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Production and Reproductive Performance of Indigenous Sheep in Ethiopia

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Abstract: This review aimed at to evaluate production and reproduction performance of indigenous sheep in Ethiopia. Sheep production in Ethiopia contribute a significant amount to income, food (meat and milk) and non-food products like manure, skins and wool. The mean age at first lambing was 464.2±14.0 days for Washera sheep raised under traditional management system in Amhara National Regional State. The lambing interval for most Ethiopian indigenous sheep under traditional management are between 7 and 10 months. These differences might be due to variation in breed, season, sex of lamb, type of birth (single, twin), parity and management practice. The overall average weaning age thin-tailed Gumuz sheep (3.95± 0.9 months). The average slaughter ages were 6.34, 6.37, 7.33 in high, mid and lowland areas of Ada Barga and Ejere Districts of West Shoa Zone, Oromia, Ethiopia respectively. Mean birth weight for Farta breed was 2.7±0.28 kg, 3.1±0.12 kg for Washera and 2.9±0.06 kg for their crosses. Ethiopian local sheep were considered by slow growth, late maturity and low production potential. Feed shortage, diseases and parasites, animal management, genotype and genetics and socio-economic and institutional constraints were the main problems in sheep production in the country. Facility of vaccination, better feeding, clean water and night time enclosure relatively advances the production performance of indigenous sheep in Ethiopia.

Key words: Production · Reproduction Performance · Indigenous Sheep · Ethiopia

INTRODUCTION

Small ruminants are widely reared in a crop-livestock farming system and are distributed across different agro-ecological zones of Ethiopia [1]. The total population of sheep in Ethiopia is estimated at 30.7 million and 99.7% of them are indigenous [2].

The country possesses fourteen traditional sheep populations that are clustered into four major groups of sheep types based on their tail type namely, short fat-tailed, long fat tailed, thin-tailed and fat-rumped tailed sheep [3]. In Ethiopia, small ruminants contribute a significant amount to income, food (meat and milk) and non-food products like manure, skins and wool. They also serve as means of risk mitigation during crop failures, property security, monetary saving and investment in addition to many other socioeconomic and cultural functions [4].

The average holding of sheep per household in Ethiopia ranges between 3.7 [5] to 31.6 [6]. This all makes Ethiopia's sheep population the second in Africa and sixth in the world [7]. Ethiopian local sheep are considered by slow growth, late maturity low production performances. The mean carcass production of such sheep is estimated around 10 kg [8], which is low as compared to the average of sub-Saharan countries with annual off take rates of around 33% [9]. The productivity of local sheep is low with high mortality of lambs [10].

The low productivity of indigenous flocks can partially be attributed to the low management standards of the traditional production systems. However, facility of vaccination, better feeding, clean water and night time enclosure relatively advances the production potential of indigenous sheep. In addition, skins of sheep are important by-products of small ruminants in sub-Saharan Africa [11]. The major factors attributed to low productivity indigenous sheep are poor nutrition, genotype, inadequate indigenous breed utilizations for production, limited knowledge of the husbandry practices and environment [12].

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A lot of researches were conducted in the country for academic and for development purposes in the past to evaluate and improve the productivity of the indigenous Ethiopian sheep. However, the information made from such research works were not compiled and made available to beneficiaries. The purpose of this review article was to evaluate and document the performance of indigenous Ethiopian sheep for major production and reproduction traits under different management situations and to highlight future research priorities.

Level of Performance for Major Traits

Age at First Lambing (AFL): The number and availability of breeding males in the flock determines the speed of genetic improvement of the flock [13]. According to Yadeta, *et al.* [14] reported the AFL was 14.12, 14.36 and 15.22 months for sheep in high, mid and lowland respectively in Ada Barga and Ejere districts of West Shoa Zone, Oromia Ethiopia. Age at first lambing ranged between 16.2 and 16.9 months in mixed farming systems of sub-Sahara African countries [15] averaged 18.10 at eastern Amhara region [16] and in Seka, Mana and Dedo districts of South-western Ethiopia Yisehak, *et al.* [17] reported AFL of 15.90, 15.85 and 15.63 months, respectively.

The age at first lambing of African sheep seems to have wide variation and might be attributed to breed, husbandry and management practices. Poor nutrition and disease delayed the age at first lambing through limiting early animal growth. Age at first lambing of Menz sheep were 15.67 months [18]. Afar sheep had AFL of 13.52 months [19]. However, Mengiste *et al.* [20] found that age at first lambing was 15.4 months for washera breed under traditional management system, in contrast to 13.3±1.7 and 7.8±2.4 months for Horro sheep breed [21]. Under on-farm management system Gumz had age at first lambing of 13.67 months [22], in Alaba southern Ethiopia Tsedeke [23] reported that AFL of 12.7 months and Fsahatsion, *et al*. [24] reported an average AFL of 12.4 months in Gamo Gofa Zone, Southern Ethiopia.

Age at first lambing (AFL) is predisposed by genetic and nutrition, disease and parasite infestation factors resulting in wide variability within and between breeds and among different production system. Better management and planed nutrition for earlier maturity and thus for earlier age at puberty could help to shorten the age at first lambing.

Table 1: Age at first lambing (AFL) for some tropical sheep breed/types

Sheep Breed/type	Management type	Age at first lambing (month)	Source
Washera	Traditional	15.46	[25]
Menz	Intensive	15	[26]
Menz	Traditional	17.06	[27]
Menz	Traditional	14-16	[28]
Menz	Traditional	16.5	[29]
Horro	On farm	13.3	[21]
Afar	On-farm	13.52	[30]
Blackhead Ogaden	Traditional	23.56	[31]
Menz	On-station	23.3	[32]

Lambing Interval: Lambing or kidding interval is the interval between two parturitions that determines reproductive efficiency in small ruminant production. At least three times kidding or lambing is expected per two years under normal circumstances [33]. To attain three lambing every two years, lambing interval should not exceed 8 months (245 days). There were reports on the possibility of attaining three parturitions from indigenous small ruminants in two years [19]; 9.16 month for washera sheep [25]; 8.04months [34] and 7.34 month [24]. The lambing interval for most Ethiopian indigenous sheep under traditional management was between 7 and 10 months. These differences referred to in breed difference, season, sex of lamb, type of birth (single, twin), parity [35] and management practice [29]. Ethiopian sheep had the range of 7 to 12 months reported for sub -Saharan African sheep [36].

Table 2: Lambing interval (LI) for some tropical sheep breed/types

Sheep breed/type	Management system	Lambing interval (month)	Source
Arsi-Bale	Traditional	7.8	[28]
Menz	Traditional	12.7-13.6	[27]
Horro	On-farm	9-10	[37]
Afar	On-farm	9.01	[30]
Washera	On-farm	9.03	[38]
Bonga	Traditional	8.9	[39]
Blackhead Ogaden	On-farm	10.5	[31]
Horro	On-farm	8.7	[30]

Lambing interval varied according to the feed availability, management and mothering ability and breed of sheep across parts of the country and the world too. Assen and Aklilu [40] for Ethiopian native sheep lambing interval was (196.5 days), Hassen and Tesfaye [41] for native Bangladesh sheep (247.7±49 days).

Litter Size: Level of nutrition had affected litter size in that, poor nutrition during service period reduced ovulation rates and increase embryonic mortality and

consequently decreased litter size [29]. Litter size was influenced by the plane of nutrition, as the availability and quality of feed impact rate ovulation and embryo survival [29]. Liter size of Ethiopian sheep breeds like Menz and Afar sheep breeds was low [42] which was almost close to one lamb per lambing. Litter sizes of 1.14 ± 0.01 and 1.04 were reported for Menz sheep under village condition [43]. The LS reported for Horro ewes ranged from 1.29 – 1.57 and 1.13 for Bonga sheep. Solomon, *et al*. [4] also reported that Washera sheep breed is large in body size and also prolific. Litter size (LS) or prolificacy was defined as the number of progenies born per parturition [36]. It is one of the most important reproductive parameters affecting the productivity of a dam and thereby the profitability of a farm.

Table 3: Litter size (LS) for some tropical sheep breed/types

Sheep breed/type	Rearing system	Litter size (month)	Source
Bonga sheep	Traditional	1.13	[4]
Washera	Traditional	1.11	[4]
Menz	On-farm	1.02	[27]
Menz	Traditional	1.11	[28]
Arsi-Bale	On-farm	1.7	[23]
Arsi-Bale	On-farm	1.52	[44]
Blackhead somali	On-station	1.04	[3]
Horro	On-station	1.14	[45]
Horro	On-station	1.34	[46]

Although Ethiopia is the second in Africa and sixth in the world in sheep populations [6]. indigenous sheep were poor in performances [46]. Ethiopian indigenous sheep were considered by slow growth, late maturity and little production potential. The mean carcass production of such sheep is estimated as around 10 kg [8], which was low as compared to the average of sub-Saharan countries with annual off take rates of around 33% [9].

The productivity of local sheep was low with high mortality of lambs [10]. The low productivity of indigenous flocks can partially be attributed to the low management standards of the traditional production systems. However, facility of vaccination, better feeding, clean water and night time enclosure relatively improves the production potential of indigenous sheep. In addition, skins of sheep were important by-products of small ruminants in sub-Saharan Africa [11] and contributes to national revenue in most countries.

Weaning Age: The weaning age of lambs were 3.84, 3.93 and 4.44 months in high, mid and lowland of agro ecologies Ada Barga and Enjere district of West Shoa Zone, Oromia Ethiopia, respectively [14]. Tsedeke [23] reported weaning age 4 and 4.6 months, respectively for kids and lambs in Alaba, Southern Ethiopia. Zewudu, *et al.* [47] in western and south-western Ethiopia reported that the overall average weaning ages for both sexes and breeds of indigenous sheep was 4.80 months, within a range of 1 to 9 months. Assen and Aklilu [40] reported 4.4 and 4.7 months for lambs and kids in high and midland of Tigray zone respectively. The overall average weaning age thin-tailed Gumuz sheep (3.95± 0.9 months) [48]. Weaning age of 3-4 months [49].

Slaughter Age / Market Age: The slaughter age can vary from country to country and even within a given country due to variation in culture, religion, reason of slaughter and market weight of a given area. The average slaughter ages were 6.34, 6.37, 7.33 in sheep and 6.5, 6.39, 6.03 months in goats in high, mid and lowland areas of Ada Barga and Ejere Districts of West Shoa Zone, Oromia, Ethiopia respectively [14]. According to Yenesew, *et al.* [50], the age at which most of the sheep sold on market ranged from 6 to 12 months, in Burie district, North Western Ethiopia. Assen and Aklilu [40] reported shorter mean slaughter age of 7.55 ± 2.27 and 7.55 ± 2.39 months for sheep and goat in order.

Birth Weight: Birth weight of lambs was significantly different between breeds, agroecology, sexes of lamb and parity of the dam [51]. Birth weight was an indicator of the size and vigor of the lamb at the beginning of postnatal development and an important factor influencing later growth [51]. Larger lambs at birth had greater capacity for growth and were more likely to be heavier at weaning [52]. Mean birth weight for Farta breed was 2.7±0.28 kg, 3.1±0.12 kg for Washera and 2.9±0.06 kg for their crosses [51]. Washera lambs were weightier than the 2.69±0.02 kg birth weight stated by Mengistie Taye, *et al.* [53] and the 2.6±0.01 kg weight reported by Shigdaf Mekuriaw, *et al.* [54]. It also showed that Farta and their crossbreds were heavier than the 2.5±0.02 kg and 2.59±0.01 kg, respectively [55]. Breed type significantly contributed for the difference in weight.

Sex was a significant source of variation in which the birth weight of male lambs was higher than that of female lambs. Similar reports are available from previous studies [53, 56]. Tibbo [10] confirmed that Horro lambs were heavier than Menz lambs at birth (2.40 vs. 2.06 kg), at weaning (9.48 vs. 8.64 kg) and at yearling (19.0 vs. 17.1 kg) and consequently, had earlier pre weaning (78.0 vs. 72.6 g per day) and post-weaning (31.0 vs. 29.1 g per day) growth rates. Abegaz [57] however, disclosed that the yearling weight of most indigenous breeds is between 20 and 25 kg although some breeds (e.g. Horro) can weigh up to 34 kg under on-station management.

Table 4: Birth weight, weaning weight and yearling weight of indigenous sheep breed of Ethiopia

Sheep Breed	Management	Birth weight	Weaning weight	Yearling weight	Source
Menz	On station	2.06	8.64	17.1	[10]
Menz	On station	2.20	8.3	16.9	[58]
Menz	On station	2.07	9.01	15.5	[59]
Gumz	On farm	2.79	12.5	-	[60]
Washera	On farm	2.83	13.3	-	[32]
Afar	On station	2.70	11.5	24.5	[61]

Constraints of Sheep Production in Ehiopia: Major constraints of sheep production in the study area were shortage of feed and land which was contributing (40%) the other constraints were sheep diseases (26.67%), labor shortage (16.6%) market problem (10%) and lack of extension service (6.67%) [62]. Feed shortage as the first ranked sheep production constraints whereas disease and inadequate veterinary services were the second and third constraints respectively.

Sheep disease and parasites were the other main constraints for sheep productions. Especially Anthrax, Sheep and Got pox, PPR are major contributors to high mortality of sheep in Ethiopia [63]. The most common parasites were Mengemites, tick and fleas. Traditional medicine were generally used to cure the animal but sometimes they cause serious problem due to higher dose and lack of knowledge about the disease type [30]. The same sources indicated that disease lower the productivity of animals and it may occur during feed shortage period and poor management of sheep. Feed scarcity may influence the animals to low disease resistance.

EARO [64] reported feed shortage, diseases and parasites, animal management, genotype and genetics and socio-economic and institutional constraints were the main problems in sheep production in the country. This study was also in line with that of Abebe, *et al.* [5], feed shortage in the dry and rainy season, diseases, inadequate veterinary service and lack of capital were the main Sheep production constraints in Lallomamma Mider Woreda, North Shoa [64]. Land and feed shortage, disease Scarcity of water, drought and genotype were as among major constraints for small ruminant in Gamo Zone, Southern, Ethiopia [65].

Most (74%) of the respondents indicated that high prevalence of diseases and parasite infestation are the major constraints to small [66]. The same author stated that, parasitism in general and Helminthiasis in particular ranks high. Tsetse fly infestation was also reported to be economically significant in the lowland districts [66]. The same author stated, feed shortage (65%) was the second major limiting factor to small ruminant production. Both disease and feed problems were reported to be more pronounced in Mettu and Darimu districts whereas, scarcity of water was reported to be more prevalent in Bacho district. Other constraints included market problem, inadequate inputs, lack of extension support and credit services [66].

Sheep predominantly graze and pick up more parasites so that they have higher with parasite larvae, so being less exposed to infective acquired resistance than goats which mostly browse Goats with their browsing behavior consume uncontaminated matter larvae and therefore might have lower acquired resistance than sheep [67]. Regarding age, higher prevalence of lungworm infection was observed in the groups of 6-12 months (33.91%) as compared to age groups of less than or equal 6 months (19.05%) and greater than 12 months (22.73%). This might be associated with the infrequent grazing behavior of animals with less than 6 months age and the acquired resistance of adult animals when they are greater than 1 year [68].

CONCLUSION

The low productivity of indigenous flocks attributed to low management standards of the traditional production systems. The age at first lambing of Ethiopian indigenous sheep seems to have wide variation and might be attributed to breed, husbandry and management practices. Poor nutrition and disease can lead to delayed age at first lambing through limiting early animal growth. There is variation of lambing interval due to feed availability, management and mothering ability and breed of sheep across parts of the country and the world too. Level of nutrition has effect on litter size in that, poor nutrition during service period lead to reduced ovulation rates and increase embryonic mortality and consequently decrease litter size. The productivity and reproductive performance of sheep was constrained by shortage of feed, land, diseases, labor shortage, market problem, lack of extension service and common parasites like mengemites, tick and fleas. To improve the productive and reproductive performance, improvement in management

(improved feeding, clean water), nutrition and provision of vaccination and selection and breed improvement strategy is important.

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