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Review OPEN ACCESS

Review on challenges, opportunities and genetic improvement of sheep and goat productivity in Ethiopia

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ABSTRACT

Livestock production methods in Ethiopia are usually subsistence system with low productivity. Henceforth this paper is expected to gather the information on challenges, opportunities and genetic improvement of Ethiopian sheep and goat productivity. It is further provides highlights on Ethiopian sheep and goat breeds, production systems, constraints such as feed shortage, diseases, absence of enhanced technologies and inputs, institutional, administrative and program support, lack of improve genetic potential of indigenous breeds and conservation, advancement and utilization of AnGRs. However, information extends on past and present genetic improvement and opportunities for example institutional backing for domesticated animals research and advancement, practical use of animal genetic resources, creating different systems of production, practical involvements and intensifying emerging export market of sheep and goat in Ethiopia. Therefore, there is an urgent need to take different measures to tackle these constraints in order to exploit diverse genetic potentials of these animals.

Keywords: sheep and goat, constraints, genetic improvement, opportunities

Introduction

Ethiopia is a land of diversity with 18 different agro ecologies and hosts several flora and fauna. It has one of the largest livestock populations in the African continent with an estimated population of about 30.70 million heads of sheep and 30.20 million heads of goats. Most of these sheep and goats are distributed across various agro-ecological zones of the nation (CSA, 2016/2017).

Sheep and goat are very important for farmers and pastoralists as a source of livelihood. Notwithstanding from their role at house-hold and communal level, small ruminants have national significance as they give around 46% of the national meat utilization, 58% of the estimation of hide and skin generation and significant amount of export earnings (Kassahun et al., 1991). Sheep and goat can adapt to versatile environments and thus can thrive under unfavorable conditions. They also have the ability to utilize coarse feed, shrubs and can even graze over the mountain slopes, which are otherwise unsuitable for agricultural purposes (Ebegbulem et al., 2011). Unfortunately, the potential of these caprines are yet to be fully exploited (EARO, 2000; Kassahun and Solomon, 2009). There is an increase in demand (both within and for export) for meat from small ruminants. However, the gap between demand and supply is widening, indicating an urgent need for improving the

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productivity of sheep and goats through genetic improvement (Kassahun and Solomon, 2009). But there are principal constraints limiting their potential such as; diseases and parasites, poor nutrition (quality and quantity), unimproved genetic potential of local breeds, poor marketing infrastructure and access to markets, minimal institutional and support services, and poor access to and sub-optimal utilization of knowledge, information and technologies (Tibbo, 2000; Tsedeke 2007; Gizaw et al., 2013). The influence of these constraints are manifested through reduced reproductive efficiency, high mortality, slow growth rate of survivors and low economic return (Tsedeke, 2007). Above all these challenges, opportunities are enormous in the areas of development and better utilization of AnGRs, which exist in crop and livestock integration system (IBC, 2004). In addition, wide genetic inconsistency, capacity of the indigenous types of sheep and goat to thrive under uncomfortable ecological conditions including high disease occurrence and poor nourishment are some of the vital hereditary attributes, which give opportunities for research and advancement of farm AnGRs. Therefore, the objective of this paper is a review on challenges, opportunities and genetic improvement of sheep and goat productivity in Ethiopia.

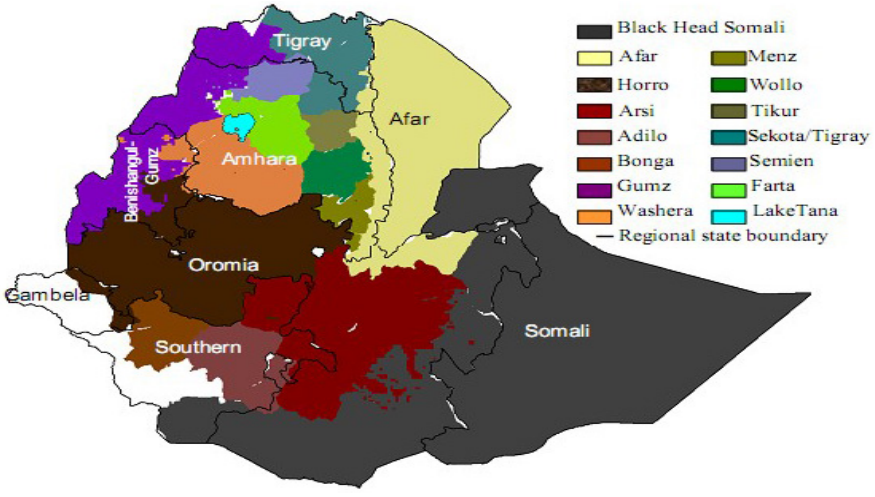

Figure 1 Regional states, breeds of sheep and goats in Ethiopia.

EThiopian Sheep and Goat Breeds

According to Solomon (2008) who reported around 14 traditionally known sheep populations in Ethiopia. These populations are called sheep types in some texts. Ethiopia sheep types are classified into four major groups based on their phenotypic attributes, for example, short fat-tailed, long fat-tailed, thin-tailed and fat-rumped sheep. Although, based on DNA characterization and differences, Ethiopian sheep types have been categorized into nine genetically distinct breeds.

Goats were also classified based on differences in their physical qualities and genetic variations at DNA level, 4 families and 12 breeds of goats have been documented in Ethiopia (Farm Africa, 1996; Tesfaye, 2004). Both sheep and goat types are named after their geographic area as well as the ethnic groups where they are discovered (Tesfaye, 2004).

Sheep and Goat Production System in Ethiopia

The methods of livestock rearing in Sub-Saharan Africa and in specifically Ethiopia was characterized by various criteria, the core ones being animals and crops integration system, the animal-land association, production intensity and kind of produce (Wilson, 1991). Other criteria comprises of size and worth of livestock affluence, distance and time of animal

movement, kinds and breeds of animals kept, financial involvement and family dependency on livestock (Wilson, 1991). As indicated by Zinash and Syoum (2001) described three kinds of livestock systems of production in Ethiopia, for example broad pastoralist in arid and semi-arid rangelands, combination of animals with cropping in rain-sustained and irrigated regions and methods related with perennial tree crops.

Constraints

There are numerous numbers of constraints that limits the productivity of sheep and goat in Ethiopia. The major ones are feed shortage, drought, housing and occurrence of disease, which affect their production potentials (Tesfaye, 2008).

Feed shortage

Feed shortage as one of the challenge facing sheep and goat production may arise due to prolonged drought resulting to a period of below average rainfall leading to feed and water shortage (IGAD, 2011; Legesse et al., 2014). Whereby the most nutritious vegetation is quickly eaten up and later animals will have eaten the rejected residual. This situation leads to reduction of feed quality, which in turn diminishes the nutrient intake of the animals or fall below their maintenance (Tesfaye, 2008).

Diseases

Occurrences of diseases are another major factor affecting productivity of sheep and goat, which lowers their immune system making them vulnerable to disease infection. According to IGAD (2011) and Legesse et al., (2014), the most frequently reported disease by veterinarians and animal's health service are those, which cause huge economic loss. Disease usually results from a combination of factors including inadequate feeding and low standard of management. As reported by Dhaba et al. (2012) diseases and parasites infestation influence the improvement of small ruminant production system, which in turn cause high mortality rates both in adult and young animals.

Absence of enhanced technologies and inputs

The accessibility of advanced skills and efforts are basic components to change traditional subsistent way of animal production into market-oriented productive endeavors. Notwithstanding, lack of service deliveries, enhanced innovations and inputs remained unreachable or inaccessible to livestock producers in various locations (Zelalem, 2007). As reported by Fikru and Gebeyew (2015) that both advancement in technologies and effective delivery framework are fundamental in this system to achieve its optimum. Additionally, the rate of improvement of breeds and development of multiplication centers in order to provide hybrid stock to the farmers has been slow. More so, the present distribution method of crossbred, high grade and exotic animals, helped by sponsored AI benefit, cannot fulfill the demand by smallholders (IBC, 2004).

Inefficiency of institutional, administrative and program support

The rate of progress in production and farmers' revenue depend greatly on the level of implementation of advanced technologies and marketing support strategies. However, Kedir (1998) reported that ineffective institutional, administrative and program support system is the most contributing factor for low adoption of innovation in livestock production in Africa. As indicated by Berhanu et al. (2007) that appropriation of enhanced advancements is emphatically influenced by policies made by the government for example supply of input, market, credit, and price factors. In addition, there is poor

communication between the main features of research and development through ineffectiveness of extension services.

Lack of improve genetic potential of indigenous breeds

As described in IBC (2004) breeds, breeding management and productivity are very significant factors, which required attention in animal sector. Animals' production is affected by an intricate relationship of genetic potential of animal breeds, the rearing method and environment where they are produced. According to Rege and Lipner (1992) native breeds have the ability to adapt in the tropical environment and have the potential to resist high level of heat and diseases existing in Ethiopia. They have the capacity to thrive, survive long time of both feed, and water scarcity. However, these characteristics have been achieved via natural selection and needs to be improved through proper design breeding program.

Conservation, advancement and utilization of AnGRs

According to (IBC 2004; Solomon et al., 2010) explained the various factors that have limits conservation, advancement and usage of AnGRs, for example poverty, which is the most severe issue that restricts the conservation and sustainable utilization of farm AnGR). Conservation of genetic resources cannot be discussed without setting up a sound poverty alleviation program in place. Additionally, lack of human resource capacity, deficiency in technical know-how and expertise is another challenge confronting better utilization of AnGR. Besides, there are very few animal breeders, specialists in new reproductive technology and molecular genetics. The Ethiopian government is prepared and devoted to offer necessary support in this area. Nonetheless, the nation is faced with lack of budgetary assets. Therefore, monetary support is essential from national, regional and global initiatives, and from international community.

Past and Present on Genetic Improvement of Sheep and Goat in Ethiopia

As explained by Kassahun and Terry (2009) in an attempt to improve indigenous breeds of goat, semen from Boer bucks was imported from Langston University in 2006. This was to cover the indigenous does through artificial insemination (AI) at Haramaya and Hawassa Universities. However, the results of AI were not very encouraging and hence were discontinued

Secondly, Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP) was initiated in the year 2007 with an aim to combine desirable traits of exotic Dorper sheep and Boer goats with indigenous breeds for exploitation of hybrid vigor, thus improving the carcass yield of the crossbreds (Crossbreeding Program).Furthermore, Boer goats and Dorper sheep were imported from South Africa under USAID project. The ESGPIP Genotype Program activities included the importation of improved genotypes, multiplication of purebreds, crossing with indigenous goat and sheep and distribution of both crossbred and exotic animals to the selected community members. Additionally, the project also encompassed evaluation of the imported animals on selected farms and in research institutions. Some of the Boer bucks and their offspring (crossbred) are being reared at Ataye farm. Here the dam lines used for crossbreeding were the Central Highland does (Chiemela et al., 2015).Thus, it can be concluded from the study that while there were some encouraging results from the crossbreeding experiment and the crossbreds showed meat type traits. However, the overall efficiency of the crossbreds was not quite as expected. Furthermore, the adaptability and the overall productivity of the crossbreds need to be studied further especially at the beneficiaries (farmers) end (Chiemela et al., 2015).

Nevertheless, Ayele (2016) stated that the adoption of results generated from past research endeavors has been negligible and the impact on the overall production and productivity level is hardly notable. Moreover, efforts were made to improve indigenous sheep by selection (on-station) thereby selecting 3 breeds (Menz, Afar and Horro) through selective breeding. Conversely, the establishment of elite nucleus flock for Menz sheep gave a promising result from on-station selection

program for Menz sheep. Due to the past failures from the previous experiments led to quick research and response on the plan for alternative community based breeding programs. For example, the establishment of village-based cooperative/community breeding program for Menz, Horro and Bonga sheep breeds are in place**.** The International Livestock Research Institute (ILRI/ICARDA) and Boku University came with the idea of Community Based Breeding Programs (CBBP) in Ethiopia. It is a kind of value chain approach, which focuses on improving the indigenous breeds. Currently appreciable genetic improvement has been achieved in Menz program (DARGEGN village). From the results so far body weights at birth, 3 and 6 months of age increased by:0.42, 2.29 and 2.46 kg, respectively, in the third generation when compared to those in the base generation.

The role of ILRI/ICARDA in approach of community based breeding programs are quite enormous such as; adoption of value chain approach, organization, breeding, feeds and feeding systems, health interventions, marketing and input supply. They also helped from planning to implementation of CBBP for example, participatory research (research and development at a time), animal identification, farmers' preference, recording, selection and culling. In addition, because of the results obtained from CBBP the Government of Ethiopia took it as the best practice and allocated budget from the national system and started implementation in Growth and Transformation Plan 2 (GTP 2), with livestock master plan of Ethiopia (20 years) since 2015. This master plan includes sheep and commodity strategy from the year 2015-2030with partnership between National Agricultural Research System (NARS) and ILRI/ICARDA, which is a promising idea in livestock sector.

Opportunities

Institutional backing for domesticated animals' research and advancement

It is generally known that animals are an important sector of revenue in the African continent. Livestock is a source of proteins, revenue and investment funds, transportation, skin and hides (AU/IBAR (2002). In a period of globalization, estimates of future worldwide demand for animal's products show significant opportunities for producers in Africa. Specifically, increase in human growth and urbanization in South-east Asia exhibit a developing potential trade for Africa and other developing nations (Delgado et al., 1999). As indicated by Solomon et al., (2010) that, there are availability of organizations producing and disseminating enhanced livestock technologies, giving credits and health services. Moreover, colleges of agriculture and institutions are becoming a driving force to encourage farmers to be full time future agriculturists. For instance, in Oromia Regional State, where livestock department and other sectors have been a separate entity in order to function effectively and create a synergy between Ethiopian Institute of Agricultural Research (EIARS). Thus, this could help project research assistance and fast adoption of new technologies by farmers.

Practical use of animal genetic resources

According to (EARO, 2000; Kassahun and Solomon, 2009) described Ethiopia as a nation with immense and different animal's populations. The presence of genetic differences, which exist within and between animal populations, creates room for genetic advancement. In addition, some sheep and goat breeds have good traits (characters) in terms of bringing income, particularly few numbers of sheep and goats located in the lowlands of the nation are in high demand in Middle East. For instance, Menz sheep, subalpine, long-fat-tail sheep and central highland goats produce good quality meat and their hides and skin are converted into leather. These various qualities could be utilize to upgrade efficiency in the local and international market.

Creating different systems of production

Gizaw et al. (2013), stated that there are enough space for opportunities and tremendous improvement due to different system of production and production environments that exist in the country. Furthermore, the presence of wide rangelands in most of agro-ecologies is encouraging for integrated farming for both crops and animals. Fikru and Gebeyew (2015), explained that land assets in the pastoral zones are primarily dedicated for production of animals. More so, those pastoral zones are entirely involved in animal rearing and would thus be able to effectively received modern technologies in area of livestock if proper tools were provided. However, production of sheep and goats is currently subsistence farming method, which yield very low output, but the present plan to empower the small-scale livestock production will likewise support the expansion of sheep and goats productivity.

Practical intervention

There are tremendous opportunities to support livestock development because of availability of advance livestock technologies can increase production in most of research institutes, development and training centers. For instance, these comprises of upgraded sheep and goats types, forage crops and management schemes that are created or embraced from somewhere else. Beside, multiplication centers and animal technologies are set up which can boost productivity (Solomon et al., 1995; Mukasa-Mugerwa et al., 2002).

Intensifying emerging export market

According to Homa (2017) government has completely strategized to use its resources from animals through added value alongside to create more employments for its citizens and encourage foreign trades. Information from the Ethiopian Revenue and Customs Authority indicated that 73% was earned through leather exportation, which can be processed into other finished goods such as shoes, bags, clothes. Years back, the nation's leather company has brought a lot of attention from foreign investors who have established their factories thereby creating employments for Ethiopians. NEPAD-CAADP (2005), explained that exportation of live animals and meat involved few individuals that have the right to export livestock to other countries. About 72,000 metric tons of meat have been reported to be exported per annually. These enormous potentials from livestock resources is a great opportunity to the country.

Conclusion

Sheep and goats are essential part of livestock rearing in terms of quick source of income, milk, meat, fleece, manure, and economic growth in Sub-Sahara Africa. They are one of the major source of revenue in Ethiopia comprising about 30.70 million heads of sheep and 30.20 million heads of goat in the nation. They also play a vital role in household for rural farmers. Nonetheless, there are a lot of factors that hinders sheep and goats production yet they can be overcome on account of the uncountable opportunities which they possess

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