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Volume 7 (4); 25 July 2017

Research Paper

Nutritive value of ash leaves (Fraxinus angustifolia) for growing rabbits.

Djellal F, Kadi SA, Madani T, Abbas K, Bannelier C and Gidenne T.

Online J. Anim. Feed Res., 7(4): 72-78, 2017; pii: S222877011700012-7

Abstract

The digestibility and nutritive value of ash (*Fraxinus angustifolia*) leaves, harvested in autumn was determined (direct method), using ten rabbits (individually caged) weaned at 35d old (mean body weight: 911g) fed ad libitum only fresh ash leaves during 16 days. Ash leaves composition was: organic matter (OM) 89.3%, crude protein (CP) 14.6%, neutral detergent fibre (NDF) 39.4, acid detergent fibre (ADF) 28.3, acid detergent lignin (ADL) 16.1% on dry matter (DM) basis. The faecal digestibility of the ash leaves was measured between 48 and 52 day sold. The digestibility of OM, CP, NDF and ADF were 74, 67, 59 and 59%, respectively. The concentration in digestible energy and digestible protein of the ash leaves was estimated to 13.6±0.90 MJ/kg DM and 98±10.43 g/kg DM, respectively. In general, ash leaves harvested in autumn could be considered as a good source of fibre and energy for the growing rabbit. Therefore, Incorporating ash leaves moderately in a pelleted and balanced diet with a sufficient level of ingestion should be considered in ration formulation of growing rabbits.

Keywords: Ash leaves, *Fraxinus angustifolia*, nutritive value, autumn, digestibility, Growing Rabbits

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Research Paper

Prevalence of small ruminants Schistosomiasis and its associated risk factors in Mecha district, Northwestern Ethiopia.

Assfaw F, and Samuel D.

Online J. Anim. Feed Res., 7(4): 79-85, 2017; pii: S222877011700013-7

Abstract

Schistosomiasis is a snail-born trematode infection of man and animal in tropical and sub tropical countries. It is an economically importance diseases caused by *Schistosoma* species and result in economic losses through mortality and morbidity from severe infection. A cross-sectional study was conducted from November 2014 to April 2015 in Mecha district, Northwest Ethiopia. A total of 384 fecal samples were collected from randomly selected sheep and goat in three peasant associations. The sample was processed with sedimentation technique to detect *Schistosoma* eggs by using light microscope. Therefore, the overall prevalence of *Schistosoma* infection irrespective of factors was found to be 9.4% (12.9% in ovine and 5.5% in caprine). In cases of sites where samples were collected, Kurtbahir showed higher prevalence (14.6%) than other two study sites (8.4% for Kudimi, and 4.2% for Enamrt). Age-wise prevalence of *Schistosoma* infection in sheep was significantly (P< 0.05) varied. Similarly significant association of *Schistosoma* infection with age and body condition score also observed in ovine population (P< 0.05), not in caprine. Species-wise prevalence *Schistosoma* infection in sheep and goat was significantly (P< 0.05) varied. However, *Schistosoma* infection did not affect (P> 0.05) by sex in both species. In general, Schistosomiasis is one of the major health concerns of livestock production. Therefore, control of schistosomiasis based on drug treatment, snail control and appropriate sanitation measures were recommended.

Keywords: Small ruminants, Schistosomiasis, Sedimentation, Prevalence, Mecha district, Ethiopia

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Research Paper

Gene segregations, linear body measurements and performance evaluation of dairy cattle crossbreeding in Northwestern Ethiopia

Getu A, Guadu T, Addisu Sh, Assefa A, Mogese N, Chanie M, Bogale B, Birhanu M, Alebie A, and Feresebhate A

Online J. Anim. Feed Res., 7(4): 86, 2017; pii: S222877011700014-7

Abstract

An investigative research work was delivered to address the objective of characterizing the cross breeding effects on dairy cattle performances in North West Ethiopia (North Gondar, South and west Gojam). In the same time, exploratory field survey and multistage sampling technique was conducted to collect the polygenic traits and improvement effects of cross breeding in the study areas. Blood level like F_1 (50E:50L), F_2 (25E:75L), F_3 (75E:25l) and F_4 (12.5E:87.5l) dairy cattle characterization work was conducted from north Gondar, south Gondar and west Gojam zone. The interaction effect of body weight and other liner body

measurements for all dairy cows with different blood levels were highly significant (P< 0.01). Body weight and body length at F_3, F_2, F_1 and F_4 blood levels of the cows were indicated that none, little and significant (P< 0.01) reduction were observed on the measurable trait values across the blood levels like body weight least square mean value of 405.86, 405.72, 401.38 and 346.13 (kg) and 184.78, 182.32, 178.68 and 169.59^b (cm) for body length, respectively. Whereas, performances of cows were reduced as exotic blood levels were increased. So, this work remarked that F1 generation of an animal had superior in different aspects, while the gene segregation effect was observed at F3 (75E:25I) generation. Similarly, the factorial ANOVA indicated that peak milk yield (12.83lt/day) was measured from parity three and F_1 generations. Therefore, gene segregation and down crossing effect could be the causes of economic losses and should be flew the bloods through generations. In addition, characterization of the randomly disseminated genetic resources should be employed to evaluate and know the breeding practices and effect of the merit or demerits of cross breeding in the country.

Keywords: Measurable Traits, Crossbreeding, Genetic Improvement, Cattle, Amhara

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Research Paper

Effect of new formulated diets on growth and biochemical parameters of *Babylonia spirata* (Lin, 1758), gulf of Mannar.

Chelladurai G. and Karthick N.

Online J. Anim. Feed Res., 7(4): 91-96, 2017; pii: S222877011700015-7

Abstract

A feeding experiment of three dietary protein levels (30%, 35% and 40%) with three replicates was conducted to determine the proper protein level for the growth and survival of the *Babylonia spirata* under laboratory conditions. Snail with initial body weight ranged from 50.95 ± 0.33g to 51.05 ± 0.21g and initial length ranged from 5.96 ± 0.62 cm to 6.91 ± 0.70 cm were fed the experimental diet for 3 months. Mean weight gain, survival rate, biochemical parameters of snail fed the 40 % protein diets was significantly (P<0.05) different from that snail fed the 30% and 35%. The results of the study indicate that a diet containing 40 % dietary protein was recommended for snail growth under our laboratory conditions.

Keywords: Formulated diet, Growth, Biochemical parameters, Babylonia spirata

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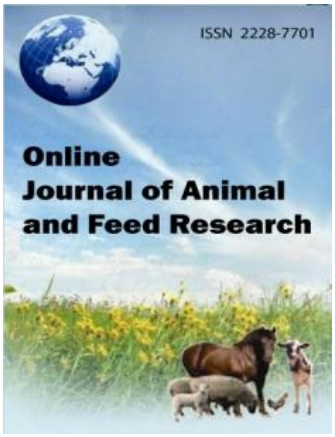

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NUTRITIVE VALUE OF ASH LEAVES (*Fraxinus angustifolia*) FOR GROWING RABBITS

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ABSTRACT: The digestibility and nutritive value of ash (*Fraxinus angustifolia*) leaves, harvested in autumn was determined (direct method), using ten rabbits (individually caged) weaned at 35d old (mean body weight: 911g) fed ad libitum only fresh ash leaves during 16 days. Ash leaves composition was: organic matter (OM) 89.3%, crude protein (CP) 14.6%, neutral detergent fibre (NDF) 39.4, acid detergent fibre (ADF) 28.3, acid detergent lignin (ADL) 16.1% on dry matter (DM) basis. The faecal digestibility of the ash leaves was measured between 48 and 52 day sold. The digestibility of OM, CP, NDF and ADF were 74, 67, 59 and 59%, respectively. The concentration in digestible energy and digestible protein of the ash leaves was estimated to 13.6±0.90 MJ/kg DM and 98±10.43 g/kg DM, respectively. In general, ash leaves harvested in autumn could be considered as a good source of fibre and energy for the growing rabbit. Therefore, Incorporating ash leaves moderately in a pelleted and balanced diet with a sufficient level of ingestion should be considered in ration formulation of growing rabbits.

Keywords: Ash leaves, *Fraxinus angustifolia*, nutritive value, autumn, digestibility, Growing Rabbits

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INTRODUCTION

In Algeria, the quality of the dominant forage is often too poor to satisfy the nutritional requirement of the growing rabbit. Furthermore, this situation generates a supplementation with imported concentrates thus increasing the costs. Moreover, the fibres levels are generally too low to meet the fibre requirement of the growing rabbit (Gidenne et al., 2015). New low-cost alternatives fibre sources are thus needed, such local high-fibre materials and non-conventional forage. Indeed, tree leaves has been shown to be one possible alternative.

Fodder trees are exploited in animal feeding especially for ruminants. Leaves and twigs can be grazed directly or cut and distributed to the animals (El Shaer, 2000). Ash (*Fraxinus sp.*) is one of those fodder trees exploited in the whole Mediterranean area. *Fraxinus angustifolia* Vahl, synonym of *Fraxinus oxycarpa* Willd and *Fraxinus rotundifolia* Mill. subsp. *rotundifolia*, is a medium-sized tree also known as ash, narrow leaf ash, narrow-leafed ash or desert ash. It's native to North Africa and south-western Europe and covers central-southern Europe and northwest Africa, up to the Caucasus (Caudullo and Houston Durrant, 2016). In Kabylia (Algeria), *F. angustifolia* is the most available species of ash, and very common in garden, where it is planted in borders of plots, and street ornamental tree (Kadi and Zirmi-Zembri 2016). Several researchers reported its nutritional and medicinal benefits in many articles (Belkadi et al., 2015; Moulaoui et al., 2015; Ayouni et al., 2016).

Ash leaves has been reported to be a valuable component in ruminants feed due to its adequate content in energy and protein (Bourbouze, 1980). It's used in feeding of goats (Masson et Decaen, 1980; Bourbouze, 2005); sheep (Pereira et al., 2008) and cattle (Vergara et al., 2007).

Herbivore, rabbit is known to valorise roughage and fibrous resources. Several studies (Raharjo et al., 1986, Deshmukh et al., 1993a) have reported the possibility of incorporating tree leaves in rabbit diets. As everywhere in

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the world, tree leaves are used as fodder source for rabbits in traditional farms in Algeria (Saidj et al., 2013). However, the traditional knowledge about use of plants was not well explored (Lukefahr and Cheek, 1990).

Several studies (Raharjo et al., 1986; Deshmukh et al. 1993a; Kadi, 2012) have reported the possibility of incorporating tree leaves in rabbit diets. Nevertheless, their nutritive value is not available in feed tables; which is the case of most natural herbaceous fodders, where even the data about their chemical composition is scarce (Kadi and Zirmi-Zembri, 2016).

With 16.4 % of crude protein (Villar et al., 2006) and 12 to 15% of ADL (Petisco et al., 2005), ash leaves would fit the minimal nutrient requirement of growing rabbits reported by Gidenne et al. (2015). Accordingly, we aimed to determine, via the direct method (Villamide et al., 2010), the nutritive value for growing rabbits of the fresh ash (*Fraxinus angustifolia*) leaves harvested in autumn.

MATERIALS AND METHODS

Animals and diets

Ten local white rabbits, weaned at 35 d of age (mean weight: 911 ± 128 g) and placed in wire mesh individual cages (56 × 38 × 28 cm) in flat deck disposition, were used to assess the nutritive value of ash leaves. The study complied with the University of Tizi-Ouzou guidelines on ethical standards.The green leaves of ash tree (*Fraxinus angustifolia)* were harvested manually, daily in the morning and distributed *ad libitum* as sole feed for the rabbits (Figure 1). Permanent access to clean fresh water is available using an automatic watering. Samples of ash leaves were collected throughout the digestibility trial period, mixed and stored in polyethylene bag at –20 °C until the chemical analysis.

(A) (B)

Figure 1 - Preparation of leaves tufts after weighing (A) and suspension in the cage (B)

Digestibility trial

After a 12 days adaptation period (52 d old), rabbits were used for the digestibility trial, following the European reference method described by Perez et al. (1995). The cages were equipped with a wire net under the floor to collect individually and totally the hard faeces during a 4-day period. Faeces were stored daily in polyethylene bags at –20 °C until chemical analysis. Two samples of ash leaves were collected every day during the 4 days. The first sample is collected at the moment of the distribution for rabbits. The second concern the daily ash leaves refused in order to determine their dry matter.

Analytical methods

The chemical analyses were performed at INRA of Toulouse (UMR 1388 GenPhySe, France). Dry matter, crude ash, crude protein (N x 6.25), energy (adiabatic calorimeter Parr), Van Soest fibre (NDF, ADF and ADL) were measured on ash leaves and faeces according to EGRAN harmonised procedures (EGRAN, 2001).

Statistical analysis

The results obtained were treated using Excel 2013 Microsoft® software. Because only one diet was used, the results are presented with only mean and standard error and without any statistical test. Apparent digestibility coefficients for dry matter, organic matter, crude protein, gross energy, neutral detergent fibre and acids detergent fibre of ash leaves were determined for each animal as:

Apparent digestibility = (NI – NFE/NI) * 100

With:

NI = Nutrient intake, NFE = Nutrient fecal excretion

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RESULTS AND DISCUSSION

Chemical composition

According to their chemical composition (Table 1), ash tree leaves seem to be relatively balanced feedstuff for rabbits. Indeed, their crude protein content was interesting (147 g/kg DM) for fresh tree leaves and close to that of some raw material reported in EGRAN tables by Maertens et al. (2002) and usually incorporated in rabbit diets. It is the case of some cereal by-product as wheat bran, wheat feed and rice bran but especially for that considered as fibrous feedstuffs. However, the value of CP content in ash leaves was higher than those obtained by Ibrahim et al. (2011) who reported that CP content of lemon pulp, orange pulp and yellow corn was 70.4, 64 and 77 g/kg DM, respectively. However, it is extensively lower to the four other legumes: *Leucaena leucocephala*, *Moringa oleifera*, *Gliricidia sepium* and *Enterolobium cyclocarpum*: 298, 245, 269 and 287*vs* 147 g/kg DM, respectively (Abu and Turner 2016). They contain more protein (131 g/Kg if reconsidered for 90% DM as in EGRAN tables of Maertens et al., 2002) that Alfalfa meal 12 (126 g/Kg), Beet pulp (90 g/kg), Citrus pulp (59 g/Kg), Olive leaves (90 g/Kg) or carob meal (47 g/Kg). Villar et al. (2006) reported a level of 16.3 % of crude protein for *F. angustifolia* leaves harvested in Cordoba (Spain). While, surprisingly, Mebirouk-Boudechiche et al. (2015) pointed out a rate of 22.6g/kg DM for *F. angustifolia* leaves in eastern Algeria, probably because the samples were collected in spring.

For instance, ash leaves can be considered as fibre source (NDF: 394 g/kg DM, ADF: 283 g/kg DM, ADL: 161 g/kg DM). Petisco et al. (2005) reported a rate of 14.3 % of lignin for those ash leaves. According to Gomez and Fillat (1984), the chemical composition of ash leaves depends on the period in which they are harvested and their digestibility decreases if they are cut in September and October compared with month of August.

Table 1 - Composition of fresh ash leaves (*Fraxinus angustifolia*) given as a sole ration for growing rabbits in this study compared to Sulla hay (*Hedysarum flexuosum*) and Lucene hay (*Medicago sativa*)

Items	Ash leaves composition[1]		Sulla hay (*Hedysarum flexuosum*)[2]	Lucerne 15 hay (*Medicago sativa*)[3]
	g/kg raw basis	g/kg DM	g/kg DM	g/kg DM
Dry Matter (DM)	410	–	–	–
Organic matter (OM)	366	893	859	890
Crude ash	44	107	141	110
Crude protein (CP)	60	146.7	166	170
Neutral detergent fibre (NDF)	162	394	495	464
Acid detergent fibre (ADF)	108	283	381	362
Acid detergent lignin (ADL)	62	161	90	81
Energy (MJ/kg)	7.95	19.39	17.03	-

[1]Sample of ash offered during the digestibility period; [2] Kadi et al. (2011); [3] Maertens et al. (2002).

Moreover, it is known that the fibrous feedstuffs that contain amounts of protein are scarce. According to Carabano and Fraga (1992), fibrous raw materials containing a significant amount of protein are very suitable for rabbit feeding. It's precisely the case of fresh ash leaves which contain appreciable amounts of protein (146.7 g/kg DM), fibre (ADL: 161 g/kg DM) but also energy (19.4 MJ/kg DM). Indeed, protein content of the fresh ash leaves studied here are higher than that obtained by Deshmukh et al. (1993b) for coastal Bermuda grass (116 g/kg DM) and El Shaer (2000) for *Acacia saligna* (125 g/ kg DM). This amount of protein is close of those of reference legume such as Lucerne and Sulla hay (Table 1). Therefore, those amounts of proteins and fibre justified the use of direct method for estimating the nutritive value of those leaves for the growing rabbits.

Consumption and digestibility

Ash leaves were appreciated by rabbits and were much consumed (Figure 2). The amount of intake of ash leaves recorded here (97 g DM/day, Table 1) is higher than the one (78.5 g DM/day) reported for herbage intake by Martin et al. (2016). The fresh intake thus reached 236 g as fed/day indicating a high intake capacity of the rabbit for fresh forages. According to Lebas (2013), the maximum intake capacity of rabbit per day is about 5 to 9% of its live weight expressed as dry mater. But, with fresh products such as green forage, the maximum intake capacity is about 20-25% of live weight, calculated on as feed basis (Lebas, 2013). Effectively, the daily intake (236 g as fed/day) recorded in this study was about 25% of the live weight (911 g).

Contrary to ruminants, in the rabbit an increase of diet's fiber content increases the speed of transit, allowing the animal to increase also its feed intake (Lebas, 2013). Effectively, ash leaves are high fibrous source which could increase their consumption by the rabbits. Moreover, Fraga et al. (1991) reported that fresh forages stimulate stomach growth, which accounted for subsequent higher feed intake capacity compared to rabbits fed only pellets.

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According to De Blas et al. (1985), the requirements in terms of Digestible Crude Protein/Digestible Energy (DCP/DE) ratio for maintenance are close to 6.8 g MJ/d. The daily average intake of DCP and DE were 9.52 g and 1.32MJ, respectively, which implies that ash leaves assure the maintenance requirements for rabbit (average daily gain of 2 g during 13 days).

(A) (B)

Figure 2 - Ash leaves at moment of distribution (Photo A) and one day after (Photo B)

The apparent digestibility coefficient of energy (Table 2) of ash leaves was 70%. It was slightly higher to the norms generally recorded with forages, which vary from 45 to 65 % (Villamide et al., 2010). The faecal digestibility of ash leaves energy was high (70%) and higher to those obtained by Raharjo et al. (1986) for all the species they studied. The energy of those leaves was much better digested than that (51.6%) of a fresh legume as Sulla felexuosa (*Hedysarum flesuousm*, Kadi et al., 2012). This digestibility coefficient of energy is also higher than that reported by Perez (1994) who obtained a coefficient ranged from 42.5 to 58.9% for twelve batches of luceme differing by their protein (16 to 26% DM) and crude fibre content.

The faecal digestibility of ash leaves protein was 67%, a classical normal value for forages. It's similar to the values obtained with direct method and reported in the bibliography for ryegrass (67 %) (Fernandez-Carmona et al., 2001); but slightly higher than that of Lucerne (64%) (Fernandez-Carmona et al., 1998) or Sulla flexuosa (64%) (Kadi et al., 2012) and slightly lower than that of *Leucaena leucocephala* leaves (75.9%) (Raharjo et al., 1986). NDF and ADF digestibility were high (59%) probably due to a high level of digestible fibres such as pectins (Gidenne et al., 2010).

A slight live weight loss during the digestibility trial is recorded (Table 2) as often observed in the first weeks of several studies (Raharjo et al., 1986; Deshmukh et al., 1990; Deshmukh et al., 1993b) when forage was fed as sole diet for rabbits. Accordingly, as reported by Deshmukh et al. (1990), a minimum adaptation period of at least three weeks is necessary to rabbits when they are fed solely by forage to see a trend of increase in body weight.

Table 2 - Body weights, feed intake and digestibility coefficients of the fresh ash leaves (*Fraxinus angustifolia*) given as a sole ration for growing rabbits.

Items	Weight and feed intake		Digestibility (%)	
	Mean	SE	Mean (%)	SE
Initial body weight (g)	911	52		
Final body weight (g)	903	77		
Ash leaves intake (g DM/day)	97	04		
Ash leaves intake (g as fed/day)	236	10		
Dry Matter (DM)			75	1.6
Organic matter (OM)			74	1.6
Crude protein (CP)			67	2.9
Neutral detergent fibre (NDF)			59	2.4
Acid detergent fibre (ADF)			59	2.4
Energy			70	2.0

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Nutritive value

The digestible energy (DE) was 13.6 MJ/kg DM. The standard error calculated by the equation proposed by Villamide (1996) was 0.36 (Table 3). While comparing this value to those returned in the EGRAN tables (Maertens et al., 2002), it appears that this value is higher to the value of oat seed, cereals by-products (gluten feed and wheat shorts) and oils meals (palm cake). Also, it is located at the neighborhood of the beet molasses and lupin.

The digestible proteins (DP) was 98.0g DP/kg DM (Table 3) with a standard error of 10.43 according to the equation of Villamide (1996). The ash leaves have more digestible proteins than the sundried maize whole plant silage (44 *vs.* 98) and less that the brewer's grain (157 *vs.* 98) used like raw materials at the formulation of two complete diets by Guermah and Maertens (2016).

In most publications on the rabbit nutrition, the formulation of balanced diets take into account the ratio is expressed by the report digestible proteins on the energy digestible (Gidenne et al., 2015). The ratio DP/DE calculated in this study was lower to the optimum recommended by Maertens (1996) and that is of 45-46 g digestible protein/1000 kcal of DE. This slightly low report (45 *vs.* 30) is assigned to digestible energy excess in relation to the quantity of digestible proteins of ash leaves.

Table 3 - Nutritive value of fresh Ash leaves (*Fraxinus angustifolia*)

Items	Dietary nutritive value	
	Mean	SE
Digestible Energy or DE (MJ/Kg DM)	13.59	0.36
Digestible Protein or DP (g/Kg DM)	98.08	4.26

CONCLUSION

The nutritive value of fresh ash (*Fraxinus angustifolia*) leaves harvested at autumn season and estimated by direct method was 13.6±0.90 MJ DE/kg DM and 98.1±10.43 g DP/kg DM. The ash leaves can be considered as fibrous source for growing rabbits. They are capable of supplying the maintenance requirements and perhaps also for production after an adaptation period. Their moderate incorporation in a pelleted and balanced diet (about 20%) with a sufficient level of ingestion, those ash leaves can become a good source of fibers and energy.

Besides, those results seem interesting and must be confirmed especially by the regression method proposed by Villamide et al. (2001). Moreover, the optimal incorporation level in a diet should be studied using balanced diets and measuring growth performances and health of the growing rabbits.

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Author's contribution

All authors contributed equally to this work.

Competing interests

The authors declare that they have no competing interests.

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PREVALENCE OF SMALL RUMINANTS SCHISTOSOMIASIS AND ITS ASSOCIATED RISK FACTORS IN MECHA DISTRICT, NORTHWESTERN ETHIOPIA

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ABSTRACT: Schistosomiasis is a snail-born trematode infection of man and animal in tropical and sub tropical countries. It is an economically importance diseases caused by *Schistosoma* species and result in economic losses through mortality and morbidity from severe infection. A cross-sectional study was conducted from November 2014 to April 2015 in Mecha district, Northwest Ethiopia. A total of 384 fecal samples were collected from randomly selected sheep and goat in three peasant associations. The sample was processed with sedimentation technique to detect *Schistosoma* eggs by using light microscope. Therefore, the overall prevalence of *Schistosoma* infection irrespective of factors was found to be 9.4% (12.9% in ovine and 5.5% in caprine). In cases of sites where samples were collected, Kurtbahir showed higher prevalence (14.6%) than other two study sites (8.4% for Kudimi, and 4.2% for Enamrt). Age-wise prevalence of *Schistosoma* infection in sheep was significantly (P<0.05) varied. Similarly significant association of *Schistosoma* infection with age and body condition score also observed in ovine population (P<0.05), not in caprine. Species-wise prevalence *Schistosoma* infection in sheep and goat was significantly (P<0.05) varied. However, *Schistosoma* infection did not affect (P> 0.05) by sex in both species. In general, Schistosomiasis is one of the major health concerns of livestock production. Therefore, control of schistosomiasis based on drug treatment, snail control and appropriate sanitation measures were recommended.

Keywords: Small ruminants, Schistosomiasis, Sedimentation, Prevalence, Mecha district, Ethiopia

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INTRODUCTION

Livestock production constitutes one of the principal means of achieving improved living standards in many regions of the developing world. In sub-Saharan Africa countries livestock plays a crucial role both for the national economy and the livelihood of rural communities. It provides draught power and raw material for industry (ILCA, 2007). In Ethiopia, livestock contribute about 30-35 % of agricultural gross domestic product (GDP) and 12-16 % of total GDP (AAPMDA, 1999).

Though Ethiopia is recognized for its vast wealth of livestock, the economic benefit derived from the livestock center does not commensurate with the potential (FAO, 1993). Development of large animal is constrained with certain infectious and non-infectious diseases; among infectious diseases schistosomiasis contributes its own economic losses through reduction of the production and productivity potential of animals. Parasitism is of supreme importance in many agro-ecological zones and still a serious threat to the livestock economy worldwide. Sheep and goats are known to suffer from various endoparasites of which helminthes infection are of great importance (Vercruysse and Claerebout, 2001).

Schistosomiasis is snail-borne trematode infection of man, domestic animals and wild animals in different parts of tropical and sub tropical countries (Singh et al., 2004; Islam et al., 2011). The major transmitting sites are small streams all over the highlands of Ethiopia, lakes like Tana, Zeway as well as irrigation systems, such as sugar state Wonji do also play a similar role (Shibru et al., 1989). *Schistosomes* are dioecious parasitic flatworms, which live in the vasculature of their mammalian definitive hosts. They are the causative agent of schistosomiasis, a disease of considerable medical and veterinary importance in tropical and sub-tropical regions (Rollinson and

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Southgate, 1993). Schistosomiasis is a chronic debilitating infection affecting both humans and animals by different species of *Schistosomes* and hence the disease is of public health importance. Other names given to schistosomiasis are blood fluke disease and Bilharziasis (Parija, 2004).

Although these parasites occur in many tropical and sub-tropical areas, the disease is important in livestock mainly in Eastern Asia, Africa and India. The distribution of schistosomiasis varies from places to places. Example: *Schistosoma bovis* the commonest species in Africa and Mediterranean region (Aemro, 1993). However, *Schistosoma spindale, Schistosoma indicum* and *Schistosoma nasal* have been reported as the major causes of schistosomiasis in Asia (Bont, 1995). Bulinus, Indoplanorbis and Planorbid snail intermediate hosts are transmitting *Schistosomes* to cattle (Solomon, 1985). The major transmitting sites are small streams all over the highlands of Ethiopia, lakes like Tana, Zeway as well as irrigation systems, such as sugar state Wonji do also play a similar role (Shibru et al., 1989). The Districts bordering Lake Tana are relatively potential areas for livestock production due to availability of grazing land and enough water supplies; however, the area is highly infested with helminthes parasites particularly with *Schistosoma* parasite. Koga dam and its surroundings give convenient ground for *Schistosoma* parasites and its intermediate host, snails, due to the water availability almost throughout the year and now days the irrigation practice for tomato, potato, onion and other crop farming practices of farmers. The transmission of schistosomiasis takes place only in the place where fresh water snail vector is present and where there is contact between the host and infested water (Okpala, 2004). The majority of studies done so far were bovine schistomiasis near to the study area (Belayneh and Tadesse, 2014), however, there was no detailed studies on ovine and caprine schstosomiasis in Mecha district. Therefore, the objective of the present study was to determine the prevalence of ovine and caprine schistosomiasis and to identify associated risk factors for the occurrence of schistosomiasis in the Mecha district.

MATERIAL AND METHOD

Study area

The study was conducted from November, 2014 to April, 2015 in Mecha district northwest Ethiopia. Mecha district is bordered with North Achefer, South Achefer and Ylmanadensa districts and having an altitude ranging from 1800-2500 meter above sea level and has a warm humid climate with the annual rainfall vary from 1000-2000 mm. The annual temperature of the area ranges from 12.4^0c -21^0c. The area has poor drainage and there is annual over flooding during the rainy seasons leaving pockets of water bodies for long period during the dry season. Livestock population found in this district includes cattle, sheep, goat, horse, donkey and mule. The number of sheep and goat population in the district are estimated to be 148,971 and 18,659 (MWRDAPO, 2012). Both traditional and modern (semi-intensive) farming are practiced in the study area.

Study population and Study animals

The study animals were sheep and goat randomly selected from randomly selected three peasant associations (kebeles) namely: Enamrt, Kudimi and kurtbahir. The study animals were indigenous breed sheep and goat both sexes (male and female) and two ages categories as described as (young and adult years). The age of animal was estimated by using dentition pattern of animals (young sheep≤ years and adult> 2 years) as described by Getenby (1991), for goat (young≤3 and adult>3 years) (Steel, 1996). The body condition score was described as poor, medium and good. The entire study animals were often allowed to graze the whole days in and around stagnated water and marsh area except Enamrt.

Study design

A cross-sectional study design was conducted to estimate the prevalence of ovine and caprine schistosomiasis and to identify its associated risk factors in Mecha district from November, 2014 to April, 2015.

Sample size and sampling method

Simple random sampling method was applied to select study animals. During sampling informations like origin, species, sex, approximate age of individual animals and body condition was recorded. To calculate the sample size, the expected prevalence of 50% was considered by 95% confidence interval at an absolute precision of 5%. The desired sample size was calculated according to the formula given by Thrusfield (2005).

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

Where, n= required sample size.

P_{exp}= expected prevalence.

d^2= desired absolute precision. Therefore, 384 sheep and goat were required for this study.

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Study methodology

Coprological Study. To determine the presence or absence of small ruminants' schistosomiasis, fresh fecal samples were collected from the rectum of each animal. Collected samples were placed in universal bottles containing 10% formalin for preservation and transported to Merawi veterinary clinic. Then samples were processed using sedimentation techniques (Hansen and Perry, 1994).

Data management and analysis

The collected data was entered and stored into Microsoft Excel spread sheet, 2007. The data were thoroughly screened for errors and properly coded before subjecting to statistical analysis. The data were imported from the Microsoft Excel and analyzed using SPSS software version 16.0. Descriptive statistics was used to determine the prevalence of schistosomiasis and chi-square (x^2) was used to evaluate the association between the prevalence of ovine and caprine schistosomiasis with various risk factors (species, sex, age, origin and origin), p-value less than 0.05 or 5% level of significance were considered significant in this analysis.

RESULT

Coprological examination of 384 samples indicated that 36 (9.4%) were positive for *Schistosoma* eggs. The prevalence of small ruminants' schistosomiasis between two species 12.9% in ovine and 5.5% in caprine was observed. The prevalence was greater in ovine than caprine and there was statistically significance variation (P<0.05) among two species. Similarly, over all infection rate in animals having poor body condition and adult age was significantly (P<0.05) higher than animals which have good and medium body condition and younger age. However, there was no significant association among sex group. In the present study, it was observed that the prevalence of *Schistosoma* in relation with the sites of sample collected was significantly (P<0.05) varied. The prevalence for each kebele was 14.6%, 8.3% and 4.2% in Kurtbahir, kudimi and Enamrt, respectively (Table 1).

Sex-wise distribution of *Schistosoma* infection was not significantly (P>0.05) varied, among sex group of sheep and goat. However, over all infection rate in male caprine (6.2%) was slightly higher than female caprine (4.9%). Whereas, it was slightly higher in female sheep (13.3%) than male sheep (12.5%) (Table 2).

Age-wise distribution of *Schistosoma* infection was significantly varied (P<0.05) in adult and young sheep was found to be 18.9% and 3.8%, respectively. However, in adult and young goat it was found to be 6.9% and 3.6%, respectively. This is significantly varied (P<0.05) in adult and young sheep, but not significantly (P>0.05) varied in adult and young goat (Table 3).

In the present study, it was observed that the prevalence of *Schistosoma* infection in relation with body condition score differ in ovine whereas it was not statically significant in caprine. Sheep with poor body condition score (21.5%) were more infected with *Schistosoma* than sheep with medium (7.7%) and (7.3%) good body condition score. whereas in caprine, the highest prevalence were observed in poor body condition (8.8%) than medium and good body condition (Table 4).

Table 1 - The prevalence of schistosomia infection in small ruminants' and associated risk factors.

Risk factors		Examined animals	Prevalence (%)	X^2 (P-value)
Site	Enamrt	119	5(4.2)	8.52 (0.014)
	Kudimi	121	10(8.3)	
	Kurtbahir	144	21(14.6)	
Species	Caprine	183	10(5.5)	6.29 (0.0012)
	Ovine	201	26(12.9)	
Age	Young	161	6(3.7)	10.41 (0.001)
	Adult	223	30(13.5)	
Sex	Male	168	16(9.5)	0.008 (0.93)
	Female	216	20(9.3)	
Body condition	Poor	147	23(15.6)	11.34 (0.0034)
	Medium	181	11(6.1)	
	Good	56	2(3.6)	
Overall	--	384	36(9.4)	--

*P<0.05 = significant

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Table 2 - The prevalence of sheep and goat schistosomiasis based on sex					
Species	**Sex**	**Examined animal**	**No. Positive**	**Prevalence (%)**	**X^2(P-value)**
Caprine	Female	103	5	4.9	0.17(0.68)
	Male	80	5	6.2	
Ovine	Female	113	15	13.3	0.26(0.87)
	Male	88	11	12.5	
*P>0.05 = insignificant					

Table 3 - The prevalence of sheep and goat schistosomiasis based on age					
Species	**Age**	**Examined animal**	**No. Positive**	**Prevalence (%)**	**X^2(P-value)**
Ovine	Young	78	3	3.8	9.66(0.008)
	Adult	122	23	18.9	
Caprine	Young	83	3	3.6	1.00(0.316)
	Adult	101	7	6.9	
*P<0.05; = significant					

Table 4 - The prevalence of sheep and goat schistosomiasis based on body condition.					
Species	**Body condition**	**Examined animal**	**No. Positive**	**Prevalence (%)**	**X^2(P-value)**
Caprine	Poor	68	6	8.8	3.314(0.19)
	Medium	85	4	4.7	
	Good	30	0	0	
Ovine	Poor	79	17	21.5	8.5(0.014)
	Medium	26	2	7.7	
	Good	96	7	7.3	
*P<0.05 = significant					

DISCUSSION

The diagnosis of *Schistosoma* in animals and human beings is a key step to propose and establish control strategy (Niaz et al., 2010). According to Martin et al. (2008), and Zhou et al. (2008), determining target population for chemotherapy in endemic areas, assessment of morbidity and the evaluation of control strategy all can be built on the result from diagnostic test. Therefore, the present study was conducted to determine the prevalence and to identify risk factors associated with the occurrence of schistosomiasis in ovine and caprine population in the Mecha district, Northwest Ethiopia. Accordingly, the overall prevalence of *Schistosoma* infection in the present study animal was found to be 9.4%. The present finding was higher than the study of Ferede et al. (2013) (1.7%), Maritu et al. (2014) (1.5%) and Lo and Lemma (1973) (5.5%) in Southern and South western Ethiopia, Ravindra et al. (2008), 1.7% in South India, respectively. This difference might be due to the fact that the studies conducted in the previous covered very large area from where sheep could permanently or seasonally or not at all come in contact with water lodged area for dry season grazing and watering, whereas the present study covers small area where animals graze and watering around water lodged area (except for Enamrt which don't have specific stagnated water).

The difference in prevalence between the present study and the study conducted by Ravindra et al. (2008) in South India is due to difference in environmental factors (agro-ecology and climate), sampling time, epidemiological factors (availability of stagnant water body, marshy area and drainage system for irrigation practice which favor the development and multiplication of snail intermediate hosts) and agro-ecology, climatic conditions and animal management practices. However, the prevalence of the present study is lower than another previous study conducted in Lake Tana where in a prevalence of 20% was reported Haile (1987) and Islam et al. (2011). This difference is because the present study included both marshy areas (Kurtbahir and Kudimi) and dry areas (Enamrt) but the current study was restricted only to Lake Tana which has higher stagnant water, lower drainage and predominantly marshy which is more favorable for the development and multiplication of snail intermediate hosts and environmental factor, sampling period, epidemiological factors.

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The site- wise result of this study showed a significantly varied (P<0.05), higher prevalence of ovine and caprine schistosomiasis in Kurtbahir (14.6%) than the other two peasant associations (Kudimi, 8.4% and Enamrt, 4.2%). This difference was due to swampiest and moisture nature of Kurtbahir than the other two. This may indicate that as the site is nearer to large stagnated water body due to this the infection rate becomes higher. Similarly, Urquhart et al. (1996) has reported that water lodged and poorly drained areas with acidic soils are often endemic for schistosomiasis.

Schisotoma infection rate in relation with age in the present study was varied in ovine but, not in caprine. *Schistosoma* infection was dependent on age and it was observed that higher prevalence in adults, this is similar with Islam et al. (2011) might be due to long exposure as because older animals move longer distance in search of scarce pasture and water there by, increase their chance of infection, on the other hand very young animals don't graze extensively as the older so they get less infection of cercaria.

Schistoma infection rate in relation with body condition score in present was varied ovine but, not in caprine. Animals with poor body condition score were more affected than other groups of animal. The reason might be related to the body defense mechanism of sheep and goat. This result agrees with Merawe et al. (2014), in cattle schistosomiasis affirmed that infection rate increases with animals which have poor body condition score. This could be due to acquired immune status of poor body condition score and weak animals become more suppressed and susceptible which may be due to malnutrition and other parasitic infection. So, infected animals may require long period of time to respond against *schisotom*a infection. This gives suitable time for establishment and fecundity of parasites in the animals.

In the current study, there was no statistically significant difference (P>0.05) in the infection rate between male and female animals of both species. This indicates that both sexes were have the same risk to acquire the infection. This is because of equal exposure to the risk factors as there was no restriction on movement for grazing and contact with the parasite in terms of sex. Small ruminants were seen grazing in the area that necessitates more contact times with the larval stage of the parasite and the snail intermediate vector. This creates ideal condition for the multiplication of *Schistosoma* and increases the epidemiology of the disease; Kassaw (2007) also reported that the increased contact time with schistosoma infested habitat increases the rate and endemicity of schistosomiasis.

The prevalence of the *Schistosoma* infection among the two species (ovine and caprine) was vary and statistically highly significant differences (P<0.05) were observed. The prevalence of schistosomiasis was high in ovine (12.9%) than caprine (5.5%). The reason for variation among two species is due to variation in the behavior and feeding system of animals as described by Agrawal and Sahastbudne (1982). Sheep visit regularly contact snail contaminated water when drinking. So, higher propensity for contact with drinking water as a source of contamination could explain high prevalence. Goat show distinct aversion to immersion in water even avoids walking through it. So this may reduce their potential for exposure.

CONCLUSION AND RECOMMENDATION

The prevalence of ovine and caprine schistosomiasis recorded in this study based on coprological examination revealed the presence of schistosomiasis in sheep and goat population of the study area at a considerable level. The study has revealed that occurrence of *Schistosoma* infection in sheep and goat was significantly affected by the origin of the animals, age, species and body condition status of the animals. In addition, the occurrence of the diseases is closely linked to the presence of bio-types suitable for the development and multiplication of intermediate hosts. Therefore, this study revealed that small ruminant's schistosomiasis was one of the major parasitic diseases contributing to loss in productivity and production of sheep and goat in the study area. Based on this study, the following recommendations are forwarded:

- ✓ Schistosomiasis should be taken into consideration as one of the major limiting factor to livestock productivity in Mecha district hence any endeavor towards animal disease control strategy must include it in the priority list.
- ✓ Habitat modification and drainage or increasing of water flow activities should be practiced.
- ✓ Implementation of appropriate control measures for the intermediate host should be encouraged.
- ✓ Strategic use of anti-helminthes should be practiced to reduce pasture contamination with blood fluke eggs.
- ✓ Further and detailed studies on small ruminants' schistosomiasis and its intermediate host should be done in the study area.
- ✓ Ant-helmentic drugs which effectively against schistosoma should be widely available in veterinary clinic.

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Author's contribution

A.Fentanew performed the data collection, laboratory works and write up of the manuscript. S.Derso analyzed the data and revised the manuscript. All authors read and approved the final manuscript.

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Conflict of interests

No conflict of interest

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GENE SEGREGATIONS, LINEAR BODY MEASUREMENTS AND PERFORMANCE EVALUATION OF DAIRY CATTLE CROSSBREEDING IN NORTHWESTERN ETHIOPIA

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ABSTRACT: An investigative research work was delivered to address the objective of characterizing the cross breeding effects on dairy cattle performances in North West Ethiopia (North Gondar, South and west Gojam). In the same time, exploratory field survey and multistage sampling technique was conducted to collect the polygenic traits and improvement effects of cross breeding in the study areas. Blood level like F_1 (50E:50L), F_2 (25E:75L), F_3 (75E:25I) and F_4 (12.5E:87.5I) dairy cattle characterization work was conducted from north Gondar, south Gondar and west Gojam zone. The interaction effect of body weight and other liner body measurements for all dairy cows with different blood levels were highly significant ($P<0.01$). Body weight and body length at F_3, F_2, F_1 and F_4 blood levels of the cows were indicated that none, little and significant ($P<0.01$) reduction were observed on the measurable trait values across the blood levels like body weight least square mean value of 405.86, 405.72, 401.38 and 346.13 (kg) and 184.78, 182.32, 178.68 and 169.59^b (cm) for body length, respectively. Whereas, performances of cows were reduced as exotic blood levels were increased. So, this work remarked that F1 generation of an animal had superior in different aspects, while the gene segregation effect was observed at F3 (75E:25I) generation. Similarly, the factorial ANOVA indicated that peak milk yield (12.83lt/day) was measured from parity three and F_1 generations. Therefore, gene segregation and down crossing effect could be the causes of economic losses and should be flew the bloods through generations. In addition, characterization of the randomly disseminated genetic resources should be employed to evaluate and know the breeding practices and effect of the merit or demerits of cross breeding in the country.

Keywords: Measurable Traits, Crossbreeding, Genetic Improvement, Cattle, Amhara

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INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa, of roughly 53.99 million animals out of this total cattle population, the female cattle constitute about 55.48% and the remaining 44.52% are male cattle. In Ethiopia, large livestock population plays an important socio economic roles and contributing about 12% of the Gross Domestic Product (GDP). According to FAO (2005) and CSA (2011) in Amhara region, about 28% of the animal population was females of which about 55% of Ethiopian total cattle population and produces about 3.2 and 0.82 billion liters of milk per year in Ethiopia and in Amhara region, respectively are produced The average lactation milk production for the indigenous cows is ranged from 494–850 liters per 1.5 years with 1.54 liters per cow per day (CSA, 2007).

Performance potentials of local cattle are relatively low and crossbreeding with *B. Taurus* was recommended to improve their productive and reproductive performances. Consequently, in Ethiopian history, domestication and the use of conventional livestock breeding techniques for genetic improvement of dairy cattle to enhance milk

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production of local breeds is over about six decades (Leakey, 2009). It also appears important to estimate the expected level of hetrosis for traits of economic interest in dairy cattle in order to evaluate the profitability of crossbreeding (Mauro et al., 2009). This program was launched during the invention of Ethiopia by Italy with importation of exotic dairy cattle breeds.

Later on, the first livestock development project (1958-1963) created the Dairy Development Agency (DDA) that was concerned mainly with the development of commercial dairy farms in Addis Ababa (Fekadu, 1990). Following this Chilalo Agricultural Development Project (CADU), an integrated project established jointly by the Ethiopian and Swedish Governments, in Arsi region initiated intensive small scale dairy development in Ethiopia in 1967/68 was established (Kiwuwa et al., 1983). This was followed by the Wolaita Agricultural Development Project (WADU) that was established in 1971 and funded by the World Bank, applied the CADU program (Hailemariam, 1994). The focus of the program was on increasing the milk productivity of local breeds through crossbreeding and distribution of F_1 heifers to farmers (EARO, 2001).

Linear body measurement has positive correlation to evaluate the performance improvement trends of dairy cattle. In addition, crossbreeding has resulted in good improvements in production of milk especially when supplemented with adequate management levels in terms of nutrition and disease controls. In spite of, the presence of large and diverse animal genetic resources, the productivity of livestock remains low in many regions of the country (Fikre, 2007). However, genetic improvement effect and gene segregation trend on different blood level with the phenotype of the animal is not identified. Therefore, the extents of exotic genotypes have been diffused into the indigenous populations, significance importance on dairy genetic improvement, and its progress and the level of dilution is not independently assessed. The objective of the study was to put a bench mark on the gene segregations effects, linear body measurements and performance evaluation of dairy cattle crossbreeding in North West Ethiopia.

MATERIALS AND METHODS

Description of the study area

The study was conducted in three zones and 9 districts of Amhara regional state from 2015 to 2016. Amhara National Regional State (ANRS) is located in the north-western part of Ethiopia. Geographically, it is situated between latitude 9°–13°45'N and longitude 36°–40°30'E. It is bounded by the Afar, Benishangul, Oromiya and Tigray regions in the east, south-west, south and north, respectively, and by Sudan in the west. The total area of the region is estimated at 170,152 km^2, which is about one-sixth of the country's total area (Gizaw et al, 2013). The region ranges from 600 m.a.s.l (meter above sea level) at Metema and 4520 m.a.s.l at Ras Dashen, North Gondar, which is also Ethiopia's highest point. The wide range of altitude is a major factor in determining the temperature range of the region. Generally, lowland areas (<1500 m a.s.l.) experience hot temperatures, while highland areas (>1500 m a.s.l.) experience relatively cooler temperatures. For example, in the hot to warm sub moist agro-ecological zone, where the altitude ranges from 600 to 1400 m a.s.l., the mean annual temperature range is 21–27°C while in the cold to very cold moist zone, where the altitude ranges from 2800 to 4200 m a.s.l., the mean annual temperature varies from 7.5°C to 16°C (CSA, 2007).

Exploratory approach as a study design and multistage sampling techniques like both purposive and random sampling methods were considered. Based on the blood levels and crossed dairy cattle potential, the 3 zones were selected. From the total 180 households about 150 matured crossed dairy cattle were used for the study (FAO, 2011). Both qualitative like blood level of dairy cattle, parity and sex of the owners and quantitative data like body length (BL), body weight (BWT), tail length (TL), heart girth circumference (HGC), high at weather and high at hip (HAH) were considered. Similarly, systematic simple random sampling technique was used to select the crossed dairy cattle owners. General liner model was developed using meter and heart girth as a measurable tool for linear body measurements and body weight of an animal with the fixed effect of blood level and parity. While, data were analyzed using SAS software (SAS, 2002).

Model: 1. $Y_{ijk} = \mu + A_i + D_j + AD_{ij} + e_{ijk}$

Y_{ijk} = the observed milk yields of the cattle
μ = overall mean
A_i = fixed effect of i^{th} type (n = cattle blood levels)
D_j = the effect of k^{th} parity (j = 1-4)
AD_{ji} = the fixed effect interaction i^{th} of blood level with j^{th} of parity
eij_k = random residual error

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RESULTS AND DISCUSSIONS

Performance of hybrid dairy cattle

Average productive and reproductive performance of different blood levels of dairy cattle in the region were characterized under different production systems using measurable traits. About 25, 20.1 and 20%of the interviewed owners were females from north Gondar, west Gojam and south Gondar zone, respectively. While the majority of the respondents about 75% were fully involved in small scale mixed crop-livestock in per urban and urban types of crop-livestock production systems and used cattle as source of income for immediate expenses such as purchasing of salt, coffee, clothe and animals' medicine. Most of the cows held on peri urban and urban farms were lactating during the study period, while higher percentages of dry cows were observed on rural small scale farms. Milking, processing, cleaning and selling of dairy products such as milk and butter was performed by adult males and females. Most of the information was generated from males which indicated that mainly men are responsible for rearing of dairy cows.

According to the respondents' point of view good performance of dairy cows could be attributed to genetic and non-genetic factors such as blood level, supplementary feed and care of farmers to their animals. The present finding discovered that parity had significant cause of variation for the performances of milk production with the least square mean value of 4.90±0.34, 6.56±0.44, 8.58±0.71 and 8.55±1.12 litter/day for P1-P4, respectively. While blood level was one of the fixed effects of dairy cattle performances with the average peak milk yield and gene segregation signs average mean value of 12.8^{a,}, 12.0^{a}, 11.07^{a} and 8.57 ^{b} litters of milk per day for F_1, F_2, F_3 and F_4 generation, respectively.

Average productive and reproductive performances of hybrid dairy cattle and their significant difference were estimated under existing farmers' management condition (Table 1). In this result, average milk yield of F_1 hybrid dairy cattle was much higher than 5.9 and 6.4 litter/day reported by Addis et al (2015) and Belay et al (2012), respectively. The performance of milk yield in the hybrid dairy cattle obtained from the present study was higher in F_1 (9.59 litters/cow/day) but smaller in 6.82 litters/cow/day where gene segregation was observed from F_2 and F_3 even if hetrosis effect is expressed on the local dairy cows like 9.12 and 8.15 litters/day/crossed breed than 1.54 litter/day/local cows, respectively. However, higher milk yield performance was record from monitored cows in F_1 generation reported by Addis et al (2015) with F_1 daily milk yield of 11 liters. Another study conducted in North Showa zone indicated that 50% cross breeds were produced 1511.5 litter of milk per lactation which was more amount of milk than local breeds (457.89 L) (Mulugeta and Belayneh, 2013).

This variation from the pure breed is indicative for the better performance of the hybrid and existence of variability in milk production could be an indication of the potential for genetic improvement through cross breeding followed by selection with selected indigenous superior dairy cattle.

Table 1. Current production systems and Performance aspect of dairy cattle in different blood levels in Amhara Ethiopia (least square mean)

Blood Level	Milk Yield				Overall
	P1	P2	P3	P4	
F1	5.63^{bc}	9.43^{a}	12.83 ^{a}	10.45 ^{a}	9.59
F2	6.71^{a}	9.10^{a}	12.0 ^{a}	8.65 ^{b}	9.12
F3	6.02^{ab}	7.64^{b}	11.07 ^{a}	7.88 ^{b}	8.15
F4	4.90^{c}	6.55^{b}	8.57 ^{b}	7.25 ^{b}	6.82
Overall Mean	4.90-0.34	6.56-0.44	8.58-0.71	8.55-1.12	8.42

F_1= 50E:50L, F_2= 25E:75L, F_3= 75E:25l, F_4= 12.5E:87.5l, P= parity

Interaction effect of fixed factors to quantitative parameters

From the total sampled dairy cattle with 8 measurable parameters such as BWT (kg), BL (cm), HGC (cm), HAG (cm), HAH (cm), TL (cm) and teat length in cm for different blood level were considered. The GLM least squares mean of body weight and liner body measurements of F_1, F_2, F_3 and F_4 hybrid dairy cattle with their variations and comparison test was stated. The overall mean square of body weight obtained for F_1 - F_3 hybrid dairy cattle were significantly ($P<0.05$) heavier in body weight than F_4 generations. Whereas, F_1 dairy cattle generations had better different aspects than other blood levels. Even if the hetrosis effect is dominant at the interaction effect indicated that serious gene segregation effect was observed at F_4 generation.

Thus, F_1 in body length associated with milk yields were found to significantly long with the value of 184.78^{a} which is relatively taller than the report of Yan et al. (2009) who stated that the body length of F_2 crossed one was 146.37 cm. However, F_2 and F_3 had bigger body weight 405.72 and 405.86 than F_1 and F_4 generations,

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respectively. The overall mean for body weight trend obtained for mature cows at F_1 up to F_4 generations were 389.77 (kg), which was heavier than other Ethiopian local cattle.

Table 2 - Comparison least square mean (Lsm) of body weight (kg) and linear body measurements (cm) of the hybrid dairy cattle in Amhara Ethiopia

Blood level	BL	BWT	TL	HGC	HAW	HAH	Teat length
F1	184.78^{a}	401.38^{a}	87.38^{b}	166.50^{ab}	130.50^{ab}	133.88^{a}	7.38^{a}
F2	182.32^{a}	405.72^{a}	125.18^{a}	170.77^{ab}	132.27^{a}	135.09^{a}	6.77^{ab}
F3	178.68^{ab}	405.86^{a}	85.18^{b}	173.77^{a}	133.22^{a}	134.09^{a}	6.36^{b}
F4	169.59^{b}	346.13^{b}	84.81^{b}	164.86^{b}	127.22^{b}	123.79^{b}	7.04^{ab}
Over all hybrid	178.84	389.77	95.64	168.97	130.80	131.71	6.89

F_1= 50E:50L, F_2= 25E:75L, F_3= 75E:25l, F_4= 12.5E:87.5l, BL= body length, BWT= body weight, TL= teal length, HGC= heart girth circumference, HAW= high at weather and HAH= high at hip

CONCLUSION AND RECOMMENDATIONS

The overall trends of cattle crossbreeding and its effect on body measurement via dependant variables on local dairy cattle in North West Ethiopia was stated. Following that the performance of local dairy cows are reached at peak at F_1 blood level and gene segregation effect is started at F_3 generations. Therefore, the breeding strategy of the country is better to assess the breeding program and focused on the levels of gene segregation effects.

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Author's contribution

All authors contributed equally to this work.

Competing Interests

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

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EFFECT OF NEW FORMULATED DIETS ON GROWTH AND BIOCHEMICAL PARAMETERS OF *Babylonia spirata* (LIN, 1758), GULF OF MANNAR

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ABSTRACT: A feeding experiment of three dietary protein levels (30%, 35% and 40%) with three replicates was conducted to determine the proper protein level for the growth and survival of the *Babylonia spirata* under laboratory conditions. Snail with initial body weight ranged from 50.95 ± 0.33g to 51.05 ± 0.21g and initial length ranged from 5.96 ± 0.62 cm to 6.91 ± 0.70 cm were fed the experimental diet for 3 months. Mean weight gain, survival rate, biochemical parameters of snail fed the 40 % protein diets was significantly (P<0.05) different from that snail fed the 30% and 35%. The results of the study indicate that a diet containing 40 % dietary protein was recommended for snail growth under our laboratory conditions.

Keywords: Formulated diet, Growth, Biochemical parameters, *Babylonia spirata*

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INTRODUCTION

Generally, meats of molluscs especially gastropods were highly nutritious, owing to its contents of proteins, rich vitamins and minerals (Thanonkaew et al., 2006). Therefore, the biochemical composition of marine gastropod persists as an excellent nutritional assurance for millions of malnourished peoples. The gastropod meat has been considered to be free of cholesterol but contains high nutritive substances substances (Asadatun Abdullah et al., 2016).

The use of prepared feed formulation would helps to manipulate in a proper way and obtain an optimum nutritional value. Further, it could be properly prepared and stored for a longer duration according, to their demands (Nyameasem and Borketey-La, 2014). The usages of such as formulated feeds in spotted Babylon farming have made a significant contribution to their production in Thailand (Chaitanawisuti et al., 2010). By adaptation this strategy in *Babylonia areolata* may have been observed to increase within growth high protein content of 27% and 45%.

The artificial feed formulation and preparation can be done with optimal nutrition for *B. spirata* at the lowest possible cost. The diet development is involved certain factors such as the cost of ingredients, pellet ability and diet acceptability, water stability of the feed and handling requirements (Chaitanawisuti et al., 2010). In recent days, the increasing demand of the meat, operculum and shells of the gastropod have led to the development of active fishery in different parts of India (Periyasamy et al., 2011). The heavy fishing may result in the depletion of natural stocks to a large extent. Several bivalves are produced through aquaculture, but gastropods are not produced

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through aquaculture and they can also be cultured for commercial production. Only a few studies were done in India on breeding, larval rearing and sea ranching of gastropods (Mohanraj et al., 2010). The present study deals with the work, influence of formulated diets on growth and biochemical parameters of *B. spirata.*

Materials and Methods

The samples of *B. spirata* with their initial weight ranged from50.68g to 52.52g and initial length ranged from 5.53cm to 5.82cmwere collected at the Therespuram coastal area (80^0 48'N; 78^0 94' E), Tuticorin, Southeast coast of India. Collected samples were made to acclimatize in 7 days in by using aerated plastic holding tanks (1.5m×2m×0.5m L: W: H) in the Marine Gastropod Hatchery Research Laboratory, Kamaraj College, Tuticorin, Tamil Nadu, India. During this study period, the snails were fed with natural live clam meat. Then they were randomly distributed into triplicate FRP tank containing 200L at 40 snail /tank and three experimental groups were maintained. The tanks were regularly cleaned, disinfected and allowed to dry for 24h after which they were filled with dechlorinated ambient seawater to 2/3 sizes of the tanks. The bottom of the rearing tanks was covered with 3 cm layer of coarse sand (500 to 1000 micron mean grain size) as substrate. After removing the snails from culture tanks, sand was cleaned using a water jet flushing and sundried at 30days intervals in order to remove the accumulated waste materials. During this period the snails were fed with formulated (30%, 35% and 40 % crude protein) at once day. The total experiment was conducted for 90 days.

Experimental diet

The procedures for feed preparation were modified by Hardy (1980). The feed ingredients were homogenized thoroughly in a food mixer. After adding distilled water to the mixed ingredients, a paste was made using a hand mixer. The paste was shaped into 0.5 mm thick sheets and they were cut into 2 cm^2 flakes, sealed in a plastic bag and stored at -20^0C. The experimental diets were formulated with the composition protein of 30%, 35% and 40%. The fish meal and groundnut oil cake serves the protein source, fish oil as serves lipid source, tapioca powder serves as the carbohydrate source, wheat flour serves as a binder and vitamin and mineral mixtures were also added (Table 1).

Table 1 - Composition of basal diet

Ingredients	30%	35%	40%
Fish Meal	26	32	38
Groundnut oil cake	26	32	38
Tapioca	23	17	11
Maida	23	17	11
Cod liver oil	1	1	1
Vitamin and Minerals mix	1	1	1
Proximate Composition	**30%**	**35%**	**40%**
Moisture	74.26 ± 0.26^a	74.96 ± 0.78^b	75.12 ± 0.15^a
Protein	30.45 ± 0.47^b	34.63 ± 0.19^b	39.17 ± 0.31^a
Carbohydrate	10.87 ± 0.96^c	10.96 ± 0.46^{ac}	11.05 ± 0.24^c
Fat	2.16 ± 0.44^d	2.20 ± 0.63^b	2.54 ± 0.10^c
Ash	8.11 ± 0.78^e	8.13 ± 0.75^{bc}	8.23 ± 0.84^c

^{abc} (Mean±SD) the same letter in the same row is not significantly different at P<0.05.

Water quality

The seawater quality parameter was analyzed weekly for its purity. It includes parameters like, temperature (^{0}C), salinity (ppt), pH and dissolved oxygen (mg/L) were examined by using SYSTRONICS water analyzer 371.

Growth parameters

The growth performance and biochemical profile were expressed in terms of weight measurements like weight gain (g) and survival (%) were monitored according following formula of Chaitananawisuti et al. (2011).

Weight gain (g) - Final weight –Initial weight

Survival (%) - $\frac{F_2}{F_1} \times 100$

F_1 - Number of snail at the being of experiment

F2 -Number of snail at the end of the experiment

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Estimation of Biochemical profile

The Folin- Ciocallteu phenol method of Lowry et al. (1951) was adopted for the estimation of total protein in the tissue. Total carbohydrate content method was followed by Dubois et al. (1956). The lipid content was estimated gravimetrically by following the method of Floch et al. (1956). The moisture and ash content was followed by AOAC (1990).

Statistical analysis

All experimental data obtained were analyzed using one-way analysis of variance (ANOVA) followed by Duncan's multiple range test $P < 0.05$ was considered for describing the significant level (SPSS Version 20).

Results and Discussion

The aquaculture of molluscs seems to be seriously affected worldwide by bacterial pathogens and predators' that cause high losses in hatcheries as well as in natural beds. The main responsible for the mortality outbreaks is a number of *Vibrio*sp and *Aeromonas* species that are considered important pathogens in aquaculture (Chen et al., 2005). The pathologies caused by *Vibrio* in bivalves and gastropods have been described since the 1960s; however, over recent years successive episodes of high mortality have been recorded due to these microorganisms. The average shell length and weight and survival rate of *B.spirata* fed with formulated diet for three month are shown in Table 2. The growth expressed as body weight, shell length and survival rate were significantly not different $p<0.05$ among the experiment diets. Among the average body weight gain, the highest was observed at 40% level of protein diet (2.14 ± 0.84g) and the lowest was observed at 30% level of protein diet (1.01 ± 0.36g). In average final shell length, the highest was observed at 40% diet (6.91± 0.70cm) and the lowest was observed at 30% diet (5.96 ± 0.62cm). The average survival rate, the highest was observed at 40% of protein diet (91 ± 1.04%) and the lowest was observed at 30% diet (89 ± 1.06%). The maximum growth and survival rate were observed in 40% protein diet.

Table 2 - Average length, weight and survival rate of *B. spirata* fed with (30%, 35% and 40%) different formulated diet for 3 month

Diets	Initial weight (g)	Final weight (g)	Weight gain (g)	Initial length (cm)	Final length (cm)	Survival (%)
30%	50.95 ± 0.33^{a}	51.96 ± 0.32^{ba}	1.01 ± 0.36^{ca}	5.56 ± 0.63^{a}	$5.96 \pm 0.62^{b,a}$	89 ± 1.06^{ca}
35%	50.16 ± 0.12^{ab}	51.63 ± 0.15^{b}	1.47 ± 0.55^{c}	5.79 ± 0.45^{ab}	6.59 ± 0.45^{b}	90 ± 1.23^{cb}
40%	51.05 ± 0.21^{a}	53.45 ± 0.24^{b}	2.14 ± 0.84^{cab}	5.81 ± 0.41^{a}	6.91 ± 0.70^{ba}	$91 \pm 1.04^{c,a}$

Table 3 - Proximate composition of formulated deitof *B. spirata*

Proximate composition (%)	30%	35%	40%
Moisture	74.53 ± 0.06^{bac}	74.31 ± 0.19^{c}	80.17 ± 0.19^{a}
Protein	46.12 ± 0.57^{bca}	37.68 ± 0.55^{c}	50.61 ± 0.61^{a}
Carbohydrate	13.22 ± 0.74^{bac}	11.92 ± 0.17^{c}	15.41 ± 0.84^{ac}
lipid	4.02 ± 0.03^{bac}	3.80 ± 0.02^{c}	4.09 ± 0.03^{ac}
Ash	16.33 ± 1.15^{bac}	13.33 ± 1.52^{cac}	15.66 ± 0.57^{a}

^{abc} (Mean±SD) the same letter in the same row is not significantly different at $P<0.05$.

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Table 3 - Average water quality parameters observed during experimental period of (12 weeks) in *B. spirata* at 30%, 35% and 40% of basal diet.

30%				
Weeks	**Temperature (°C)**	**Salinity (ppt)**	**pH**	**DO mg/L**
1	26.32±0.74^{a}	33.04±0.25^{b}	7.21±0.39^{ab}	5.30±0.12^{d}
2	26.90±0.98^{ab}	32.66±0.58^{b}	7.15±0.14^{c}	5.13±0.38^{d}
3	27.12 ±0.30^{a}	33.19±0.21^{a}	7.13±0.21^{c}	5.06±0.16^{a}
4	27.00 ±0.94^{a}	33.92±0.77^{ba}	7.06 ±0.11^{a}	5.16±0.24^{a}
5	27.96±0.73^{abc}	32.53±0.51^{b}	7.61±0.78^{c}	5.05±0.16^{dbc}
6	26.85±0.86^{a}	33.13±0.48^{b}	7.56±0.11^{cab}	6.02±0.51^{d}
7	27.12±0.81^{a}	32.16±0.19^{b}	7.10±0.51^{cab}	5.26±0.17^{dab}
8	26.08±0.37^{a}	33.26±0.14^{ba}	7.86±0.95^{c}	5.96±0.63^{da}
9	27.03±0.44^{ac}	33.62±0.37^{bc}	7.45±0.61^{c}	5.02±0.37^{d}
10	26.97±0.42^{a}	33.07±0.43^{ba}	7.26±0.07^{ca}	6.30±0.12^{d}
11	27.06±0.83^{a}	33.52±0.31^{b}	8.03±0.73^{ab}	6.55±0.47^{d}
12	26.05±0.50^{a}	32.20±0.39^{b}	7.60±0.46^{c}	6.77±0.61^{da}
35%				
Weeks	**Temperature (°C)**	**Salinity (ppt)**	**pH**	**DO mg/L**
1	26.55±0.17^{a}	32.60±0.16^{ba}	7.16±0.36^{ca}	5.11±0.13^{d}
2	27.80±0.12^{a}	33.26±0.62^{b}	7.63±0.24^{cab}	5.33±0.48^{d}
3	26.18±0.29^{a}	32.66± 0.63^{ba}	7.27±0.23^{cad}	5.41±0.26^{d}
4	26.25±0.52^{a}	32.92±0.54^{b}	7.66±0.19^{c}	5.08±0.24^{d}
5	27.49±0.69^{a}	32.63±0.63^{ba}	7.28±0.45^{ca}	5.65±0.66^{d}
6	28.15±0.19^{a}	33.83±0.19^{b}	7.16±0.36^{ca}	5.33±0.71^{d}
7	26.92±0.29^{a}	33.16±0.26^{ba}	7.33±0.24^{ca}	5.11±0.67^{da}
8	27.18±0.29^{ab}	33.90±0.46^{b}	7.60±0.63^{cb}	5.16±0.43^{db}
9	27.03±0.64^{ac}	33.62±0.54^{bc}	7.31±0.45^{c}	6.05±0.27^{d}
10	27.67±0.62^{ac}	32.77±0.29^{bc}	7.13±0.64^{c}	5.93±0.12^{dc}
11	27.11±0.43^{a}	32.50±0.26^{b}	7.23±0.27^{cad}	6.21±0.67^{d}
12	26.85± 0.63^{a}	33.08±0.39^{ba}	7.20±0.23^{c}	6.07±0.03^{d}
40%				
Weeks	Temperature (oC)	Salinity (ppt)	pH	DO mg/L
1	26.66±0.57a	33.00±0.55ba	7.82±0.39ca	5.41±0.43d
2	27.30±0.98a	33.06±0.58b	7.83±0.54cab	5.53±0.38d
3	27.68±0.30a	33.96±1.01ba	7.83±0.49ca	5.41±0.36da
4	27.45±0.94a	33.92±0.77b	7.71±0.51cab	5.78±0.34d
5	27.49±0.74a	33.53±0.56b	7.63±0.74ca	5.45±0.46da
6	27.55±0.26a	32.93±0.48b	7.36±0.41c	5.93±0.51da
7	27.42±1.01a	32.46±0.81ba	7.70±0.61ca	5.61±0.37d
8	26.78±0.37a	32.90±0.54b	7.80±0.55ca	5.66±0.43da
9	26.93±0.44a	33.12±0.37b	7.81±0.41ca	5.45±0.37d
10	27.67±0.72a	32.77±0.43b	7.83±0.37c	5.93±0.42da
11	26.81±0.43a	32.60±0.41b	7.63±0.43ca	6.21±0.47da
12	26.85±0.70a	32.88±0.39b	7.60±0.46c	6.07±0.43da

^{abcd} (Mean±SD) the same letter in the same row is not significantly different at P<0.05.

According to Nilnaj Chaitanawisutia (2010) have reported *B.areolata* is one of the most important cultivable species with significant commercial value. Currently, the most common practice in spotted babylon culture in Thailand. Similarly, Chaitanawisuti and Kristanapantu (2000) have reported that average growth rate of juvenile spotted babylon of *B.areolata* was 3.86 mm mo^{-1} in length and 1.47 mo^{-1} in weight after 8 months when cultured at a density of 300 snails/m^2 in flow through system and 3.21 mm mo^{-1} and 1.10g mo^{-1} when held in a recirculation system. Temperature and salinity are considered to be the most important physical factors influencing marine organisms and the biological effects of these factors are complex and wide ranging. Secondly, temperature affects the hatch rate, incubation period, the size of the newly hatched larvae, larval yolk absorption and utilization, larval feeding behavior, larval survival and larval growth (Shi *et al*., 2010). The temperature, salinity, diet and rearing density are exogenous factors affecting larval growth, settlement and metamorphosis Crisp (1974). Theaverage water quality parameters observed during the experimental period for twelve weeks are shown in Table. 3. These

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parameters were significantly P<0.05 different including the temperature which ranged between 26.66 ± 0.57 ^{0}C and 27.68 ± 0.30 ^{0}C, the salinity between 32.12 ± 0.37 ppt and 33.92 ± 0.77 ppt, the pH from 7.60 ± 0.46 to 7.83 ± 0.49 and the dissolved oxygen from 5.41 ± 0.36 mg/L to 6.21 ± 0.47 mg/L. These values are suitable for rearing of *B. spirata.* Similarly, Kritsanapuntu et al. (2006) observed the higher body weight gain and shell length increments were observed in *B. areolata* held in recalculating seawater system at water exchange of 15 day intervals. The proximate compositions of *B. spirata* tissues fed with different formulated diet are shown in the Table.3. The maximum moisture content (80.17 ± 0.19%), Protein (50.61±0.61), Carbohydrate (15.41±0.84), Lipids (4.09±0.03), Ash (15.66± 0.57) was recorded in 40% of protein deit and minimum in 30% protein det. All the above proximate values are (p<0.05) not significantly different. Palapandi *et al*. (2010) have reported the proximate composition of *Cymbiummelo*. Among proximate composition, protein ranged from 20.78% to 30.19%, carbohydrate 5.14% to 2.59%, lipid 3.39% to 2.76 % and moisture content 83.69% to 76.59%. Similalry, Periyasamy *et al*., (2011) has reported that *B.spirata* meat is a valuable food with high quality protein and well balanced diet.Nutritional contents of protein (53.86%), carbohydrate (16.85%) lipid (9.30%). SiniMargt *et al*. (2013) have also observed the biochemical composition of four important gastropods from Kanyakumar coast. The maximum protein content was observed in *B.spirata* (39.8%) and *B. zeylancia* (35.8%). In conclusion, the results of our study reported that 40% of protein diet better growth performance and biochemical variables in *Babylonia spirata*.

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Conflict of interest

There is no conflict of interest to be declared by the author

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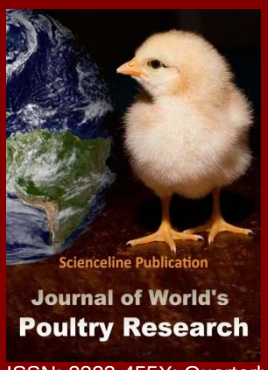

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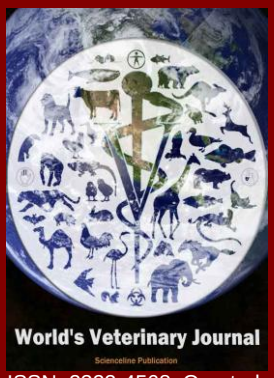

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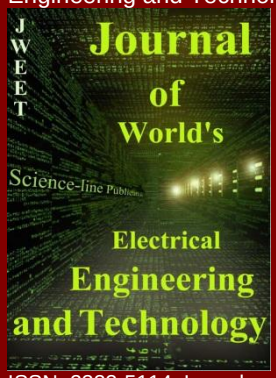

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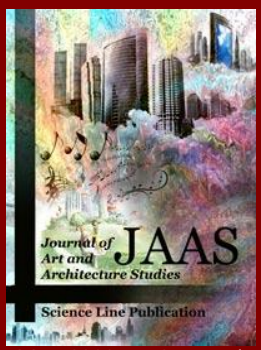

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