

CHAPTER 1

1 INTRODUCTION

Goats (*Capra hircus*) are found across all agro-ecological environments and in nearly all livestock production systems (Winrock International, 1983) and are suitable for very extensive to highly mechanized production systems (Wilson, 1982; FAO, 1987). There are approximately 570 breeds and types of goats in the world, of which 89 are found in Africa (Galal, 2005). Ethiopia has the largest livestock population of any country in Africa, and is endowed with different agro-ecological zones of highlands, sub-humid, semi-arid and arid environments (Farm Africa, 1996). The animal sector contributed 18 % of the Gross Domestic Product (GDP), 40 % of the agricultural GDP and 17 % of the export income in 2001, in Ethiopia (LMA, 2002). There were 23 million goats in Ethiopia (CSA, 2004), which is 13.5 % of the African goat population (FAO, 1991) and these goats are grouped into nine distinct genetic entities (Tesfaye *et al.*, 2004).

Small ruminants are kept for various purposes. Their role for income generation, food supply (meat and milk), and financial security for the rural poor population is documented (Gryseels, 1988; Zelalem and Fletcher, 1993; Barrs, 1998; Workneh Ayalew, 1999). These animals provide 46 % of the value of national meat production and 58 % of the value of hide and skin production and play an integral part in the production systems of the country (Tembely, 1998).

The major factors that affect the productivity of small ruminants in Sub-Saharan Africa are feed supply, genotype, animal management, policy and institutional constraints (Ibrahim, 1998). Similar factors are also responsible for affecting the performance of small ruminants in Ethiopia. The major feed resource in the country, natural pasture, has shown remarkable seasonality in yield and quality and lacks the critical nutrients that support animal growth particularly during the dry season (Zinash and Seyoum, 1991). However, agro-industrial by-products, which may have the potential to supplement and improve the

performance of animals, have not been adequately tested with the local animals, and have not been effectively utilized as animal feed (Getenet *et al.*, 1999).

An increase in human population, coupled with urbanization, has resulted in a higher demand for meat per capita. If we continue to produce livestock and their products at the current rates, the increase in livestock production will lag behind the human population increase. The FAO (1990) estimated that animal production should be increased by 4 % annually to meet the demand of the human population by the year 2010. The potential of small ruminants is not yet fully tapped and currently special markets for small ruminants are expanding. The annual total meat demand of the Middle East countries is about 207 thousand ton of meat and 12 million head of cattle, camels, sheep and goats. Similarly, the African countries annual demand is about 86 thousand ton of meat and 3.2 million head of cattle, sheep and goats (Belachew and Jemberu, 2003). These figures demonstrate how large the demand is if the country is able to produce the required quantity and quality of animal protein in a sustainable manner.

In Ethiopia, goat meat is in demand for domestic consumption as well as for the export market mainly to the Middle East countries. Goat meat valued at USD 4 million was exported to Middle East countries in 1998 (EEPA, 2003), while the annual national goat meat production was estimated at 66 thousand metric ton (FAO, 1991). Both the export volume and the goat meat produced are low due to various reasons, which require urgent attention (Chapter 2.2.2.).

The proximity of Ethiopia to the Middle East and their adaptation to the indigenous animals are some of the advantages for the Ethiopian export market (Belachew and Jemberu, 2003). However, the international market for meat has become more competitive and the meat traders have had to adopt improved practices in production, processing and packaging of meat. Strict quality control measures to meet specific export market demands need to be

implemated. Market requirements also differ both in sizes of carcass and the level of fatness of the carcass.

In the tropics, the interest in goat production has begun to grow in recent years. This has come about with the realization that goats are an underutilized and poorly understood resource. An in depth understanding of their role, capabilities and outputs will contribute further to increase the overall productivity of tropical goat farming systems. Despite the large goat population, diversity and their economic significance, the research attention given to the indigenous goats of Ethiopia has been minimal (EARO, 1999; Getnet *et al.*, 1999).

The information so far available on goats is very limited and fragmented (Farm Africa, 1996; Getahun, 2001; Addisu, 2001). Most of the indigenous goats have not been compared and characterized in terms of growth, carcass and meat quality using improved nutrition. Hence, their merits remain largely unknown. As indicated by Laes-Fettback and Peters (1995) and Vercoe and Frisch (1987), it is necessary to identify the merit of all available genetic resources, the possible integration of the animals into various production systems and to make effective use of their potential in order to quantify the existing breed differences in growth rate, and the response of the animals to different feeding challenges. Oman *et al.* (1996) have also reported that the effect of breed type and diet on goat carcass characteristics has only been investigated in a limited number of studies.

The NRC (1981) reported that excessive walking increases the nutrient requirements of goats. Lachica and Aguilera (2003) also reported the maintenance energy requirements of free ranging goats to be from 0 to 75 % greater than animals in confinement; the costs of locomotion contributing substantially to this increase. Presently, more and more grazing land is being brought under cultivation; deforestation and overgrazing have also led to environmental degradation. For most of the year animals move around the farm even during the absence of adequate grazing material. These situations aggravate body weight loss of

goats under extensive systems and animals take more time to reach a target market weight. Hence, exploitation of the goat as a meat producer seems feasible under stall-fed conditions. More over, it has been identified that exporters faced lack of uniform and constant supply of goats, and therefore they have to cover large areas and take longer time to fetch the required type and number of goats from the extensive systems. Feedlot operations however, could help augment the indicated supply. Huston and Waldron (1996) reported very little information to be available on feedlot performance of goats and Dhanda *et al.* (2003) also recommended studying how goats perform under feedlot conditions.

Comparisons of carcass characteristics and meat quality between breeds give information on the suitability and performance level of the breeds under defined management and environmental conditions. Moreover, the information to be generated on meat production traits of indigenous goat genotypes will help in the development of a breeding strategy to be used in further improvement.

1.1. Objectives of the study:

- To assess the effect of genotype and grainless diets on dry matter intake and feed efficiency of young goats under stall-fed conditions and to determine the effect of a grainless diet on rumen degradability and fermentation in adult indigenous goats.
- To assess the genotypic effect on carcass characteristics and meat quality of extensively managed indigenous goats.
- To evaluate the effect of genotype and grainless diets on growth performance and carcass characteristics
- To measure the effect of genotype and grainless diets on meat quality of stall-fed Ethiopian goats.

1. 2. Hypothesis tested (Null hypothesis)

- Indigenous goat genotypes under the same nutritional regimes will have similar growth performance and do not produce carcasses of different quality.

1.3. References

- Addisu A., 2001. A comparative study on slaughter components with emphasis on edible offal of some indigenous goat types in Ethiopia. M.Sc thesis, Alemaya University, 2001.
- Barrs, R.M.T., 1998. Costs and return of camels and small ruminants in pastoral herds of Eastern Ethiopia. P. 162-175. In: Proceedings of the Sixth Ethiopian Society of Animal Production, 14-15 May 1998. Addis Ababa, Ethiopia.
- Belachew, H. & Jemberu, E., 2003. Challenges and opportunities of livestock marketing in Ethiopia. In. Proceedings of the 10th annual conference of the Ethiopian Society of Animal Production. Addis Abeba, Ethiopia.
- Central Statistics Authority (CSA), 2004. The 2001/02 Ethiopian Agricultural Sample Enumeration, Executive Summary, May 2004, Addis Ababa, Ethiopia.
- Dhanda, J.S., Taylor, D.G, Murray, P.J, Pegg, R.B. & Shand, P.J., 2003. Goat Meat Production: Present Status and future Possibilities. Asian-Aust.J.Anim.Sci. 16, No. 12, 1842-1852.
- Ethiopian Agricultural Research Organization (EARO), 1999. Livestock and Nutrition Research Program Strategy. EARO, Addis Abeba, Ethiopia.
- Ethiopian Export Promotion Agency (EEPA), 2003. Meat export statistics. EEPA, Addis Abeba, Ethiopia.
- FARM-Africa, 1996. Goat types of Ethiopia and Eritrea. Physical description and management systems. Published by FARM-Africa and ILRI, Nairobi, Kenya. pp.1-76.

- Food and Agriculture Organization of the United Nations (FAO), 1987. Small ruminants in the Near East. Selected paper prepared for expert consultation on small ruminants research and development. Animal production and health paper, No. 54, vol.1. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Food and Agriculture Organization of the United Nations, 1990. Production Year book 1989. Volume 43. FAO, Rome, Italy.
- Food and Agriculture Organization of the United Nations, 1991. Livestock and livestock products, Quarterly Bulletin of Statistics. 4(3), 39. FAO. Rome, Italy.
- Galal, S., 2005. Biodiversity in goats. *Small Rumin.Res.* 60:75–81.
- Getahun L., 2001. Growth pattern and carcass characteristics of Somali and Mid-rift valley goats. MSc thesis, Alemaya Univesity, 2001.
- Getenet B., Alemu Y. & Mekonnen H., 1999. Performance of lactating Somali does supplemented with different proportions of groundnut cake and wheat bran. In: *Livestock production and the environment-Implications for sustainable livelihoods. Ethiopian Society of Animal Production (ESAP) Proceedings*, Addis Ababa, Ethiopia.
- Gryseels, G., 1988. Role of Livestock on mixed smallholder farmers in the Ethiopian highlands: Case study from the Baso and Worana Werda near Debre Berhan. University of Wageningen, the Netherlands.
- Huston, J.E. & Waldron, D.F., 1996. Effects of protein level and roughage level in feedlot rations for goats. Research Report, Texas Agricultural Experiment Station.
- Ibrahim, H., 1998. *Small Ruminant Production Techniques*. ILRI Manual 3. ILRI (International Livestock Research Institute). Nairobi, Kenya.
- Lachica, M. & Aguilera, J.F., 2003. Estimation of energy needs in the free-ranging goat with particular reference to the assessment of its energy expenditure by the ¹³C-bicarbonate method. *Small Rumin. Res.* 49, 303–318.

- Laes-Fettback, C. & Peters, K. J., 1995. A comparative study of performance of Egyptian goat breeds. II. Growth performance and productivity. *Arch. Tierz.*, Dummerstorf. 38 (5), 563-575.
- Livestock Marketing Authority (LMA), 2002. Assessment Report on the preference of importers to live animal and carcass from Ethiopia. (Amharic version). LMA, Addis Ababa, Ethiopia.
- NRC, 1981. Nutrient Requirements of Goats: Angora, Dairy and Meat Goats in Temperate and Tropical Countries. National Academy Press, Washington D.C., USA.
- Oman, J.S., Waldron, D.F., Griffin, D.B. & Savell, J.W., 1996. Effect of breed-type and feeding regimen on goat carcass characteristics. *Sheep & Goat, Wool and Mohair*, research reports. Texas Agricultural Experimental Station. Texas.
- Tembely, S., 1998. Small ruminant production in Ethiopia. Prospects for improving productivity. Proceedings of the 5th national conference of Ethiopian Society of Animal Production. 15-17 May 1997. Addis Abeba, Ethiopia.
- Tesfaye Alemu, T., Fidalis, M.N., Hoeven, E., Yadav, B.R., Hanotte, O. & Hanlin, H., 2004. Genetic characterization of indigenous goat populations of Ethiopia using microsatellite DNA markers. In. 29th International conference on animal genetics, ISAG September 11-16, 2004, Tokyo, Japan.
- Vercoe, J. E. & Frisch, J. E., 1987. Pre-and post-weaning growth of different breeds of beef cattle in the Tropics. In: *Bioclimatology and the adaptation of livestock*. Ed. Johnson, H. D., World Animal Science. B5, 59-68.
- Wilson, R.T., 1982. The economic and social importance of goats and their products in the semi-arid area of north tropical Africa. Proceedings of the 3rd International conference on goat production and disease.

Winrock International, 1983. Sheep and goats in developing countries. Their present and potential rate. A World Bank technical paper. Washington D.C., U.S.A.

Workneh A., 1999. Preliminary view on aggregating biological and socio-economic functions for evaluation of goat production in subsistence agriculture with reference to smallholder mixed farms in eastern Hararghe, Ethiopia. P. 67-76. In: Proceedings of the Second annual EAGODEV 8-10 December 1998. Arusha, Tanzania.

Zelalem A. & Fletcher, I., 1993. Small ruminant productivity in the central Ethiopian mixed farming systems. In: Proceedings of the fourth National Livestock Improvement Conference, 13-15 Nov. 1991. Addis Abeba, Ethiopia.

Zinash S. & Seyoum B., 1991. Utilization of feed resources and feeding systems in the central zone of Ethiopia. In: Proceedings of the third National Livestock Improvement Conference. IAR, Addis Ababa, Ethiopia. pp.129–132.