ADDIS ABABA UNIVERSITY
FACULTY OF VETERINARY MEDICINE

EFFECT OF TRADITIONAL HUSBANDRY ON REPRODUCTIVE PERFORMANCE OF GOATS IN BENISHANGUL-GUMUZ REGION

BY

YESHAWORK BEGASHAW

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A thesis submitted to the school of Graduate studies of Addis Ababa University in partial fulfillment of the requirements of the degree of Master of Sciences in veterinary Gynecology and obstetrics.

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A study on effect of traditional husbandry on reproductive performance of goats in Benishangul-Gumuz region

BY

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LIST OF ABBREVIATIONS

ACZ…….Agro-Climatic Zone

AI…….Artificial Insemination

ARR…….Annual Reproductive Rate

BGR…….Benishangul-Gumuz Region

BSE…….Soundness Examination

CCPP……..Contagious Caprine PleuroPneumonia

CP……..Crude Protein

CSA……Central Statistic Agency

EARO…….Ethiopia Agricultural Research Organization

FAO……Food and Agriculture Organization

IAR…….Institute of Agriculture Research

KI……Kidding Interval

MoA……Ministry of Agriculture

MoARD…..Ministry of Agriculture and Rural Development

NDF…..……Neutral Detergent Fiber

PGE…….Parasite of Gastro Enteritis

PPR…….Pest de Petite Ruminant

SEA……Small East Africa

SM……..Sexual Maturity

ABSTRACT

Study was conducted from October 2007 to April 2008 in six districts of two administrative zones of the Benishangul-Gumuz region to determine the reproductive performance of goats under traditional husbandry system. Structure questionnaire and a field clinical survey studies were used on a total of 200 randomly selected households. The entire goats owned by the households were clinically examined for the presence of any health problem. Records of animal identification, parameters of reproductive performance such as weaning age and age at puberty, litter size, KI, the type of management practice and clinical parameters were taken on pre-designed format. The type of management was measured from conditions of housing (absence or presence), feeding (presence of supplementation), and health (getting veterinary service). The level of management was categorized as poor, moderate and good according to Song *et al*., (2006). Accordingly, goats were primarily (68%) kept for income generation while some (26%) keep goats for both income generation and/or meat. The common housing practice was either poor (48.5%) or inexistent (51.5%). Feeding on natural pasture with supplementation (commonly maize, sorghum or kitchen waste) constitute 29% while the remaining 71% were known to exclusively depend on grazing. The major production constraints were health problems (53%); poor genetic potential (20.43%) and shortage of feed (20.32%). Generally, goats reached puberty at 6.5±1.22 (male) and 6.7±1.22 months (female). The mean (±sd) kidding interval was 252.35±31.46 days with a mean (±sd) litter size of 1.6±0.3. Annual reproductive rate was found to be 2.2kids/year. The mean (±sd) weaning age was 4.74±0.7 months. All animals were clinically examined on the basis of the history, inspection, palpation, percussion, auscultation and information was taken from each household during the study period. Out of 461 clinically examined animals the incidence of external parasitism, internal parasitism; reproductive diseases, and infectious diseases were in the order of 80.7 %, 23.2%, 16.1% and 22.8 %, respectively. The primary goat feed resource was natural pasture and river was a main source of water. The prevailing housing is rudimentary and difficulty for management of different categories of goats. Over all management level, especially health management and feeding regime were found to be the

primary factors significantly affecting the reproductive parameters of goats. Kidding interval and weaning age were the most affected parameters by existing traditional husbandry in the study area.

Keywords: Goat/ Reproductive performance/ Traditional Husbandry

1. INTRODUCTION

Goat is the oldest domestic ruminant making an integral part of a subsistence farming systems without complex market economy in many developing countries (Payne, 1990). The scientific community has only belatedly considered the contribution of goat toward the national economy while improving traditional livestock production system and production (Devendera, 1999). Goats are highly adapted to a broad range of climatic and geographical conditions and are more widely distributed than any other mammalian livestock. They are energetic, inquisitive, versatile in the art of food gathering, which result in widely varying and opportunistic diet (Ahmed *et al.,* 2000). Goats can travel up to twice as far as cattle in search of desired forage on daily basis they have great tendency than cattle and sheep to change their diets with season and available food supply (Gilboa *et al*., 2000). Goats re managed under any imaginable production system including feral, transhumance, nomadic, extensive and total confinement systems. In arid zones goats are allowed to range freely, while in the mixed smallholder farming system of the semi-arid and sub-humid zones they are kept under more controlled conditions, particularly during the growing season to avoid crop damage (Payne, 1999). They are prolific and require low inputs for a moderate level of production, reach maturity early and are profitable to keep (Devendra and Burns, 1993).

In Ethiopia, based on their phenotypic features 14 goat types were identified (FARM-Africa, 1996). They are known to inhabit both the arid and semi-arid parts where there is erratic rainfall and the available food supply is not uniform. Goats are mainly raised for their milk, meat, fibers and skin. They play an important socioeconomic role in rural areas and women who are among the most resource poor farmers as in many parts of Africa. The estimated goat population in Ethiopia 18 million is larger than the population of sheep under pastoral and agro-pastoral production system (Workeneh and Rowlands, 2004). And goat population of Benishangul-Gumuz region is 200,470 (CSA, 2003). The number by itself may not sufficiently contribute to the economic growth of the country unless productivity is substantially improved. Improvement of productivity is fundamentally based on careful

performance evaluations of the genetic potential of the indigenous goat breeds and designing appropriate improvement of breeding methods (Jansen and Burg, 2002; Bourdon, 2000; Wiener, 1994). The indigenous goat genetic resources of Ethiopia are found scattered over different geographical location varying in agro-ecological and socio-cultural conditions. Therefore, it is necessary to characterize and identify individuals, families, groups, type and breeds of animals and the environment to which the different types or breeds are adapted (FAO, 1993). Under traditional husbandry system breeding is uncontrolled, housing is in some instances non existent, and feeding is primarily based on natural pasture, which in turn is dependent on season (Bourdon, 2000).

Management system is one of the major factors that affect the reproductive performance of goats. Inadequate management at critical times of production especially at weaning and pregnancy represents one of the major economic losses due to poor husbandry (Payne and Wilson, 1999); and harsh climate exacerbate pre- and postnatal reproductive wastage, mortality and morbidity (EARO, 2000). Neonatal mortalities are usually caused by management problems such as starvation, miss mothering and exposure to physical injury. Culling non-productive animals are not practiced and the sale of pregnant goat for meat is common. The traditional management system of keeping and grazing animals by mixing age, sex and with other species gives little opportunity for controlled mating and maintenance of improved genotype (Degefa, 1993).

The general feeding system is to graze all livestock and mixed sex group together on communal or privately owned land. In consequence, all animals are given equal opportunity and hence are subjected to equal constraints imposed by grazing poor pastures (Ranjhan, 2004). Goats have been considered, and still are by many, as having very little or even negative value in contributing to human welfare and having no role in sustainable production systems. In this regard, even though the study region is rich in goat population, so far no study has ever been conducted to determine the performance of goats under the prevailing production system. Therefore, the main objectives of this study, were

- To describe the traditional husbandry system of goat production
- To determine the reproductive performance and the effect of traditional husbandry on reproductive performance

2. LITERATURE REVIEW

2.1 Goat husbandry systems

Efficient management of goats demands that all aspects of the life cycle will get appropriate husbandry attention. Goat requires adequate care and management so that they give the highest production. The maximum offspring survival requires the combination of management, nutrition and genetic selection and improvement of reproductive performance (Martin *et al.,* 2004*).* The people who own different breeds and the geographical location influence the management of goats in the tropics to a large extent. Considering that, there exist within the tropics extremes climatic and diverse environmental conditions; it is not surprising that there is quite considerable variation in management system. For example, goats of the Shale in Africa are managed differently from those in south Asia where the emphasis is on crop production. The growth pattern is affected by season, physiological stage, and type of modifying elements in the modification strategy (Ogebe *et al*., 1995). Livestock production system in sub-Saharan can generally be divided in two major types, namely traditional and modern intensive system (Ibrahim, 1998). The traditional system is subdivided into pastoral, agro-pastorals, sedentary and urban/peri-urban.

2.1.1. Pastoral system

Pastoral systems are found in arid and semi-arid area of Africa, where low rainfall causes varying degree of nomadism among the local inhabitants. The system is characterized by a marked seasonality in feeding system in feeding supply; typically; there is only one wet season. Annual rainfall may vary from 700mm to a level as low as 200mm. Goats may be kept in large flocks, and may or may not be mixed with sheep or other species. Goats are kept for meat, milk and cash as well as fulfilling various traditional and cultural obligations. They are valued for their ability to survive periods of drought better than cattle or sheep. The pastoral system dominates the North East and eastern part of Ethiopia.

2.1.2. Transhumance or agro-pastorals

Mobility of livestock and part of the family between the grazing land and cultivated areas is the major characteristic of the system (Peacock, 1996). This system dominates in semi-arid and dry sub humid zones of the tropics. The rainfall (500 - 1000mm per year) is moderately higher allowing growing maize and sorghum, which contribute a good part (10-50%) of household's revenue (Wilson, 1989). This is the dominant goat production system found in Western Ethiopia. The indigenous people, mostly in Metekele and few woredas of Assosa, practice shifting of cultivation. The typical characteristic of the system is cultivation of irregular plots, far from the village, for one or two year and then leaving it for more than 5 years for natural vegetation to grow. Crop such as sorghum, maize, haricot, bean and oil seeds are planted. The rainfall is monomodal, usually inadequate for rain fed crops except in few marginal areas bordering Sudan (Peacock, 1996).

2.1.3. Mixed farming system (sedentary and urban/peri-urban)

The sub-humid zone lying between the humid and semi-arid zones of west, east and central Africa, are characterized by rainfall of 1000 - 1500mm per year (Peacock, 1996). Sorghum and maize are the main crops grown, with some root crops near the humid zone. Goat may be moved seasonally as in pastoral flocks, which may graze on crop residues during the dry season, returning to grazing lands during the wet season. Some of the pastoralists in this area are also referred as agro-pastoralist. Settled farmers keep smaller flocks of goats. Which are normally herded with sheep and may be allowed to roam freely during the dry season, but are tethered during the cropping season. They are normally kept within the family compound during the night (Peacock, 1996).

2.2. Management of goats in Ethiopia

In many parts of Ethiopia including Benishangul-Gumuz region there is no modern or intensive production system. Along with the camel, goats are the main livestock species kept

by nomadic pastoralists in the lowland. They are usually an integral part of the agriculture in the highland farming system playing complimentary roles with other species of livestock (Workeneh, 1992).

2.2.1. Housing

Housing of goats is influenced by the environmental effects of temperature, humidity and rainfall and the purpose for which the goats are raised (Devendera, 1982). Housing objectives are primarily to protect the health especially pregnant animals, nursing goats, and their young that are less capable of surviving unfavorable climatic conditions. Good housing makes it possible to control goats better. They can more easily be observed during phenomena such as coming on heat, mating, pregnancy and kidding and prevention of theft (Jansen and Burg, 1991). Poor housing facilities allow the build-up of pathogens and the spread of an infection (Payne & Wilson, 1999). Whether animals are housed individually or as a group is one of the considerations when thinking about housing. In general goats are stalled as a group as this is less labor intensive and cheaper for the goat keeper.

2.2.2. Feeding and watering

Under tropical conditions particularly in Africa not only feed availabilities are limited in quantity and quality but their resource also fluctuates with season. This affects the reproductive performance of goats (Gipson *et al*., 2007; Mekash, 2007; Mucuthi and Munie, 1994). Resource-limited smallholders mostly keep goats in mixed crop–livestock production systems where such a strategy helps them produce at the lowest cost. The expression of reproductive traits of domestic animals is highly influenced by nutrition (Robinson, 1996). It is thus essential to provide goats with the required nutrients to maintain their body metabolism, and beyond that, to produce and reproduce effectively. However, the fact that the dominant feed resources available for livestock in the tropics are natural grasslands and crop residues suggests limited nutritional support for fertility (Mekasha, 2007).

Goats are ruminants they can digest roughage effectively. They are essentially browsers that feed mostly on the leaves, flowers, fruits, and twigs of shrubs and other ligneous plants. They however, eat grass and herbs when there is no alternative. Goats have very eclectic tastes and select feed from a wide range plants. The ability of goat to consume lower quality forage the type and proportion of feed should be related to the functions of the goats. Young growing goat need more protein than do buck and dry does. A ration containing 12-15% protein is desirable for bucks and dry does, but 15-20% protein may be better for young goats and does that are producing milk (Taylor and Thomas, 2001). Seasonal shortage is acute in the highlands while water availability is critical in most of the pastoral areas (EARO, 2000). In arid and semi arid agro- ecological zones, there is food and water shortage. In sub-humid and humid agro-ecological zones, goats suffer from seasonal feed shortage (Rutagwenda *et al*., 1984). In mixed livestock production system of the highlands, all the feed resources available for livestock production comes from the permanent pasture and transit pasture between cropping cycles, crop residues, and rangelands, which is already over utilized (Abrams, 2000). This provides a poor food resources base to livestock. Contributions of agro-pastoral by-products and cultivated forages are not readily available at the farm level and their use is limited due to the high cost of transportation (Arthur *et al*., 1982).

The watering frequencies of goats differ from place to place in accordance with the availability and the potential of goats to stay long without watering. Goat breeds indigenous to dry area are known for their capacity to withstand prolonged periods of water deprivation and they can graze far away from watering sites. Reports from Silanickove (2000) and Nigatu, (1994) indicate that watering frequency of in lowland goats reaches 82%.

2.2.3. Health management

Mortality due to microbial and parasitic diseases, influence negatively the development of goat production. The incidence of diseases also becomes highly serious where a low level of nutrition causes reduced resistance. Viral and parasitic diseases are widely distributed and generally constitute the major causes of livestock morbidity and mortality and sub-optimal productivity in all agro-ecological zones (EARO, 2000; Ademosun, 1988). Goat production under traditional system is faced with different health problems, which have impact directly or indirectly on the productivity. The common bacterial diseases such as CCPP, *Caseous lymphadenitis*, Viral diseases such as PPR, External parasites such as mange and ticks, helminths and other internal parasites like *Coccidiosis*, and reproductive diseases like abortion, metritis, prenatal mortality, and mastitis (Merma and Rannobe, 1994). Health problems are exacerbated by poor animal health services, high cost of drugs, and unimproved traditional management (Payne and Wilson, 1999).

2.3. Reproduction and reproductive performance

2.3.1. Performance Parameters

Knowledge of the reproductive performance of goats in the dry tropics is vital for improved breeding program. Doubtless, fluctuation of the environmental conditions will be an important cause of variation in breeding efficiency (Martin *et al*., 2004; Garcia and Gall, 1981). The level of reproductive performance depends on the interaction between genetic and environmental factors, but is particularly susceptible to the influence of husbandry. Under condition of heat stress reproductive performance is likely to be depressed, leading to the low fertility, late sexual maturity, long kidding intervals, etc (Devendera, 1999).

Although goats are seasonal breeders in higher latitude, they breed throughout the year in tropical environments (Peacock, 1996). In such systems, both fertile and infertile male and female goats are kept together in the same grazing/browsing field. This negatively influences flock fertility, be it in a single or multi-herd system. Besides, in a country like Ethiopia, which has several goat breeds, such management systems might increase the risk of unwanted crossbreeding, and losses of purebred genotypes. In places where limited controlled natural mating is practiced, selection of the bucks is usually based on phenotypic measures, without paying attention to basic andrological examinations. Parameters of reproductive performance in goats include age at sexual maturity, age at first kidding, kidding interval and litter size and annual reproduction rate (Hassan *et al*., 2007 and Payne et al., 1999).

2.3.2. Puberty and sexual maturity

Puberty in goats, as in other livestock, is the period when animals become sexual mature. Survivability of tropical goats has generally attained prominence at the expense of reproductive features in low-input production systems. The time taken for male goats to reach puberty varies based on genotype, nutrition, season, and other environmental factors (Abi-Saab *et al.*, 1997). In goats, sexual maturity is reached quite early around 5-7 month of ages but mating is often delayed to ensure that the doe is able to accommodate the foetus (Payne, 1990; Devendera, 1982). They are generally ready to breed at the age of 8 - 12 months for bucks and 8 - 16 months to doe. As a rule, goats are first served when they reach about ¾ of the adult weight (Peacock, 1996).

2.3.3. Kidding interval

Kidding interval (KI) is the period between two consecutive kidding and is composed of the service period (from kidding to conception) and the gestation period. Gestation length in goats has been found to be constant around 146 days (Devendera and Burns 1993; Wilson, 1989) other reports range from 144-145 days (Taylor and Thomas, 2001). The service period is the

most important determinant of kidding interval and one of the major components of reproductive performance, which is affected by the breed, season, year of parturition, parity and postpartum weight of the dam (Mandonneta et al., 2005; Devendera and Burns 1993). Management practice and restriction on breeding also elongate the interval between Kidding. Meat breeds commonly have short kidding interval than milk breeds presumably because of the influence of lactation. Under traditional systems, kidding interval for most small east African goats (SEA) ranges from 238-265 days (Alemayehu, 2003). This interval is slightly shorter compared to those obtained from previous studies in West Africa for West African Dwarf goats and with other types of goats in other parts of Africa (Song *et al*.,2006 and Odubote, 1996).

2.3.4. Litter size

The number of kids born or litter size (LS) per doe is influenced by ovulation rate, which is again affected by breed, and level of nutrition. Season and age related factors such as parity are also important (Nigatu, 1994). Twining in goats is common and there is good deal of evidences that prolificacy increase with age. According to Song *et al*.,(2006); Silva *et al*., (1998) average litter size for Alpine goats and Korean native goats are in the order of 1.69+ 0.5 and 1.69±0.03, respectively. Fertility in goats appears to be higher at about 5- 6 years of age. According to FARM- Africa, (1996) western lowland and Keffa goat in Ethiopia are known for their prolificacy trait with an average number of kids born per breeding females of 3.5 and 3.1 respectively.

2.3.5. Annual reproductive rate

The annual reproductive rate (ARR) is a composite parameter, which does not appear to be utilized as much as it should be (Wilson, 1989). The total number of young per breeding female per year has been calculated as the size of the litter and the number of days in a year divided by the kidding interval, which are (litter size x 365/ kidding interval). The impact of

reproduction in goat productivity is best estimated by the annual reproductive rate (ARR), (ARR) have been reported to be 1 kid per doe according to (Seabo *et al.*, 1994) and 2.3 kids/doe (Odeoye, 1995).

3. SOCIO–ECONOMIC ROLE OF GOATS

Goats are multi-purpose animals exploited for milk and meat production in Ethiopia, and skin for leather industry (Awgichew, 1985). Each year 37% of the total goats are presented for slaughter and contribute about 15% of national meat consumption (MoARD, 2002).

Goats provide families on small farms with an alternative ways of obtaining milk and income generation in places where the average land holding is declining. Goats are economically important in developing countries, by ensuring food and fiber supply and providing income to small households (Sahlu and Goetsch, 2005; Lebbie, 2004; Sahlu *et al.*, 2004). Often as the only animal protein source, goat meat and milk help ensure infant development and sustain human health in some parts of the world. Owing to increased demand for goat products, more livestock producers are raising goats in developing countries, including Ethiopia (Sahlu and Goetsch, 2005).

Goat production helps meet local meat demands, keeps hard currency from being spent on importing meat, and increases hard currency reserves through exports of goat meat and skins. Goat production provides employment for poor rural families, especially for women and children (Lebbie, 2004). Goats can also serve as a store of value and a security system. They can be sold to attain immediate cash assets for poor goat holders, helping them improve livestock and crop farming and financing social events (Morand-Fehr *et al*., 2004). Annual milk production derived from goats is about 100, 000 metric tone (FAO, 1993). This figure makes goats the second milk producer in Ethiopia next to cattle. It is evident in the southern and agricultural highlands of Ethiopia; the milking goat has proved to be good source of milk under circumstance of shrinkage of grazing land (Workeneh and Rowlands, 2004).

Especially during droughts when crops fail, goats, due to their adaptation capabilities, survive on woody browses and infrequent watering; coupled with their high reproductive rate and short generation interval, goats enable their owners to recover quickly and economically (Lebbie, 2004; Morand-Fehr *et al.*, 2004; Peacock, 1996). The value of goats for the use of the vast areas of natural grasslands, regions where crop production is yet impracticable,

should not be overlooked (Lebbie, 2004). Goats are also important in various cultural activities, especially in pastoral and agro–pastoral production systems.

4. CONSTRAINTS OF GOAT PRODUCTION

Small ruminant breeds are the results of many generations of natural selection dominantly for survival under the prevailing fluctuating feed resource, disease challenges, low level of management, harsh climate rather than high levels of production as the main target (Kosgey, 2004; Payne and Wilson, 1999). The traditional small ruminant production system is based on almost a zero input. Alongside, complimentary to each other, the crop and livestock sub-sectors may compete for scarce farm resources, which can be more apparent with livestock production. Goats are kept in different systems of production in the tropics. Different ways of feeding, breeding, and usage of goats have evolved in response to factors such as climate, need of the owners, economic environment, level of technology available, within each system of production. Goat keepers have developed their own method of looking after goats according to their particular circumstances (Peacock, 1996).

Major problems found in pastoral goat flocks in Africa are high mortality of kids before weaning, typically as high as 30%, or higher in periods of drought, long parturition intervals reaching two years, occasional epidemic diseases, such as contagious pleuropneumonia (CCPP), causing mortality rates of up to 100%. Factors contributing to problems include a marked seasonality in the quantity and quality of forage consumed. During the dry season, low protein levels and high fiber content limit production and may cause weight loss and low milk production. Goats are able to take advantages of pre-rains flush of growth in browse species, which often occurs. There may be occasional mineral deficiencies while infrequent watering may further reduce milk production. Occasional epidemic diseases, particularly contagious pleuropneumonia (CCPP), may have devastating consequence. Internal and external parasites, particularly tick, may transmit disease such as heart water. Mange also may

cause high mortality and morbidity. Having many kids born at the same time can cause kid management problems.

Common constraints of goat in sub-humid zones are high pre-weaning mortality rate and adult mortality from PPR near the humid zone (Ibrahim, 1998; Peacock, 1996) factors contributing to the problems seasonal fluctuations in feed supply limit the production and reproductive performance of goats, increasing human population is placing a strain on feed resources and internal parasites also in the areas high stock number are markedly big problem.

Potential productivity of goat is constrained by poor understanding of the many values of goats and of strategies for improved natural resource management in target environments. False perceptions (environmental degradation, biases, inadequate official support and resources use) are the major beliefs of people to rule against goat production. Until recently, in Southern Africa there has been an official bias against the goat as destroyer of vegetation. Because of this prejudice, an effort to exploit the full potential of this animal has been generally minimal compared to efforts in sheep and cattle (Ademosun, 1988). Theft, predation, and poor hygiene in ascending order appear to be the most important problem limiting goat production (ILRI, 2000).

Ethiopia has diverse goat genetic resources, which have not, however, been characterized in terms of functional traits. Moreover, selection for reproductive traits has not been performed, hampering breed improvement. The prevalence of diverse agro–ecologies each with distinct physico–geographic and climatic characteristics poses another challenge to efficient reproduction. The best lambs/bucks are often sold at an earlier age before maturity or castrated and sold for their meat without considering their use as future breeding stock (Devendera, 1993). The uncontrolled mating results in lambing/kidding throughout the year, therefore, gives a chance for lambing/kidding to occur in undesirable seasons and for indiscriminate mating. It also creates problems in the application of improved management system at critical reproductive stage or matching the best pasture- growing season with the nutrient requirement (Elhag *et al*., 2002).

5. MATERIALS AND METHODS

5.1. Study area

The study was conducted in Benishangul-Gumuz region (BGR) (Figure 1.). The region is located at 687 km west of Addis Ababa. It has three administrative zones, 20 districts (woredas) and one special woreda (CSA, 2005). The region has boundaries in Northeast with Amhara region, Southeast with Oromiya region and Sudan in the west. It is located between geographical coordinates of 90 30' N to 110 39'N Latitude and 340 20'E to 360 30'E longitude. The altitude ranges between 600-2731 m.a.s.l. The region is generally characterized by semi-arid and sub humid climate. The rainfall is monomodal occurring for 6-7 months, between May and October. The average annual precipitation is 1000 mm. The mean minimum and maximum temperatures are 17^0C and 32^0C, respectively (Anon, 1997). The agro-climatic zones (ACZ) of the region are classified as low land (Kola, 74%), Midland (Woyenadega, 25%) and (Dega, 1%) highland (CSA, 2005).

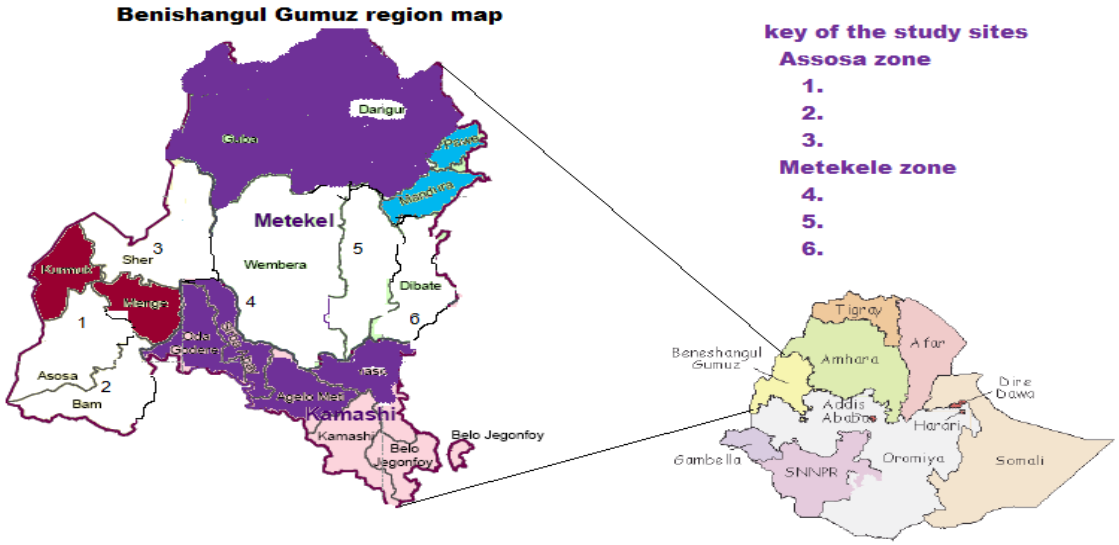


Figure 1. Map of the study area; (Source: UN-OCHA Ethiopia-IMU, 2005.)

5.2. Study animals

Small ruminants specifically of goats reared in the two zones of the region were targeted. The goat breeds have been characterized as small East African (SEA) known for their relative significance of surviving in harsh environments (FARM-Africa, 1996). The predominant production system along the region is mixed farming system and few marginal part of across the Sudan border the prevailing production system is pastoralist. The existing livestock or specially goat management is traditional system, not practiced any intensive or semi intensive farming system in the study area. In the region not has been practiced any of vaccination regimes, only control vaccination is the most practiced when occurring outbreak in certain area of the region. And also not has been practiced any kind of mass deworming.

5.3. Study design

The sample size for this study was determined using the formula described in Thrusfield, (2005) as follows:

$$\frac{N = 1.96^2 \times Pex\ (1 - Pexp)}{d^2}$$

Where: N = required sample size, P = expected prevalence based on previous preliminary surveys; d = desired absolute precision (5%), 1.96 to indicate 95% confidence level. Based on the above formula our sample size for households therefore, 10% of the households from each districts and 200 households considering 15% based the previous prevalence of (Maru, 2002).

5.3.1. Questionnaire survey

A total of 200 households were randomly selected from six districts of the two zones. Households in each peasant association were first randomly selected and identified. A pre-tested structured questionnaire (Appendixi-1) was used to interview goat breeders on different production and reproduction parameters. The production parameters included housing,

feeding, breeding and health management variables while information on age at puberty, kidding interval, kidding rate etc were collected to determine reproductive performance.

5.3.2. Field clinical survey

Goats owned by households previously identified for questionnaire survey were monitored during the study period through follow up study. All animals were clinically examined on the basis of the history, inspection, palpation, percussion and auscultation information was taken from each household and animal during the study period for the presence of any health problem. Records of animal identification, parameters of reproductive performance such as weaning age and age at puberty, litter size, KI, and the type of management practice were taken. The type of management was measured from conditions of housing (absence or presence), feeding (presence of supplementation), and health (getting service or not and sick or healthy). The level of management was categorized according to Song *et al*., (2006) as good owners provide proper supplementation for their goats, housed their goats and received regular veterinary services. Moderate when owners practiced two of the three management practice and poor when the owners did not practice any of the three. Litter size (head) was calculated from the number of kids born to each doe at each birth while KI was defined as the number of days between two successive kidding. The annual kidding rate was calculated as a ratio of the number of doe of reproductive age to the number that are kidding per year.

5.4. Data analysis

All data were entered in Microsoft excel work sheet and analyzed using statistical package, SPSS 15.0 for windows 2006 version. Descriptive statistics was applied to describe the questionnaire and field clinical survey data. ANOVA was applied to study the effect of management system on reproductive performance taking level of management and district as a fixed independent factor in the model. The prevalence of diseases was determined using

descriptive statistics. (Degefa, 1993) P value of <0.05was used to determine the level of significance in statistical differences.

6. RESULT

6.1. Questionnaire survey

The most prevailing traditional system of goat husbandry in the study area was found to be the mixed farming. Households usually keep one or more types of livestock and have a small plot of land for cropping cereals. Accordingly, a household in the study area consist of a mean number of 3 cattle, 6.6 goats (3 does, 1.5 bucks and 2.1 kids), and 0.5 sheep and 1 ha of land. Goats generally make the largest proportion of the whole of domestic ruminants. Of all the households, 64% had a large goat herd size (>5), while the remaining 37% had small flock size. Goats are primarily (68%) kept as a source of income, while 6% goats are kept as a source of meat and 26% as a source of the combination of the previous (appendix-2).

6.1.1. Feeding and watering

The major feed resource in the study area was grazing natural pasture at communal grazing where different livestock graze together. Only 45% of goat breeders do provide supplementation that constitute grain, kitchen waste or mill byproducts (Figure-2). In addition, many farmers also provide tilled crop residue from crop field and such feed was known to make a significant contribution to goats feed. Availability of feed is known to be seasonal in all study sites often increasing with increasing level of precipitation. Water in all cases, was abundant and accessed for all breeders with no seasonal limitation.

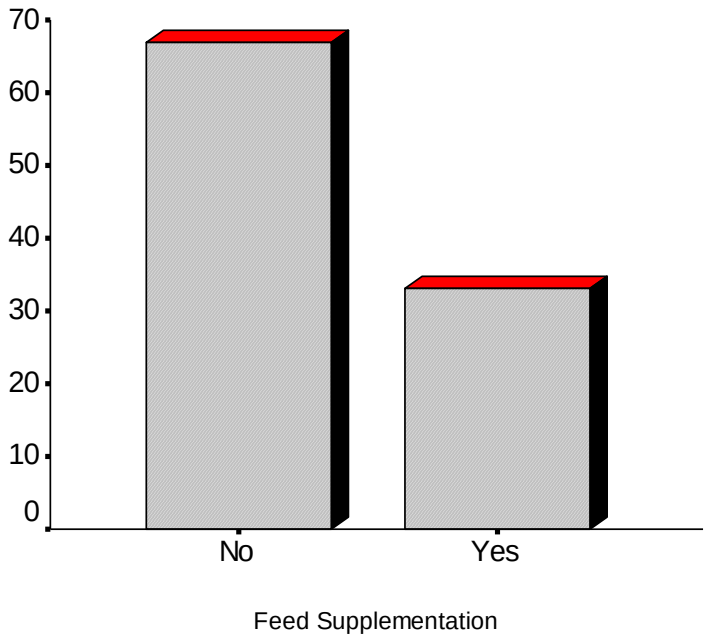


Figure.2. Feeding system based on feed supplementation

6.1.2. Housing practices

Out of the 200 households, only 48.5% of goat breeders in the study area house their goats properly; the remaining 51.5% keep their goats in an open-air fence near the house. Young animals were always kept around the homestead until weaning usually to avoid walking long distances in search of feed and water and to minimize exposure to predators. The major reason for housing during the night has been to minimize attack by predators and to avoid robbery. Predators rarely destroy barns and open air fences to causes a complete loss of the flocks.

6.1.3. Goat health management

About 47% of respondents did not receive any form of veterinary service while 53% received veterinary service from vet clinics at the ministry of agriculture. Overall, 85% the households reported the presence of one or more types of diseases affecting their goats. Both external and internal parasitism (80.7% and 23.2%, respectively) caused by different species of parasites and infectious diseases caused mainly by mycoplasms and viruses were known to be the major causes of morbidity and mortality in goats of all ages.

6.1.4. Reproductive performance under different levels of management

The mean (±SD) weaning age and the mean age at puberty were in the order of 4.74±0.68 months, and 6.53±1.22 and 6.61± 1.23 months for male and female, respectively. The overall annual reproductive rate (ARR) was 2.2 kids per doe. The reproductive performance of goats under the current traditional system of husbandry in the study area is summarized in (table 1.)

Table 1.Overall reproductive performance of goats in the study area (N=200)

Reproductive performance parameters	Mean	SD	Min	Max
Goat herd size	5.19	1.89	1	9
Age at Puberty, Male [Month]	6.53	1.22	5	10
Age at Puberty, Female [Month]	6.61	1.23	5	9
Kidding Interval [Days]	252.35	31.46	185	315
Litter Size	1.53	0.28	1.2	3
Weaning Age [Month]	4.74	0.68	3	6

Puberty in the female is usually recognized by the presence of frequent bleating, vaginal discharge, restlessness, and courting of others. Heat in the doe included constant bleating, vaginal discharge, and restlessness, frequent tail twitching, and riding of others and standing to be mounted. Goat breeders usually assess the reproductive performance or fertility of the

goats by observation of the condition of the genital organs, libido, the number of kids born to the doe and body condition. Males are usually selected based on their body size, size of testicle and strength of their libido. Animals found to be poor in their reproductive performance will end up in market for sale. Pregnant animals receive no special care except rare cases of separate housing.

6.1.5. Major goat production constraints

Out of the 200 households interviewed, 53% responded disease of different forms to be the major goat production constraint in the study area. Of all the health problems, external and internal parasitism, orf, respiratory diseases, and foot rot are among the high ranking in the same order. Summary of the remaining high-ranking production constraint are indicated in (table-2). Many of the farmers browsing and tethering their goat in communal rangelands; the study area has a six-month dry season and only a six-month rainy season. Grazing is extremely scarce during the dry season causing many animals to grow far slower and eat such materials that have little nutritional value.

Table 2. Major goat production constraints as indicated by goat producers (N=200)

Production Constraints	Frequency	Proportion [%]
Disease	106	53
Poor genetic potential	41	20.5
Feed and water	23	11.5
Livestock development	17	8.5
Market constraint	13	6.5

6.2. Clinical field survey

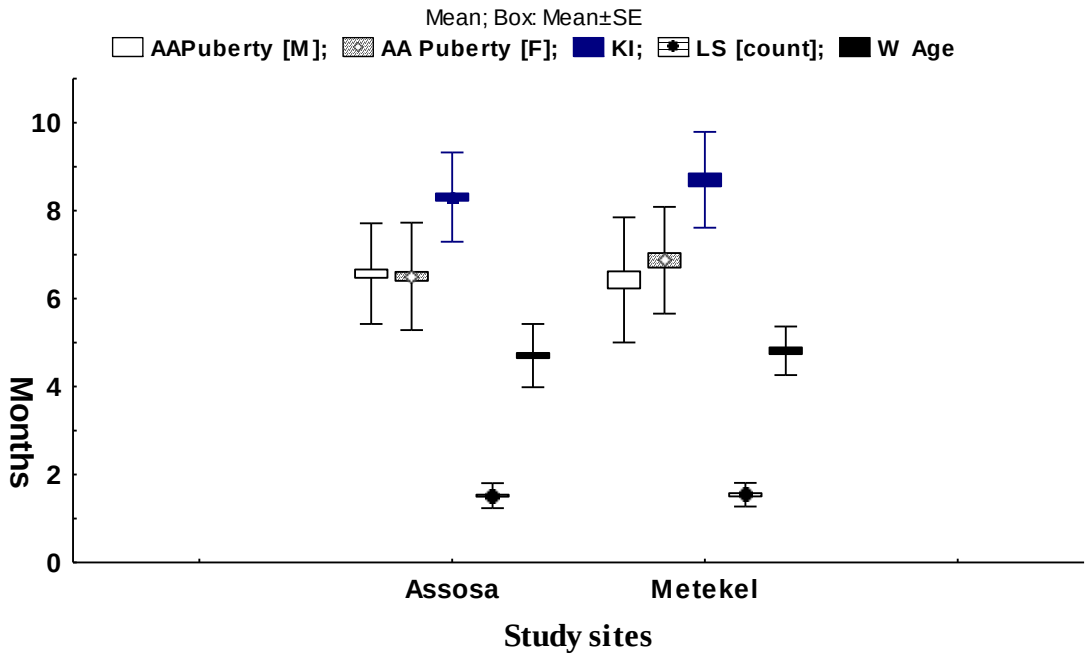
All animals of reproductive age were clinically examined and their owners were interviewed. Out of 461 animals clinically examined, 59 and 41% of the animals were positive for one or more types of diseases in Assosa and Metekel, respectively. External parasitism generally constitutes the highest prevalence in both study sites (Table 3).

Table 3. Summary of the prevalence of diseases affecting goats in the study areas (N=461)

Type of the disease problem	Frequency	Proportion [%]
External parasitism	372	80.7
Internal parasitism	107	23.2
Infectious diseases	105	22.8
Reproductive diseases	74	16.1

6.3. Effect of management on reproductive performance

Descriptive statistical results of the reproductive performances of goats are summarized for the two study sites in (figure. 3). Only limited differences were noted in some aspects of reproductive parameters. Comparison of reproductive performances between the two sites to study the influence of geographical location did show no significant difference between the study sites.



Figur**e** 3. Reproductive performance of goats in the two study sites (N=200)

The level of management varied for different households and also study site (Table 4). KI and weaning age were statistically significant ($p<0.05$) among the different level of management.

Table 4. Distribution of the reproductive performance of goats among the different level management (N=200)

Reproductive performance	Level of Management	N	Mean	SD
Age at Puberty Male [Month]	Good	16	6.69	1.20
	Moderate	66	6.47	1.14
	Poor	118	6.54	1.28
Age at Puberty Female [Month]	Good	16	6.56	1.15
	Moderate	66	6.56	1.37
	Poor	118	6.64	1.16
Kidding Interval [Days]	Good	16	234.38	27.32
	Moderate	66	250.91	35.68
	Poor	118	255.59	28.71
Litter Size	Good	16	1.52	0.28
	Moderate	66	1.52	0.31
	Poor	118	1.53	0.26
Weaning Age [Month]	Good	16	4.75	0.77
	Moderate	66	4.83	0.74
	Poor	68	4.63	118

KI was relatively shorter in animals under good management, while animals under poor management weaned earlier than those under moderate or good management systems (Figure 4). The rest of the reproductive parameters were not statistically significant ($p>0.0.5$) among the different levels of management in the study area.

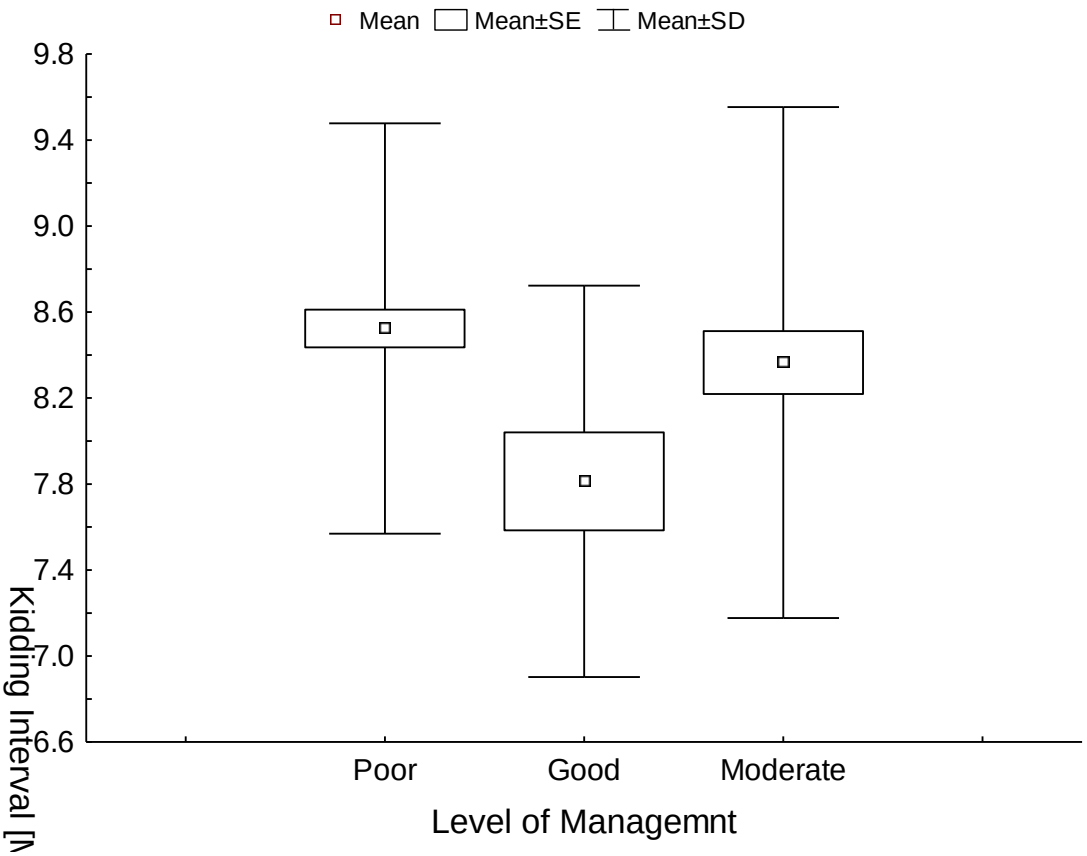


Figure 4. Distribution of kidding interval among the different level of management

The mean KI was statistically significant ($p<0.05$) at different level of management. But even though the mean KI was longer in poor management level but, the mean KI for good management level is shorter when compared with poor and moderate management level (figure-3).

The individual influences of different components of management such as feeding (presence or absence of supplementation), housing, and health management (receiving veterinary service or not) on the reproductive performances of goats were compared under their respective category (Table 5, 6 and 7).

Table 5. The reproductive performance of study goats under two feeding systems

	Supplementation	N	Mean	SD	X^2	P
Age at Puberty Male [Month]	No	134	6.53	1.29	4.98	.418
	Yes	66	6.53	1.08		
Age at Puberty Female [Month]	No	134	6.63	1.24	1.83	.766
	Yes	66	6.55	1.20		
Kidding Interval [Days]	No	134	263.10	26.39	88.93	.000
	Yes	66	230.53	29.72		
Litter Size	No	134	1.53	0.29	2.48	.981
	Yes	66	1.51	0.26		
Weaning Age [Month]	No	134	4.81	0.62	14.57	.009
	Yes	66	4.59	0.76		

Table 6. Distribution of the reproductive performance of goats between animals housed and those not (N=200)

	Housed	Mean	SD	N
Age at Puberty Male [Month]	No	6.55	1.30	103
	Yes	6.51	1.14	97
Age at Puberty Female [Month]	No	6.60	1.18	103
	Yes	6.61	1.28	97
Kidding Interval [Days]	No	254.03	31.81	103
	Yes	250.57	31.15	97
Litter Size	No	1.52	0.27	103
	Yes	1.53	0.29	97
Weaning Age [Month]	No	4.68	0.68	103
	Yes	4.79	0.68	97

Table 7. Distribution of the reproductive performance of goats between animals that received veterinary service and those did not (N=461)

	Vet. Service	N	Mean	SD	X^2	P
Age at Puberty Male [Month]	No	94	6.47	1.06	6.46	.264
	Yes	106	6.58	1.35		
Age at Puberty Female [Month]	No	94	6.59	1.16	2.61	.626
	Yes	106	6.62	1.29		
Kidding Interval [Days]	No	94	247.13	31.22	8.49	.027
	Yes	106	256.98	31.08		
Litter Size	No	94	1.52	0.26	3.38	.947
	Yes	106	1.53	0.30		
Weaning Age [Month]	No	94	4.63	0.71	9.23	.035
	Yes	106	4.83	0.64		

NB: Vet. =Veterinary, p=p value

There was a significant difference (X^2 = $p<0.05$) in the mean KI and weaning age between animals supplemented and those that were not. No statistical difference was found in the rest of the reproductive performance parameters for differences in supplementation. On the other hand, there was no statistically significant difference in the reproductive performance of goats under the current housing system. Comparison of the reproductive performance between owners receiving veterinary services and those that are not getting veterinary services revealed the presence of significantly difference (X^2= $p<0.05$) in the mean age of weaning and KI.

7. DISCUSSIONS

The major goat feed from natural pasture, browse and bushes, fodder plants are available naturally an in Ethiopia (Berhanu *et al.*, 2002; Markos, 2000; Adugna *et al.*, 2000) reported that natural pasture makes major contribution in livestock feeds. But (Mekasha, 2007) reported under tropical condition particularly in Africa feed resource availabilities fluctuates with the season , strongly affecting the efficiency of reproduction, however, in the present study the results disagree with the previous report with no significant difference between grazing in natural pasture and with supplement groups in the reproductive performance of goats. This can attribute doe to availability of sufficient natural pasture for their reproductive. A marked seasonal variation in the quantity and quality of feed supply and the acute problem of feed supply during dry season found in this study is in agreement to Adugna *et al.*, (2000); (ILRI, 2000).

In the present study between the mean of housed goat and not housed goats did not have any significant difference on the reproductive performance. Housing of flocks in the barn is more similar as reported by (Berhanu, 2002; Markos, 2000; FARM-Africa, 1996 and Nigatu, 1994).

Goat owners rated parasitic diseases as the main cause of mortality and these were reported as the most prevalent flock health threats across all the sites. The results in this study are in good agreement with previous reports by Markos, (2000) for goats in Benshangule-Gumuz region. According to Tembely (1998) infectious diseases cause considerable morbidity and mortality in goats under traditional husbandry system of Debre Berhan area. Similarly, reported by the same author that parasitic diseases (gastrointestinal nematodes) and infectious diseases (*PPR*, *CCPP* and foot rot) are major causes of morbidity and mortality of goats in Ethiopia. The prevalence of the disease among the study sites was similar. This is probably because of conditions allowing transmission of diseases due to the common watering points (river and) which might have contributed to the spread of infectious. Sick animals are normally deficient in many ways to perform compared to healthy ones. In this regard, morbidity can have a direct negative consequence on the reproductive performance.

The reproductive performance such as kidding interval (days), litter size, age at puberty, annual reproductive rate and weaning age attributes are important indicators of the reproductive potential of goats because of their close association with fertility (Peacock,1996) and (Mekash, 2007).

The result of the current study is higher than previous reports by Payne and Wilson (1999) who indicated KI to be 210-230 days in West African goats under traditional production systems. Another report by Alemayehu, (2003) reveals for most small east Africa goats (SEA) the KI range to vary from 238 to 265 days. This interval is slightly shorter compared to those obtained from previous studies in West Africa for West African Dwarf goats and with other types of goats in other parts of Africa (Wilson, 1981) .The kidding interval of 250 days is similar to that found for West African. In animals whose breeding is not controlled and where goats mate at the first opportunity, KI is primarily affected by intrinsic factor rather than failure of proper breeding management. The present finding confirms the influence of the poor nutritional condition.

Litter size averages for Alpine goats are 1.69+ 0.5 according to (Silva *et al*., 1998). Other research information revealed (Song *et al*., 2006) the mean litter sizes wear 1.69±0.03 and 1.78±0.16 at birth for Korean native goats. In contrast to these two reports and the finding of Payne *et al*., (1999) and Seabo et al., (1994) where the annual kidding rate was 1.46 kids, the present study indicates a smaller litter size value. Almost similar findings (2.3 kids/doe) have been reported by Odeoye (1995). According to Joe *et al*., (2004), the weaning age of goats is 5-7 and 3-5 months for female and this was male, respectively. Tesfaye *et al.,* (2000) reported weaning age of 3.18 month for Boran Somali and 3.3 month for Mid Rif Valley goats, a finding which is similar to the present study. Payne and Wilson (1999) reported tropical male goats reach sexual maturity at 4.12 months. These two reports showed slightly lower interval compared with the present result. Litter size, weaning age and kidding rate are all affected by

level of nutrition and breed. In this regard, nutrition seems to be the most important factor to directly influence these parameters in this particular study.

The respondents reported that health problem was a leading constraint including parasites, infectious, reproductive disease followed by feeding and marketing constraints this is in agreement with previous reports such as Merma and Rannobe (1994) and Ademosun (1988). The effect of diseases on productive and reproductive performances of the flocks is also apparently higher. Limited capacity and coverage of the existing veterinary service to serve the vast geographical area and large livestock population in the study sites further worsen the influence of diseases.

KI and weaning age was affected significantly by the overall management practice prevailing in the study area. The present study is in agreement with the result reported by Mandonneta *et al*., (2005) and Devendera, (1993). The rest of the parameters were not affected by the management practice which varies from previous authors. Though herd size is known to be highly correlated with resource, in this particular instance since animals were all dependent on an already compromised natural pasture the effect was uniformly minimal for all cases of herd size category.

8. CONCLUSIONS AND RECOMMENDATIONS

The reproductive performance of goats in this particular study area is found to be moderately good. The primary goat feeds resource was found to be the natural pasture at communal grazing places. Feed availability was known to largely depend on the season of the year. River was a common source of water. The prevailing housing system in the study area is generally rudimentary and they are not divided to allow different category of goats in order to manage easily and keep their hygiene properly. Generally reproductive performance of goats was affected by the level of management. Particularly, the feeding system, and health management are the major factors that are significantly associated with the reproductive performances. Kidding interval and weaning age were among the performance parameters the most affected by traditional husbandry. Based on the above conclusion the following recommendations are given:

- Improvement of the prevailing management system needs to focus further to be helpful the reproductive performance of the indigenous goats.

- Optimum utilization of the seasonally available feeds through preservation of crop residues and agricultural byproducts. Strategic supplementation with low cost farm byproducts and household wastes is vital to balance the seasonal lack of feed supply and nutritional requirements.

- Improvement of veterinary services through extension would help alleviate the influence of the prevalent diseases and increases the reproductive performance.

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11. APPENDIX

Appendix 1. Questionnaire survey format

I. General socio-economic characteristics

Address: _____Owners Name:_____, Family status_____

Name of the village or PA's_____ Age:_____, Sex:_____

1. Domestic livestock holding:

Animal	Female	Male	Young	Total
Cattle				
Sheep				
Goat				
Equine				
Others				

2. What is your major source of your income?

a) Sal of milk or meat, hid b) Sal of live animal

c) Crop cultivation d) Others

3. Why do you want to breed goats?

1) For meat 2) For income 3) for milk 4) For other uses (specify)

II. Goat management system

4. Which feed system do you practice?

1. Only grazing at a communal grazing site
2. Grazing pasture and supplementation during (specify when)

3. Other_____

5. What is the most common supplement given to your goat_____what is the average amount given for_____

- Kids_____
- Bucks_____
- Pregnant goats_____

6. What is the major source of water for your goats? How often do you water? _____.

7. How are your goats housed?

a) In stable yard near the house
b) In barn
c) In open air near the house
d) Other

8. What is the major production constraint you have? (Rank them in the order of importance)

1) Lack of livestock development services_____
2) Diseases_____
3) Feed and water_____
4) Poor genetic potential of camels_____
5) Others_____

9. What are the major goat diseases in your area?

No	Type of disease and major signs	Local name	Treatment Options
1			
2			
3			
4			

10. Is there any seasonal pattern to the major health problems? If yes which season?

III. Reproductive performance

11. At what age does your goat reach puberty? Female:_____, Male:_____

12. How do you recognize puberty (what are the signs)? _____,_____,_____

_____,_____,_____

13. How does your goat give birth in a year and what is the kidding interval?_____,_____.

14. What are the signs of sexual interest/ heat in goats?

	Male	Female
a)	_____	_____
b)	_____	_____
c)	_____	_____

15. How do you assess fertility of the

Female_____

Male:_____

16. What special care do you give to pregnant goat and kid? _____

17. What is the average kidding interval and fecundity (litter size) of your goat?

18. What is the age of weaning? _____

19. How do you Handle goats with reproductive problems?

1) 1) Keep them 2) sell them
2) 3) Treat them 3) others

20. In which season breed your goats?

1) 1. Winter 2. Spring
2) 3. Summer 4. Autumn

21. Which breed of goat do you want? What are you r specific criteria for selecting?

- Male:_____
_____
- Female:_____
_____

12. CURRICULUM VITA (CV)

Personal data:

Name: Yeshawork Begashaw Dessie (Dr)

Date of birth: 18/Jan/1970

Nationality: Ethiopian

Address: P.O. Box; 242, phone: +251911065353 or +251913336045

Educational Background:

- 1988-1991 I studied at senior high school Mengistu H/ mariam.
- 1999-1997at ISCAH (higher institute of agriculture science of Havana

Research: Prevalence of E. coli in piglets in Nasareno Pig state Ranch

1997 I have been awarded DVM.

Additional training: I have been certified in computer Application: in Word, Excel 97, Access 97 with excellent results.

Working experiences:

I had been worked as field physician in Amhara region North Gondar zone, in Quara woreda since 1992 Ec up to 1995 for three years and two months. Since October 01/1996 up to date, I am working in Assosa Agricultural technical and vocational and educational Training College (TVET) as senior instructor.

Language: Fluent Amharic, English, and Spanish.

13. SIGNED DECLARATION SHEET

Signed declaration sheet I the under signed, declare that thesis is my original work and never has been presented for a MSc. Degree in any university

Name: Yeshawork Begashaw Dessie

Date of submission, this thesis has been submitted for examination with our approval as university advisors.

Dr._____:_____

Dr._____:_____