench	90	5	5
3	Surma	100	-	-

Table 7 - Percentage of respondents using crop residues as an animal feeding in the different woredas of Bench-Maji zone

No	Woredas	Feeding crop residues ranking			
		1st	2nd	3rd	4th
1	Semen Bench	5	75	20	-
2	Shey-Bench	5	50	40	5
3	Surma	-	-	-	-

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Stubble grazing

After harvesting the crops, livestock are allowed to graze stubbles of maize, sorghum and teff in both Shey-Bench and Semen Bench woredas. The stubbles are accessible to all animals in the community. The highest proportion of respondents from both woreda allows their animals to graze on aftermath of sorghum as compared to Surma woreda. The stubbles are grazed by the animals of the farm owner and later it becomes accessible to all animals which was in agreement with the finding of Ahmed et al. (2010) and Ahmed (2006).

Hay

Hay was an important feed resource which is conserved to feed animals mainly during dry season. In Shey-Bench woreda during the study time, 50% of respondents ranked hay as third next to crop-residues. But, farmers in Semen Bench and Surma woreda were not engaged in hay making to feed to their animals during the dry season might be due to lack of awareness, and qualities of grass species for hay making were less available in those Woredas. This showed that, conservation in the form of hay and silage is not a common practice in those study areas.

Left over of banana and/Enset

By products of banana and/enset also used as animal feed even if it is not widely used. In Semen Bench woreda it was ranked as third next to crop residues. The main product was used as human food, but it's left over was very important as animal feeds. However, farmers in Shey-Bench and Surma woreda were not used byproducts of banana/enset as animal feed.

Feeding taro leaf

Like banana/enset left over, taro leaf also an important feed resources in Semen Bench woredas. Its root was used as human food while its leaf part was used as animal feed. But, the percentage that provided to the animals depends up on its utilization for human food.

Table 8 - Percentage of respondents using hay as an animal feeding in different woredas of the study area

No	Woredas	Feeding Hay ranking				
		1st	2nd	3rd	4th	5th
1	Semen Bench	-	-	-	-	-
2	Shey-Bench	-	15	50	20	15
3	Surma	-	-	-	-	-

Table 9 - Percentage of respondents using left over of banana and/enset as an animal feeding in different woredas of Bench Maji zone

No	Woredas	Feeding left over of banana and/enset ranking				
		1st	2nd	3rd	4th	5th
1	Semen Bench	-	-	50	30	20
2	Shey-Bench	-	-	-	-	-
3	Surma	-	-	-	-	-

Table 10 - Percentage of respondents using taro leaf as an animal feed in the different woredas of study areas

No	Woredas	Feeding Taro leaf ranking				
		1st	2nd	3rd	4th	5th
1	Semen Bench	-	-	30	65	5
2	Shey-Bench	-	-	-	-	-
3	Surma	-	-	-	-	-

Cultivated forage species

The least in the order of importance as animal feed in the study area was cultivated pasture. This is due to the farmers in these woredas were not aware regarding cultivated pasture and conserved forage. In other words, cultivated forage species are not widely produced in the study area. However, attempts were made to improve the supply and quality of traditional forage in a few weredas by the Zonal and woredas Agriculure offices. From cultivated pasture, Elephant grass has been introduced in Semen Bench and Shey Bench. But, very small proportions of the house hold were practicing for improved forage to alleviate feed shortage.

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Agro-industrial by Products

All of the respondents from all study areas reported that, there were no agro-industrial by-products available on local market for their animals might be due to the remoteness of the area. This means the study area was far from the center which was known for different factory like flour milling, oil factory and beer factory. Taking different by products from the center (Addis Ababa) fetches high transportation cost. Due to lack of supplemental feed resources, livestock are fed on natural pasture, different by products and crop residues.

Livestock Feeding Systems

A utilization practice of livestock in different areas differs depending on availability of roughage. All respondents in Surma woreda used free grazing throughout the year. But, majority of them (60% and 65%) used free grazing in the case of Shey-Bench and Semen Bench, respectively. Few of them used tethering on fallow land, road side and in collection yard using group feeding. When natural pasture becomes less available during the dry season, farmers in the study area uses forages for their livestock by cutting and carrying feeding system from the forest areas.

Water Resources

The main sources of water in the study area were rivers. River is the main water sources to livestock in Surma and Semen Bench woredas throughout the year. But, some of the respondents in Shey-Bench woreda used ponds at home. Adult animals were watered by trekking a distance of less than 1km in Semen Bench and Shey-Bench woredas. But in Surma woreda, cattle watered by trekking 1-5km.The relatively longer distance in Surma woreda indicated that herds were wasting much of their energy in travelling to and from the watering points and hence contributed towards lower productivity of dairy cattle which was in agreement of the study conducted by Dejene et al. (2014) in Borana zone. Calves and weaker animals were watered at home on fetched water. Watering frequency of cattle was varied from one agro-ecology and season to the others. In Surma woreda cattle has been believed to be watered every other day. However, the frequency was shorter in Shey-Bench and Semen Bench woredas since the area was relatively enriched with water source. So most of the farmers in these woredas watered their animals twice a day, only very small number of them water once in a day.

Table 11 - Percentage of respondents using cultivated pasture as an animal feed in different woredas of the study areas

No	Woredas	Feeding cultivated pasture ranking				
		1st	2nd	3rd	4th	5th
1	Semen Bench	-	20	10	5	65
2	Shey-Bench	10	30	30	25	5
3	Surma	-	-	-	-	-

Table 12 - Livestock feeding system in the study area

Feeding systems	Woredas		
	Surma	Shey-Bench	Semen Bench
Indoor feeding individually	-	-	5%
In a collection yard feeding by group	-	7.5%	5%
Free grazing	100%	60%	65%
Tethering	-	32.5%	25%

Table 13 - Distance travelled by animals during watering

Distance travelled	Woredas		
	Surma	Shey-Bench	Semen Bench
Watered at home	-	10	-
<1Km	-	90	100%
1-5km	100%	-	-

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CONCLUSSION

It can be concluded that, the main feed resources to livestock in the study area were natural pasture, crop residues, cultivated pasture, hay, left over of banana and/enset and taro leaf. Natural pasture contributes the bulky of feed resources in all study areas. However, the quantity and quality of natural pasture was diminishing from time to time may be due to expansion of grazing land by crops, overgrazing and/ in general lack of management. Crop-residues were also the major livestock feed resources next to natural pasture. Free grazing was the major feeding system /utilization practices of livestock in all study areas. Shortage of grazing land was the most limiting constraint to production of livestock which was caused by the high human population density that demanded more land for crop production leading to a reduction in grazing areas with the resultant overstocking of communal grazing lands.

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Authors' contribution

TF and MD designed the research, analyzed the collected data, interpret the results and finalized the manuscript writ up. Finally, the authors re-read and approved the final manuscript.

Conflict of interests

The authors have not declared any conflict of interests.

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A REVIEW ON MILK PRODUCTION AND REPRODUCTIVE PERFORMANCE OF DAIRY CATTLE IN ETHIOPIA

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ABSTRACT: This review was conducted to review the information on milk production (lactation milk yield, lactation length and milk composition) and reproductive performance (age at first calving, calving interval and number of service per conception) of dairy cattle in Ethiopia. The mean values of lactation milk yield (LMY) ranges between 494 to 809 kg with lactation length (LL) of 128 to 353 days for indigenous breeds, 2343 to 1583 kg with lactation length of 275 to 448 days for crossbreed cows, and 1583 to 3796 kg with lactation length (LL) of 276 to 362 days for exotic breeds respectively. Both LMY and LL were significantly affected by breed, parity and year of calving. In general, F_1 crosses produce more milk compared to F_2 crosses and indigenous breeds. Milk from Boran cows had high percentage of milk fat, protein and total solids than Frisian cross breed cows. However, milk from Friesian crossbreed dairy cows had high content of milk lactose than Boran cows. Mean values of AFC for indigenous breed's ranges between 30.3 to 50.0 months while Calving interval (CL) ranges between 11.8 to 15.6 months respectively. The mean values of AFC range from 29.1 to 55.4 months for Holstein Friesian crosses and 38.8 to 46.9 months for Jersey crosses. The second filial generation (F_2) had longer AFC and CI than those from first filial generation ($F_{1)}$ crosses. From this review it can be concluded that crossing local cattle with exotic breeds improved milk production but long calving intervals were observed as exotic blood increase.

Keywords: Crossbred, Milk production, Reproductive, Ethiopia

REVIEW ARTICLE

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INTRODUCTION

Ethiopian livestock population estimated to be about 44.3 million cattle (CSA, 2004) where over 60% of the cattle are found in the highlands. Livestock contributes to the production of food (milk, meat and eggs), industrial raw materials (wool, hair, hides and skins), inputs for crop production (draft power and manure) and export earnings (live animals, skins and hides). They also generate cash income which can be used to purchase food grains, seeds, fertilizer and farm implements and for financing miscellaneous social obligations of the smallholder farmers. Dairy research and development programs have been undertaken in the past two to three decades by various organizations. A review of these programs (Sintayehu et al., 2008) that they made minimal impact on the dairy industry. Despite huge livestock population, the high domestic demand for dairy products and favorable climatic conditions in most parts of the country. The per capita milk consumption of Ethiopia is 19 kg/head/year (Belay et al., 2012). This is very low when compared to African (27 kg/head/year) and world (100 kg/head/year) per capita averages (Sintayehu et al., 2008).

This clearly shows a wide gap seen between the current supply and demand for milk in the country. Over 99% of the cattle population in Ethiopia are indigenous and about 42% are milk cows (Demeke et al., 2004).There are over six distinguishable, indigenous cattle breeds (Boran, Horro, Arsi, Fogera,Karayu and Barka) in Ethiopia evolved mainly as a result of natural selection influenced by factors like climate, altitude and available feed supply, endemic diseases, functional objective of livestock owners, management technique and market demands that make them adapted to harsh environmental conditions (IBC, 2004). Most of them belong to the zebu- type with the inclusion of some intermediate short horn sanga type (Rege et al., 2006). The objective of this paper is to review current development on milk production and reproductive performance of dairy cattle in Ethiopia.

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Dairy production systems in Ethiopia

The Ethiopian dairy production system is based on predominantly indigenous zebu cattle, which is well adapted to and distributed among the diverse ecological conditions and management systems of the country. Although no exhaustive identification and characterization work has been conducted, it is suggested that there are over 25 types/breeds of indigenous cattle, the most popular ones including Boran, Horro, Fogera, Arsi, Karayu and Nuer (IBC, 2004). The existing dairy cattle production system belongs to any of the following four major livestock production systems: lowland pastoralist dairy production system, rural and highland smallholder dairy production system, urban and peri-urban small scale dairy production system and commercial dairy farms.

I) Lowland pastoralist dairy production system:

About 30% of the livestock populations in Ethiopia are found in the pastoral areas. These areas comprise 50% of the total land area of the country and have altitudes below 1,500 meter above sea level. Livestock doesn't provide inputs for crop production but are backbone of their owners providing all of the consumable and saleable out puts and regarded as insurance against adversity. Milk production is dependent on season due to the rainfall pattern that influences feed availability.

II) Highland small- holder dairy production system

There are two types of systems in the highland. The traditional system that is based on indigenous breeds and the market oriented system that is based on crossbred dairy cattle. The milk produced is mainly consumed by the household in the traditional system while most of the milk is sold to generate income in the market oriented system.

III) Urban and peri-urban small scale dairy farming

This system is developed in and around major cities and towns. The main feed resources are agro industrial by products and purchased roughages. The system comprises small and medium sized dairy farms that own crossbred dairy cows. Farmers use all or part of their land for forage production (Azage et al., 2000).

Iv) Commercial dairy farms

Commercial dairy farms are located in urban and peri-urban areas mainly in and around the major cities. These farms are specialized dairy farms that own either crossbred and/or pure exotic breeds of dairy cattle. The commercial farms are small- to large-scale dairy farms, the large-scale farms being concentrated in and around Addis Ababa. Based on the type and quantity of inputs, and on the objective and level of intensity of production, the major livestock production systems presented above could be further classified as low-, medium-, and high-input production systems. More than 95% of the livestock population in Ethiopia is kept in low-input systems, in which production is fully dependent on natural resources and the demand for inputs is limited. Most cattle raised in the low-input systems are indigenous breeds (IBC, 2004).

Milk production performance

Milk is the ultimate goal for all dairy producers. Exotic cattle and their crosses are being increasingly used to raise milk production in hot climate. It has been realized that high level of performance could also be obtained from pure breed European cattle in most tropical environment subject to very good management. Indigenous breed of cows are generally considered low milk producers (Tadesse and Dessie, 2003). However, they are the major source of milk in Ethiopia that account for 97 % of the total milk production in the country. Milk yield has remained extremely low with national average of 1.09 liter/day/cow (Belay et al., 2012). The average milk yield of Arsi cows (Lemma et al., 2005) was 1.0 liter/head/day and Fogera cows 506.78 liters per lactation, respectively. This is mainly due to shortage of feed and poor management conditions. Milk production is further affected by the relatively short lactation length and extended post-partum anoestrus resulting in low production efficiencies (Bekele et al., 2011). The indigenous (or traditional) mixed farming and pastoral/agro pastoral systems rely mainly on local breeds, which produce 400-680 kg of milk per cow per lactation period of less than seven months (Million et al; 2004) crossbreeding of the indigenous breeds with imported temperate exotic breeds has been practice to improve the milk productivity of the local breeds through the exploitation of high genetic potential for milk production of exotic breeds and the adaptability to the local environment of indigenous breeds (EARO, 2001). The lactation milk yield (LMY) for indigenous breed's ranges from 494 to 809 kg and LL ranges from 128 to 353 days (Demeke et al., 2002; Tadesse and Dessie, 2003; Haile et al., 2008; Gizaw et al., 2011; Niraj et al., 2014) (Table 1). On the other hand, the lactation milk yield (LMY) and lactation length (LL) for the crossbreeds ranges from 970 to 2343 kg and 257 to 448 days (Tadesse and Dessie, 2003; Kefena et al., 2006) (Table 1). In addition, the lactation milk yield (LMY) for pure Exotic breeds ranges from 1583 to 3796 kg and lactation length (LL) ranges from 276 to 362 days (EARO, 2001; Demeke et al., 2002; Tadesse and Dessie, 2003; Million et al., 2004; Kefena et al., 2006; Bekele et al., 2011) (Table 1).

The review indicates that indigenous breeds had lower lactation milk yield and shorter lactation length than the crossbred and exotic breeds and also Friesian crosses appeared to perform better in both milk yield and lactation length than the Jersey crosses (Table 1). Tadesse and Dessie (2003) reported that breed, parity and year of calving significantly affect lactation milk yield and lactation length. According to Bekele et al. (2011) milk production also increases with parity status but up to the third lactation. The same results on the effect of parity status on lactation milk yield of Barka breeds (indigenous breeds) kept on station had been reported by Haile et al. (2008). The effect of year of calving had been attributed to the change in management and feeding conditions during the years. Lactation milk yield was highest for pure exotic breed however, among crossbred the ¾ F x ½ (Boran, Arsi and Barka) produced the highest yield (Table1). On the other hand, F_1crosses have better lactation milk yield (LMY) than the F_2 crosses. Similar reports (Demeke, 2004; Haile et al., 2008) have been reported that the

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superiority of F_1 over the rest of genetic groups. The consistently better rank of F_1 crosses could be attributed to maximum heterotic effect than F_2 crosses. Apparently, the lower LMY exhibited by F_2 crosses might be due to reduction in hybrid vigor (Million et al., 2004). Rege et al. (2006) also reported that the low productivity of F_2 is break down of epistatic effects in the parental population. Furthermore the decline in performance from F_1 to F_2 or backcross generation in tropical environments could be due to recombination losses than other factors.

Table 1 - Mean values of lactation milk yield (LMY) and lactation length (LL) for indigenous, crossbred and exotic dairy cattle in Ethiopia

Genetic groups	LMY (kg)	LL (days)	Location	Source
Indigenous				
Fogera	613	353	On station	Haile et al. (2008)
Barka	552	128	On station	Tadesse and Dessie (2003)
Arsi	809	272	On station	Niraj et al. (2014)
Horro	559	285	On station	Gizaw et al.(2011)
Boran	494	155	On station	Demeke et al. (2002)
Boran	771	198	On station	Demeke et al. (2002)
Barka	672	279	On station	Tadesse and Dessie (2003)
Crossbreeds				
F_1 (½ F x ½ Boran)	2149	359	On station	Kefena et al. (2006)
¾ F ¼ Boran	2336	436	On station	Tadesse and Dessie (2003)
¾ F x ¼ Boran	2343	392	On station	Kefena et al. (2006)
F_2 (½ F x ½ Boran)	1766	360	On station	Kefena et al. (2006)
F_2 (½ F x ½ Boran)	1947	348	On station	Bekele et al. (2011)
F_1 (½ F x ½ Boran)	2278	374	On station	Demeke et al. (2002)
F_1 (½ F x ½ Boran)	2088	328	On station	Tadesse and Dessie (2003)
F_1 (½ F x ½ Arsi)	2247	389	On station	Million et al. (2004)
F_2 (½ F x ½ Arsi)	1723	430	On station	Million et al. (2004)
F_1 (½ F x ½ Arsi)	1977	356	On station	Million et al. (2004)
¾ F x ¼ Arsi	2497	322	On station	Million et al. (2004)
F_1 (½ F x ½ Barka)	2312	326	On station	Tadesse and Dessie (2003)
F_1 (½ F x ½ Barka)	1488	301	On farm	Bekele et al. (2011)
¾ F x ¼ Barka	2373	448	On station	Tadesse and Dessie (2003)
F_1 (½ J x ½ Barka)	970	257	On farm	Bekele et al. (2011)
F_1 (½ J x ½ Boran)	2150	371	On station	Kefena et al. (2006)
F_2 (½ J x ½ Boran)	1343	332	On station	Kefena et al. (2006)
¾ J x ¼ Boran	1767	349	On station	Kefena et al. (2006)
F_1 (½ J x ½ Arsi)	1741	334	On station	Niraj et al. (2014)

F = Friesian, J = Jersey, LMY= Lactation milk Yield, LL = Lactation length

Milk composition

Milk compositions vary between Boran and Boran- Friesian crosses. Percentfat in milk, protein, lactose and total solids in Boran-Friesian crossbred cows ranges from 3.80 to 15.32% and in Borana cows ranges from 4.00 to 16.02 % (Mesfin and Getachew, 2007; Table 2) respectively. Percent of fat in milk (6.01%), protein (4.05%) and total solids (16.02%) contents for Boran cows were higher than that of Friesian crossbred cows whereas Boran-Friesian crossbred dairy cows have higher content of milk lactose (4.18%) than Boran cows (Mesfin and Getachew, 2007; Table 1). **Gonthier** et al. (2005) reported that the type of breed affects milk composition. According to Mesfin and Getachew (2007) indicated that the difference in milk composition between the two breeds (Borana and crossbred dairy cows) may be due to the influences of breed differences in feed conversion efficiency to specific feed type.

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Table 2 - Least squares means and standard errors of milk fat, protein, lactose and total solids of Boran and Boran-Friesian crossbred dairy cows

Milk composition (%)	Least Squares Means		
	Boran-Friesian crosses	Boran cows	P value
Fat	5.48 ± 0.02a	6.01 ± 0.05b	P<0.01
Protein	3.80 ± 0.03a	4.05 ± 0.05 b	P<0.01
Lactose	4.18 ± 0.05a	4.00 ± 0.05b	P<0.01
Total solids	15.32 ± 0.03a	16.02 ± 0.05b	P<0.01

[ab] Least square means with different superscripts within row differ at P<0.01 Source: Mesfin and Getachew (2007).

Reproductive performance

Reproductive performance is one of the major factors that affect productivity and profitability of a dairy herd. The production of milk and reproductive stock is not possible unless the cow reproduces. Genetic improvement of all traits of economic importance is closely related to reproduction rate (Gizaw et al., 2011). Poor reproductive performance is caused by failure of the cow to become pregnant primarily due to anoestrus (pre- pubertal or post-partum), failure of the cow to maintain the pregnancy and calf losses (Belay et al., 2012). This causes delay in age at first calving and long calving interval.

Research have been conducted to evaluate and improve reproductive performance of indigenous and crossbred cows under a relatively controlled condition at research centers, government owned farms and in some urban and peri-urban dairy areas in the central highland of Ethiopia (Tadesse and Dessie, 2003; Million et al., 2004). However, similar works have been conducted in urban and rural small holder dairy producers (Yifta et al., 2009) and hot low land part of Ethiopia under different production systems (Mureda and Mekuriaw, 2007). In many cases reproductive efficiency of cattle has been measured mainly by considering parameters such as age at puberty, age at first calving, day's open, calving interval and number of services per conception (Azage, 2000; Shiferaw et al., 2003). Reproductive efficiency of dairy cows is influenced by different factors including genetic, season, age, production system, nutrition, management, environment and disease.

Age at first calving (AFC)

This trait is express early in life and directly influences reproductive performance. Early age at first breeding is influences life time production of the cow and reducing generation interval leading to faster genetic gain per generation. Estimates of mean value of AFC obtained for highland zebu was 53 months (Lema et al; 2010). This figure is longer than AFC reported for exotic and indigenous crosses. Similarly another work also revealed that estimates for AFC in Ethiopian cattle were reported to be longer for Zebu (Haile et al; 2008) than for crossbreds (Mureda and Mekuriaw, (2007) analyzed data on reproductive performance of crossbred F_1 (½ F x ½ Zebu) dairy cows and results indicated that AFC was 36.2 months which is longer than AFC of 29.1 months for reported by Haile et al. (2008). Furthermore, in the work done in the central high lands and in Addis Ababa milk shed, the overall means for AFC were found to be 40.6 months (Yoseph et al., 2003) and 29.0 months (Yifta et al., 2009). Different factors contribute to the late age at first calving. Environmental factors especially nutrition determine pre pubertal growth rates, reproductive organ development and onset of puberty.

The mean age at first calving (AFC) of Ethiopian Boran breeds ranges from 45.0 to 46.9 months for those kept on station (Mureda and Mekuriaw, 2007). Moreover, Tadesse et al. (2014) found that age at first calving was significantly affected by year and month of birth in Boran cows. AFC ranges from 39.2 to 42.6 months for Holstein Friesian and 34.0 month for Jersey breed (Negash 2001; Million et al., 2006; Tadesse et al., 2010) respectively. (Tadesse et al;2010) analyzed data on reproductive performance of Holstein Friesian dairy cows in urban and peri-urban dairy production system of Addis Ababa milk shad he found that age at first calving was significantly influenced ($p<0.001$) by period of birth but not by the effect of herd and season of birth . With good nutrition it is expected that heifers would exhibit fast growth and attain higher weights at relatively younger ages (Tadesse et al., 2010). Mean values of AFC ranges from 29.1 to 55.4 months for Frisian crosses and 38.8 to 46.9 months for Jersey crosses (Million et al., 2006; Mureda and Mekuriaw (2007). Mean values of age at first calving was significantly shortest (29.1 months) for (F_1 (½ F x ½ Zebu) and longest (55.44 months) for (¼ F x ¾ Local) crosses. In addition, F_2 (½ F x ½ Local) and F_2 (½ J x ½ Local) crosses had significantly longer AFC than F_1 (½ F x ½ Zebu) and (F_1 (½ J x ½ Local) crosses (Million et al., 2006. Furthermore the relatively longer age at first calving for F_2 crosses than F_1 crosses can be attributed to unfavorable parental breakdown of epistatic combinations which have been built up in the parental populations (Million et al., 2006).

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Calving interval (CI)

Calving interval is the interval between consecutive calving. Calving interval of 12 months is considered ideal assuming average gestation period of 280 days, nearly 85 days would remain for post calving conception to occur. Long calving intervals would indicate prevalence of reproductive problems or poor management of the herd. Estimates of calving interval ranges from 11.8 to 15.6 months in indigenous breeds (Tadesse and Dessie, 2003; Lema et al., 2010; Haile et al., 2008). The mean calving interval was higher for Horro (15.6) and Boran breed (15.5 months) while lowest for Barka breed. Calving interval ranges from 13.8 to 15.8 months in Holstein Friesian (Negash, 2001; Tadesse and Dessie, 2003; Million et al., 2006; Tadesse et al., 2010) and calving interval (CI) for crossbred ranges from 12.2 to 18.5 months (Abdinasir 2000; Tadesse and Dessie, 2003; Million *et al.*, 2006; Belay et al., 2012), respectively.

Arsi cows with Frisian blood level of 25 - 62.5 and more (75%) had similar calving interval of 18.5 months (Abdinasir, 2000) which is by far shorter than 25 months reported for highland zebu (Demeke, 2004) and 26 months for other indigenous breeds traditionally managed in the highlands. Tadesse and Dessie (2003) in their work to study milk productivity of Barka, Friesian and their crosses with Barka and Boran cows found that calving interval was significantly influenced by breed, parity and period of calving. Demeke (2004) attributed this variation to the nutritional conditions that vary seasonally and yearly and to the effect of parity. Calving intervals also tend to be shorter in animals that are more productive in other respects. This may be a reflection of better management and preferential treatment given to more productive animals than unproductive animals (Haile et al., 2008). F_2 crosses had longer calving interval than F_1 crosses (Million et al., 2006). Calving interval (CI) was shorter for Jersey crosses compared to Friesian crosses (Demeke, 2004) indicating the superiority of Jersey crosses over Friesian crosses in terms of adaptation to the local condition.

Number of service per conception (NSPC)

Number of service required for conception (NSPC) is one factor considered in determining reproductive efficiency of cow. It is reflects the efficiency of management. Number of service per conception (NSPC) depends on the breeding system. It is higher under uncontrolled natural breeding than controlled breeding. Haile et al. (2008) reported that values of number of service per conception (NSPC) greater than 2 should be regarded as poor. Number of service per conception (NSPC) for indigenous breeds (Boran, Barka, Arsi and Fogera) ranges from 1.06 to 2.6 (Gebeyhu et al., 2005; Million et al., 2006; Lema et al., 2010; Genzebu et al., 2016). NSPC was lowest for Barka breed (1.11) and higher for Arsi breed (2.4-2.6). Similarly it ranges from 1.50 to 2.16 for Frisian crosses. Azage (2000) reported that the influence of breed and season on NSPC. In agreement with Lema et al. (2010) who reported that NSPC was significantly affected by herd and season that is related to availability of feed, lactation length and milk yield. Moreover, Azage (2000) compared three local Ethiopian breeds (Barca, Horro and Boran) and found that NSPC was lower for animals from wet areas than for those from drier areas. Crossbred cows required fewer services per conception than local zebu cows in both wet and dry areas.

CONCLUSION AND RECOMMENDATION

In general, results of literature review showed that indigenous breeds had lower lactation milk yield (LMY) and lactation length (LL) than crossbreed and exotic breeds. Lactation milk yield was highest for pure exotic breed. However, among crossbred the ¼ local x ¾ HF produced the highest yield. The extreme variability in lactation milk yield observed, between and within breeds in this review could be attributed to genetic, change in climatic and management factors. The review results showed that shorter ages at first calving and calving interval of F1 than F2 crosses of both HF and Jersey crosses with local breed indicating the superiority of F_1 over other crosses. F_1 crosses had shorter AFC and CI compared to other breeds. From this review it can be concluded that crossing local cattle with exotic breeds improved milk production but long calving intervals were observed as exotic blood increased. It is suggested that the strategic improvement of feeding, breeding, management and follow up is important to boost up the reproductive and productive performance as well as genetic maintenance of the breed and sustainable extension service to improve animal feed resources management and Animal health care also deserve due attention.

Auhor's contribution

Mohammed E performed the data collection, reviewed information and write up of the manuscript. The Authors read and approved the final manuscript.

Competing interests

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

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

Submission

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

Supplementary information:

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

Submission to the Journal is on the understanding that:

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

Ethics Committee Approval

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

Presentation of the article

Main Format:

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

Manuscripts should be arranged in the following order:

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

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

Article Sections Format:

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

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

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

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

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

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

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

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

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

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

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

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

Declarations section - Please include declarations heading

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

Consent to Publish

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

Authors' Contributions

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

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

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

Acknowledgements

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

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Authors should obtain permission to acknowledge from all those mentioned in the Acknowledgements. Please list the source(s) of funding for the study, for each author, and for the manuscript preparation in the acknowledgements section. Authors must describe the role of the funding body, if any, in study design; in the collection, analysis, and interpretation of data; in the writing of the manuscript; and in the decision to submit the manuscript for publication.

Data Deposition

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

References

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

Examples (at the text):

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

Examples (at References section):

a) For journal:

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

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

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

b) For symposia reports and abstracts:

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

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d) For books:

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

e) Books, containing sections written by different authors:

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

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

Formulae, numbers and symbols

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

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

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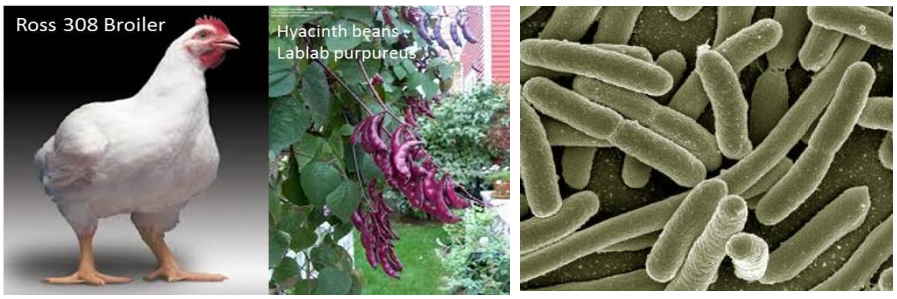
Authors of accepted articles should provide a graphical abstract (a beautifully designed feature figure) to represent the paper aiming to catch the attention and interest of readers. Graphical abstract will be published online in the table of content. The graphical abstract should be colored, and kept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



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Authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to the following guidelines:
- The submission has not been previously published, nor is it before another journal for consideration (or an explanation has been provided in -Comments to the Editor).
- The submission file is in Microsoft Word, RTF, or PDF document file format.
- Where available, URLs for the references have been provided.
- The text is double-spaced; uses a 12-point font; and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.
- The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.

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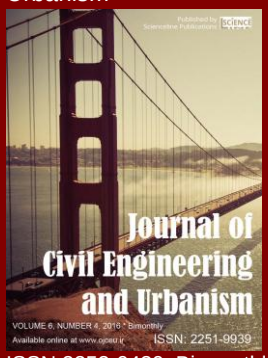

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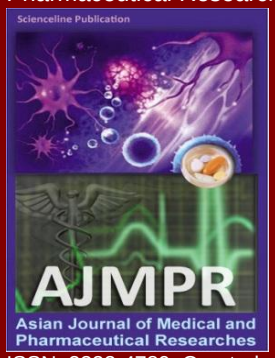

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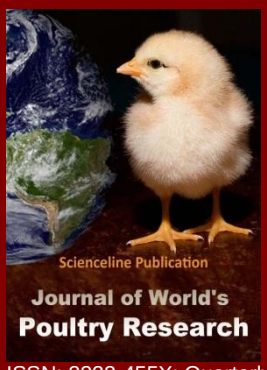

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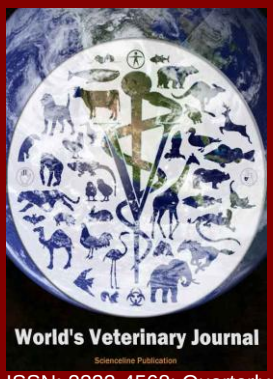

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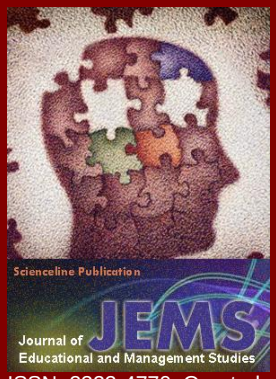

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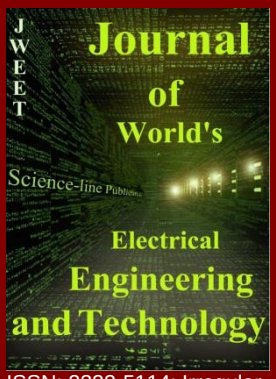

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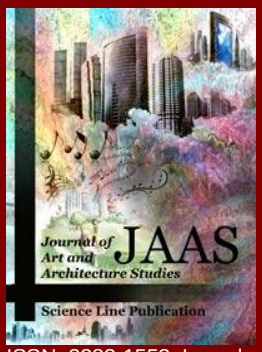

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