



T.R.
NIĞDE ÖMER HALİSDEMİR UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
DEPARTMENT OF ANIMAL PRODUCTION AND TECHNOLOGIES

COMPARISON OF SOME REPRODUCTIVE CHARACTERISTICS OF
AKKARAMAN AND BAFRA SHEEP AND GROWTH PERFORMANCE OF
LAMBS IN NIĞDE.

IBRAHİM AHMAD GARKO

SEPTEMBER 2022

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Master Thesis

Supervisor

Professor. Dr. Ayhan CEYHAN

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The study titled “**Comparison of some reproductive characteristics of Akkaraman and Bafra sheep and growth performance of the lambs in Niğde**” and presented by Ibrahim Ahmad GARKO under the supervision of Professor Dr. Ayhan CEYHAN, has been recognized as Master thesis by the jury at the Department of Animal Production and Technologies of Niğde Ömer Halisdemir University, Graduate School of Natural and Applied Sciences.

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It is certified that I have written this thesis by myself with the immense help and guidance from my supervisor. I further confirm that all information included in this thesis is scientific and is in accordance with the university rules and regulations. Any materials that I have used from external sources as well as help received and all sources used in finalizing this research work and preparing this thesis, all have been acknowledged in the thesis.



Ibrahim Ahmad GARKO

SUMMARY

COMPARISON OF SOME REPRODUCTIVE CHARACTERISTICS OF AKKARAMAN AND BAFRA SHEEP AND GROWTH PERFORMANCE OF LAMBS IN NİĞDE

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This study was aimed to evaluate the reproductive characteristics and growth performance of 102 heads of local Akkaraman ewes and 60 heads of crossbred (Chios x Karayaka B₁) Bafra genotype. Akkaraman and Bafra ewes were found as lambing rates 85.29% and 66.67% ($P<0.01$), litter size 1.31 and 1.75 lambs ($P<0.01$), total body weight at 90 days (weaning age) of lambs 46.65 kg and 45.52 kg ($P>0.05$) and survival rate at weaning age 99.1% and 91.4% ($P<0.05$), respectively. Average birth weight, live weights at 30, 60 and 90 days of Akkaraman vs Bafra lambs were 4.98; 3.72 kg, 8.09; 7.88 kg, 25.12; 19.52 kg and 35.00; 24.14 kg, respectively, in which genotype was significant ($P<0.05$) in the birth, 60 and 90 days live weight but was not statistically significant ($P>0.05$) in the 30 days live weight. The differences in body height, body length, cannon circumference, chest circumference, chest depth, ear length, ear width, rump height, rump circumference measurements were found statistically significant in Akkaraman and Bafra lambs at 30, 60 and 90 days.

Keywords: Akkaraman, Bafra, survival rate, litter size, body measurement, live weight

ÖZET

BAFRA VE AKKARAMAN KOYUNLARININ BAZI ÜREME ÖZELLİKLERİ İLE KUZULARIN BÜYÜME PERFORMANSLARININ KARŞILAŞTIRILMASI

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Bu çalışmada 102 baş yerli ırk Akkaraman ve 60 baş melez Bafra koyunların üreme özellikleri ile kuzularının büyüme performansının değerlendirilmesi amaçlanmıştır. Akkaraman ve Bafra koyunlarında kuzulama oranları sırasıyla %85.29 ve %66.67 ($P<0.01$), doğuran koyuna göre kuzu verimi 1.31 ve 1.75 kuzu ($P<0.01$), kuzuların 90 günlük (sütten kesim yaşı) toplam canlı ağırlığı 46.65 kg ve 45.52 kg ($P>0.05$) ve sütten kesim yaşında yaşama gücü oranı %99.1 ve %91.4 ($P<0.05$) olarak bulunmuştur. Akkaraman ve Bafra kuzuların doğum ağırlığı, 1. ay, 2. ay ve 3. aydaki ortalama canlı ağırlıkları sırasıyla 4.98; 3.72 kg, 8.09; 7.88 kg, 25.12; 19.52 kg ve 35.00; 24.14 kg'dır. Genotipin doğum ağırlığı, 60. ve 90. gün canlı ağırlıkları üzerine etkisi önemli ($P<0.05$), ancak 30. gün canlı ağırlığına etkisi önemsiz bulunmamıştır ($P>0.05$). Akkaraman ve Bafra kuzularından 30, 60 ve 90. günlerde alınan cidago yüksekliği, vücut uzunluğu, incik çevresi, göğüs çevresi, göğüs derinliği, kulak uzunluğu, kulak genişliği, sağrı yüksekliği ve sağrı çevresi ölçüleri arasındaki farklılıklar istatistiksel olarak önemli bulunmuştur.

Anahtar Kelimeler: Akkaraman, Bafra, yaşama gücü, kuzu verimi, vücut ölçüsü, canlı ağırlık

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SYMBOLS AND ABBREVIATIONS

Symbols	Meaning
%	Percentage
cm	Centimeter
FEC	Fecundity
FEC	Fecundity
kg	Kilogram
km	Kilometers
Ton/year	Tons per year
Abbreviations	Meaning
ADLWG	Average Daily Live Weight Gain
ASARAC	Ayhan Sahenk Agricultural Research Center
BCS	Body Condition Score
BH	Body Height
BL	Body Length
CC	Cannon Circumference
CCFR	Chest Circumference
CD	Chest Depth
CV	Coefficient Of Variation
EL	Ear Length
EW	Ear Width
FAO	Food Agricultural Organozation
HR	Height at Rump
IR	Infertility Rate
LITS	Litter Size
LP	Lambing Percentage
LR	Lambing Rate
NRC	National Research Council
PR	Pregnancy Rate

RC	Rump Circumference
SC	Scrotum Circumference
SL	Scrotum Length
SLR	Single Lambing Rate
SR	Survival Rate
SR	Survival Rate
TBW	Total Birth Weight
TBWL	Total Birth Weight Of Lambs
TC	Testicle Circumference
TL	Testicle Length
TLWW	Total Live Weight at Weaning
TRP	Trpple Lambing Rate
TV	Testes Volume
TWR	Twinning Rate
TWW	Total Weaning Weight

CHAPTER I

INTRODUCTION

1.1 Background of Study

Sheep are important livestock species around the globe. According to several researches, sheep are part of the earliest animals to be domesticated and according to certain research related to genetics and production of sheep, sheep have been kept domestically within Anatolia central and the northern part of Zagros Mountain (Zeder, 2008). Therefore sheep breeds of these days in Turkey may be the direct successors of their ancestral herd (Soysal et al., 2005). Sheep meat production has rapidly increased over the years and reached about 385,993 tons (Turkstat, 2021). Domestic breeds, for example, have a high tolerance to illnesses and low quality feed, as well as the ability to survive in various weather conditions, making well-adapted livestock a key component of agricultural production systems (Hoffmann, 2013).

Although in Turkey there are many breeds of sheep in several regions (DAD-IS FAO, 2017), the breed with the highest population is the Akkaraman breed which entails about 46% of the country's sheep population (Akcapinar, 2000). The Akkaraman sheep breed have fat tail and because of the fat tail it can survive when on poor nutrition. The Akkaraman breeds are very adaptable to different climatic conditions, produce well in weak nutrient environments and disease resistant (Akcapinar, 2000). Divisions of domestic breeds are often characterized based on ecology, morphological similarities, and their origin (Lawson Handley et al., 2007). Three genotypes of the Akkaraman sheep (Karakas, Savak and Kangal) were determined morphologically within the breed. The Kangal sheep is used for meat production that is mostly found in the Sivas Province. Karakas sheep, on the other hand, are often bred and utilized for milk production in the Diyarbakir Province (Akcapinar, 2000). In addition to these two breeds, the Elazig Province contains a third native type known as the Savak Akkaraman which has been reared for decades. Both the Karakas - Akkaraman and the Savak - Akkaraman are utilized for production of milk, however, they are of distinct sizes, forms and sorts. Certain traditional items such as "Savak Tulum Cheese are made from this breed, which is made with milk taken from Savak -Akkaraman sheep. It is known

that the cheese is consumed in large amount in Turkey (White and Kashar Cheese) (Berrin and Biber, 2015; Kamber, 2008). The weaving of rugs and carpets is also another business known to be handled by the tribe Savak (Aksoy and Tasarli, 2017). The tribe Savak which settled in Eastern and Southern Anatolia from Middle Asia has its own culture, traditions, and way of life.

The popularity of lamb meat in Turkey is growing by the day. However, the meat output from sheep farming is not at the intended level, and the meat yield per animal has been relatively constant over time because sheep carcass weights have been about 16 kg since 1995 (Anonymous, 2009).

Akkaraman breed has been the most common reared sheep breed in Turkey. This breed has been well adapted to the climate conditions of the steppe. In addition, it has good growth characteristics and survival rates in these conditions.

The Bafra breed is obtained from a crossbreeding of Chios (75%) and Karayaka (25%) breeds. The breed combines the required yield features of Chios and Karayaka sheep. This breed has a high reproductive performance, good adaption ability, and sufficient milk supply and meat quality as a result of crossbreeding (Ünal et al., 2006).

The country that has enough meat produced by sheep, according to the data from the (FAO 2019) highest is China, which produces around 2,467,645 ton/year and the tenth is Iran with 203,256 tons. Turkey is the fourth which produces 39,380 tons. Due to the large production of sheep meat from these countries, they can easily sustain the consumption of meat of their citizens and exports their meat to foreign countries.

Within all regions of Turkey, the sheep meat agribusiness has seen substantial growth and development with the prospective company increasing which is caused by the strong demand of the local market and little or small supply oversea. On the other hand, the large metropolitan centers are looking for a product with high output quality which includes high milk yield, fast growing and other parameters.

United Kingdom and New Zealand are examples of several industrialized countries that have been studying crossbreeding in sheep meat production (Dawson et al., 2003).

Mostly in Latin America and Asia, the production outcome have increased in the last decades which pave way for better access to markets and better output (Rege et al., 2011). Farmers should take interest in more studies and research and application of technology in current animal husbandry practices for the production of better output that would meet the standard of the consumers. Intensive feed techniques and other factors such as crossbreeding with exotic breeds of sheep are combined to produce and improve the efficiency output of sheep meat production. “The use of specialized sheep meat breeds such as Dorper to produce fast-growing, meaty lambs has been studied under several conditions (Bunch et al., 2004; Cloete et al., 2007). Some articles have published several researches in the semi-arid settings of Brazil. (Cartaxo et al., 2008; Cartaxo et al., 2009; Costa et al., 2010; Sousa et al., 2008). The positive benefits of nutrition on sheep reproductive are well known (Forcada and Abecia, 2006). Malnutrition can lead to irregular periods, ovulation, poor offspring, pregnancy toxemia, and twin reduction in ewes. Rams' sperm quantity and quality may be reduced as a result of poor nutrition (Abadjieva et al., 2011). One of the most important factors affecting sheep productivity is fertility. Other studies agree that the amount of offspring generated per lambing is a strong indicator and that it is more significant than the gain of lambs (Petrovic, 2000).

1.2 Statement of The Problem

A crossbred animal is an animal which have the best productive and reproductive performance when equaled to local breed animals, which happens because it obtains parameters of both parents breed that were crossed. Year by year several efforts are made to improve the local sheep breed in terms of growth and reproduction and some other genetic aspects through breeding with exotic sheep breeds. It is known that the yield of milk and growth of crossbred is better than the local breed and reproductive parameters such as twinning and triplet rate. Under suitable conditions at several research facilities, private and government farms several research have been made on the evaluation of the productive and reproductive performance of local and crossbreeds of sheep across the country.

- 1- In the current study area, the reproduction trait of ewes and growth performance of crossbred and indigenous sheep is not well characterized.

- 2- Problem to analyze the records of the local and crossbred sheep output.

1.3 Objective of The Study

The study objective is to compare and evaluate the fertility, body and testicle measurement and lambs growth traits of indigenous Akkaraman sheep breed and crossbred Bafra (Chios x Karakaya B₁) ewe genotypes.

1.4 Specific Objectives

- 1- To evaluate the productive performance of the Akkaraman sheep breed and Bafra corssbred.
- 2- To evaluate the lambs growth performance of pre-weaning weight and survival rate.
- 3- To evaluate the body measurements of the Akkaraman breed and Bafra genotype lambs and matured sheep.

CHAPTER II

LITERATURE REVIEW

2.1 Sheep Production in Turkey

One of the oldest animals that humans domesticated was the sheep (Yilmaz, 1995). Ancient Turkey had a significant role in the domestication of sheep (Zeder, 2008). From the Stone Age to the present day, sheep have been a vital part of Turkey local and national economies (Arbuckle et al., 2009). Turkey has a diverse range of sheep breeds. Many breeds are multipurpose breeds, meaning they may be used for milk, meat and wool purposes. The Chios breed, which is known for its great reproductive efficiency and milk supply, and the Kivircik breed, which is known for its high meat quality, are exceptions. In 2021, the country sheep number increased by 7.2%, and became 45.177.690 million heads (Turkstat, 2021), which made the country amongst the countries that produced sheep mostly in the world. Normally at 18 months of age, the male and female local breeds of sheep tend to start mating, which normally decreases productive problems in the sheep and henceforth there is the increase in output. It is well understood that mating sheep at tender age improves lifelong productivity. Since animals attain sexual maturity later in life. The successful in a sheep herd is significant in Turkey. Which means the longer the ewe is productive the more products and profit they produce. Diverse breeds have evolved through the years, however, according to their structure, Turkish sheep breeds can easily be classified into two groups: those with the fat tail as well as those with the thin tail (Anonymous, 2009). Recent evolutionary investigations using genetic distance estimations have shown considerable differences between the fat-tailed and thin-tailed groupings as well as close relationships between the fat-tailed Akkaraman, Morkaraman, and Tuj breeds (Uzun et al., 2006). One of the most important elements of sheep productivity is fertility; an excellent indicator is the number of progeny produced per lambing (Petrović, 2000). It is more significant than lamb growth. This suggests that the biological effectiveness of sheep in terms of producing meat, milk and wool is controlled by reproduction (Notter, 2000). In Australian flocks; low fertility is a continuing problem (Abadjieva et al., 2011).

Sheep body measurement is taken with a measuring tape and several parameters are measured to determine the lamb growth according to data taken. The parameters include body height, body length, chest depth, height at rump, cannon circumference, ear length, ear width, body height.

There were 14 types of name and several sub class of sheep that were identified on a previously publication on Turkey biological variety (Anonymous, 1987). The overall number of sheep breeds is now 27, according to a review by (Mason, 1996), which also discloses a number of other breeds and variants. While 35 sheep types were given according to the Domestic Animal Diversity Information System of the Food and Agriculture Organization, though 15 were said to be extinct (DAD-IS, 2010). Although sheep are significant in Turkey, there haven't been many contemporary articles on the animal in the international literature. There have been studies on reproduction (Ekiz et al., 2007; Oflaz et al., 2010), health and sickness, (Yilmaz et al., 2002), short-term fattening test (Macit, 2002; Macit et al., 2002; Oflat et al., 2010), and reproduction economics (Atsan et al., 2009; Keskin et al., 2010). The current paper is one in a sequence (Wilson et al., 2011; Yilmaz et al., 2011a, 2011b, 2012) that will eventually cover all of Turkey domestic animal species. It aims to provide information on some of the main native and crossbred sheep populations, some perceptions of their production and current conservation activities.

Local sheep breeds male and females normally mate for the first time at 18 months of age. Mating at an early age reduces the sheep inactive time and may therefore increase output. It is commonly known that breeding sheep when they are young increase productivity throughout the animals life, because animals achieves sexual maturity later in life in Turkey. The length or the successful life of a sheep herd is important, because the longer a ewe is productive the more she produces each year during her productive years.

A genotype of sheep crossbred to improve productivity known as Bafra (Chios x Karayaka B₁) was developed. Karayaka and Bafra yearlings weighed 48.4 and 55.0 kilograms, respectively, while breeding ewes weighed 51.1 and 61.3 kilograms (Atasoy et al., 2003).

Animal traits that may differ due to the influence of breed evolution, environment and diet have been evaluated using biometric information. Moreover, a morphological foundation could be used to access important information regarding the fitness of the animals for selection and the results of genetic improvement initiatives.

To describe the variation in size and form measurements were used by (Martini et al., 2014; Pena Blanco et al., 2013) and to characterized breeds (Arthur and Ahunu, 2015).

The body measurements have also been studied in relation to age, live weight (Searle et al., 2007b), nutrition (Searle et al., 2007a), birth date and age of dam and litter size (Shrestha et al., 2011). Selection helped develop a breed standard in Apennine sheep by reducing heterogeneity in body measurements (Panella et al., 2003). The measurement of sheep body was used in a study to predict the weight of sheep body (Aziz and Sharby, 2009) and body weight was also predicted in another research by body measurement (Valdez et al., 1997). In line with this, Sharples and Dumelow (1990) proposed that in a mule sheep and Scottish blackface breeds, dimension may be predicted from body weights. For lambs of a particular sheep breed with limited subcutaneous fat reserves, Stanford et al. (2018) described linear measurements as *in vivo* predictors of body composition. Reproductive performance is the most essential component in sheep breeding when it comes to enhancing profitability (Arthur and Ahunu, 2015). The direction of new possibilities in the selection of rams can be determined by knowing the factors relating to ram testicular property, which is essential information for both lamb productivity with indirect selection in breeding and sperm production. As a result, variables like testicular measures are crucial (Kaymakc et al., 1988). Selection for attributes in young rams, such as testis size, can be used to improve sheep fertility (Land and Carr, 1975). Young rams of productive breeds show slight but noticeable differences in testis growth and rise in sperm production and sexual activity. Although only marginally (Romanov and Finnish Landrace) might be different in their reproductive aspects, as previously demonstrated by (Louda et al., 1981). In order to promote fertility, scrotal and testicular parameters which include testicular length, the diameter of the testicle, scrotal length and scrotal circumference, Ozturk et al (1996) used as indirect criteria in selection. The early growing phase makes it easy to examine the testicular qualities variables with strong genetic and strong relationships between them (Rege et al., 2000). According to Gundogan et al (2002) there are important

elements (age, season, genotype, body weight, rearing methods etc.) had effect on the development of testicular features. Numerous investigations reveal that, among other parameters, body weight and age had a substantial influence on testicular characteristics (Rege et al., 2000).

It was discovered that body size is directly related to testicular growth and development and that rams with greater testicular characteristics had the most body weight. In general, ram lamb sexual development is closely related to body growth rather than age (Gundogan et al., 2002). According to another study by Salhab et al. (2001) there were very strong associations between testicular features and body weight.

2.2 Production Systems of Sheep in Turkey

They are four different ways of livestock production in Turkey, two of which are largely behind the production of crops. A small-house, which is popular in western and north-western Turkey, is the first system. Here there are 10-15 per head maximum weight with an average of 3-5 sheep in the family. The second kind is the widespread “settle village herd” system in Turkey. The size of the family herd ranges from 8 to 10 to about almost of 100 sheep’s in number. In this type of livestock production, the sheep livestock that the owners take out so very early morning and they herd around the village, the herd is also in the care of a shepherd who helps him protect them and many dogs. In both, the first-order system, sheep graze in common fields during the summer and regain most of the body weight that they lost during the period of winter when they were feeding on grains and trees. Towards the ending of June there are grasses that are grown but are not harvested until July. The animals now reach the peak and fat are deposited under the skin, around the kidneys and intestine, as well as, literally, on the tail. “Hills” which is the last system, is widespread in Turkey east, south and northeast. The winter and early period of spring are the season when sheep are grown in the communities. The herd is brought to the hills in the late period of springs and early period of springs when the grass grows and dies and they return in 3 to 5 months as the foods run out and cold set in, making their settlement chilly. In eastern and southeastern Turkey, there is a “nomadic” system. In the lowlands of southeastern Turkey during the cold season, some ancient nomadic tribes graze between 100,000 and 200,000 sheep. The tribes migrate to the major nations of eastern Turkey in the summer (Yilmaz et al.,

2012). When they are with their flocks, nomadic tribe members always reside in tents made with goat hairs (Ertrugul et al., 1993; Sonmez, 2011).

2.3 History of Exotic Breed Introduction to Turkey

Cross-breeding attempts to improve the output of sheep production began in 1928 (Ertugrul et al., 2009, 2010). Crossbreeding methods, which have received a lot of criticism, have managed to generate a considerable number of animals in recent years. The crossbreeding program's aims were to enhance wool production and production of meat, production of milk for people feeding and other related industrial businesses.

Backcrossing the new crossbred to the same or another exotic breed after using a foreign sire on local females and breeding from the F₁ generation, simple mating of two local breeds, employing the new crossbred for additional crosses on the local breed were the four main breeding techniques used. Turkey utilized a diverse set of animals for over 80 years that have the essential qualities to accomplish these goals. German sheep merino and Ile de France were the primary in the early days to strengthen Eastern Frisian in milk production, which remains a pivotal turning of sheep.

As part of the program aimed at improving milk production, native sheep, on the other hand, were the subject of selecting inside one particular breed or mating two local breeds (Ertrugul et al., 1993). Moreover, the breeds that are new aimed to enhance the wool quantity and wool quality within the native breed. Every sheep of the Turkish breed have a minimum of 17 identified variants except for the Acipayam, wedge tail, Kamakuyruk and Malya which do have thin tails, instead of the long, fat tails found on the other sheep.

In 1928, the Ministry of Agriculture imported the first German Wool Mutton Merino sheep, which were bred with the indigenous sheep breed of Kivircik in western Anatolia at the farm of Karacabey to make Karacabey Merino (Karacabey Merinosu). Karacabey Merino is a huge, heavy, and early maturing Merino with Merino bloods of about 90-95% it has rapid growth, high carpet wool yield, high reproductive and it is generally a medium-meat wool type (Kaymakci, 2008; Mason, 1996). The German Wool Mutton Merino sheep were crossed at Konya State Farm together with Akkaraman to develop

the Anatolian Merino in a similar way to the Karacabey Merino (Anonymous, 2009; Sonmez, 2011). This medium-sized sheep weighs more than its predecessors and yields more milk and finer wool than its native ancestor.

The Merino of the Anatolian central (Orta Anadolu (Konya) Merinosu) is similar in origin to Anatolia Merino but has a higher proportion of German blood. Development began at Konya State Farm in the year 1952 (Mason, 1996; Anonymous, 2009). And produced a sheep bigger than Merino of Anatolia, having a faster rate of growth, a bit heavy wool clip, but lower in milk production. Originating in the 1970s at Malya State Farm in central Anatolia the homonymous Malya is a fine wool, meat and milk type derived from the German Mutton Merino 35% and the Akkaraman (Yilmaz et al., 2002; Ertugrul et al., 1993; Anonymous, 2009). Due to its low proportion of exotic blood, this animal can thrive in breeding conditions that are less than ideal and is left with a thick tail. Bahri Dagdas International Agriculture Research Institute (IBDARI) in Konya province south of Ankara bred Hasak through a three-way descent. The Akkaraman dam line and the German Mutton Merino and Hampshire lamb breeding. This is a strong, substantial, mid-sized and coloured sheep that is frequently used for the production of early lambs. It has a rapid growth rate and great carcass yield. Around the base, it has a lengthy, broad tail (Anonymus, 2011; Kaymakci, 2008; Somnez, 2009).

The Hasmer, is a milk, wool type and meat sheep breed with a powerful semi physique, a rapid development rate, and exceptional carcass production, is also bred and is rare in Turkish cross-breeding programs due to the absence of local Turkey sheep blood. This breed as opposed to prior ones has a thin tail (Anonymous, 2011; Kaymakci, 2008; Somnez, 2009;).

The East Friesian has been used in several cross-breeding programs. In cooperation with Hohenheim University, the Faculty of Agriculture at Cukurova University has produced the Asaf from the East Friesian and the Awassi. The Asaf has been developed through inter se crossing of the F₁ to produce the F₂ (Kaymakci, 2008; Sonmez, 2009). The Acipayam is medium size, milk, meat, and wool type produced from East Friesian rams on Awassi ewes with some Daglic blood inserted to boost wool quality. It is a fat-tailed cross-bred of the southern provinces of Denizli, Afyon, Isparta, and Antalya. The Tahirova was produced at the Tahirova State Farm from East Friesian sire and Kivircik

dam lines (Mason, 1996) and was bred for the lowlands of Izmir Province on Turkey's Mediterranean coast. This medium-heavy breed is one of Turkey's most prolific sheep, producing a large volume of milk and a dense fleece (Anonymous, 2009). The Tahirova has been used within Turkey as a sire line in the production of further cross-breeds.

2.4 Akkaraman Sheep Breed

Akkaraman sheep is a fat-tailed sheep with a high survival potential during periods of inadequate food due to its fatty tail. It is an indigenous breed with a fat tail that serves multiple purposes and thrives in central Anatolia semi arid continental climate (Figure 2.1). This breed is very adaptable to different set of climatic conditions, disease resistant, and also produces well in little-nutrient environments (Akcapinar, 2000). The DAD-IS website, (<http://dad.fao.org>) provides comprehensive information more about sheep breeds found in Turkey.

Among the indigenous sheep breeds, it has a big frame, body is long and slender, although the dorsal line is typically straight, occasionally a little dent may be visible. The head is long and thin, the face has no fleece covering it with a lengthy neck. On occasion, the forehead has fringe (bangs) of varied sizes. Rams have slightly convex heads, its ears are long and pendulous, hoofs are strong and powerful with lean long legs. White is typically the color, on the head, nose and hooves, there are black stains. Usually, there is no fleece on the head, neck or legs. Rams with minimal or no horns are both common, it has a thick, S shaped tail that appears to be broken into three sections that fall one after the other from the back. The second section of the tail which resembles a heart and is smaller and fatter, is attached to the enormous and bulky chunk of fat at the base. The long length of tail at the end is hairless, without fat and droops downward (Koncagul et al., 2011).

The Akkaraman (White Karaman) is in general a medium-sized breed. However, of the two local types Kangal is larger and Karakaş is smaller than the usual type (Sandikcioglu, 1961).

Some body measurement of Akkaraman and Kangal Akkaraman sheep are given in Table 2.1.

Table 2.1. Body measurement of Kangal and Kangal Akkaraman sheep (Baspinar, 1985)

Body measurement	Akkaraman		Kangal Akkaraman	
	Mean	S.E	Mean	S.E
Height at withers	64.70	0.29	68.70	0.39
Body length	63.20	0.30	69.90	0.44
Chest depth	30.20	0.21	31.90	0.17
Chest width	16.20	0.11	18.20	0.14
Chest girth	81.0	0.31	92.70	0.52
Cannon circumference	7.80	0.05	8.20	0.06

S.E: Standard Error



Figure 2.1. Akkaraman lambs

2.5 Bafra Croosbred Sheep

The Bafra sheep is a crossbreed between the Chios and Karayaka sheep breeds. The Chios which is particularly found in the province of Cesme, Izmir, Aydin and the coastline areas of the Marmara and Aegean regions, is known for its high productivity (lambs and milk). The legs of Chios are lengthy, and its body is narrow and tall and is white. There are black marks near the mouth, eyes, nose tips, on the feet and around the ears. There is absent of fleece in the head, legs and underside of the abdomen. Horns on

rams are resilient and curvy, the end of the tail is long, thin and fatless whereas, the base is triangular and has a few fatty areas. The glandular udder can produce a lot of milk. Nipples are large and droopy. It is a breed that matures quickly, it produce a lot of milk and reproduces well, it has low ability to adapt. It is usually in oestrus within the entire year, it have delicious meat and lack of herd instinct. Age appropriate ewes weigh 48 to 50 kg, while matured rams weigh 65 to 70 kg, (Koncagul et al., 2011).

Black sea regions indigenious breed of sheep include the Karayaka. The breed productivity is often low, with the exception of meat quality and high tolerant, they are small breed of sheep, they typicall have white bodies and either black eyes or black legs and heads. Animals that are black or brown are also occasionally encountered, these breed are categorized as a breed with long thin tails, the ewes are hornless, while the rams have horns, the rams are bigger than the ewes (Akcapinar, 2000; Yalcin, 1986). Age appropriate ewes weigh 40 kg, while matured rams weigh 55 kg, (Koncagul et al., 2011).

In commercial crossbreeding systems, new prolific genotypes have been created using the Chios breed as an improver. The native Chios sheep and Karayaka sheep breed were backcrossed to create Bafra genotype (Aydogan and Gul, 1992; Atasoy et al., 2003). Bafra genotype have a long, thin tail and has a little fat deposit neat the base (Unal et al., 2003). Middle size in terms of head length and width, the ears are large and lateral and the neck is long and slender. The body is white, but there are black stains on the ear, eyes and the corners of the mouth. Anywhere else stains are absent. Typically fleece is absent from the head, abdomen and legs. Males have thick, spiral horns that extends to the sides. Despite having rudimentary horns, females are typically polled. Age appropriate ewes weigh 66 kg, while matured rams weigh 80 kg, (Koncagul et al., 2011).

Recently there has been an increase in the production of Bafra sheep genotype. The matured body weight of ewes was found to be 62.7 kg (Atasoy et al., 2003). This genotype produces a lot of milk and has good fertility. The mean litter size was found as 2.2 and high level of milk production (149.8 kg by machine milking following oxytocin administration) and fertility are present in this genotype (Unal et al., 2008). This medium-sized, quick-growing sheep is quite productive, with moderate milk production

and a light fleece (Anonymous 2011). A picture of Bafra genotype is shown in Figure 2.2.



Figure 2.2. Bafra crossbred lambs

CHAPTER III

MATERIALS AND METHOD

3.1 Farm Location

The data that was used in the study was obtained from Nigde Omer Halisdemir University Ayhan Sahenk Agricultural Research and Application Centre (ASARAC), in 2021-2022. The research center is located at 37° 52'- 46° N latitude and 34° 35'- 06° E longitude and the altitude of 1171 meters at sea level in Nigde, Turkey. The location of the farm is 10 km apart from the University main campus.

3.2 Animal Material

The animals used for the study were Akkaraman breed and Bafra genotype and the lambs that were born from them in the ASARAC in 2021-2022.

For reproductive purpose 102 heads Akkaraman ewes and 60 heads Bafra ewes which age range from 2, 3 and older than 4 years were used. For mating process 6 adults ram which has high libido and experienced from each genotype were selected.

Lamb growth data were taken from the birth to weaning age (90 days) from 114 heads Akkaraman and 70 heads Bafra genotype that were born. 40 heads of Akkaraman lambs and 40 head Bafra genotype of slightly same lambing time were selected randomly for body measurement.

The number of ewes that was used for matured body measurements was 20 heads of different age (2, 3, and higher than 4 years) from each genotype.

3.3 Feeding Management

The ewes and lambs feeding process were applied according to research farm practice in the study. In the research farm the animals were evaluated according to body condition

score (BCS), two weeks before mating season if the animal BCS was less than 3.0 score then it is given additional supplementary feed.

The nutrient contents of the concentrate feeds given to the animals at different periods are given in Table 3.1. From September to late October the ewes were divided into groups of 20 heads each with a single ram during the mating time, all groups were fed with 500 gr sheep milk feed and 800 gr of forage which consist of 500 gr alfa alfa hay and 300 gr of wheat straw. Supplementary feeding was continued two weeks before and throughout the mating period. 200 gr/ day barley was given per animal. After the mating period rams were kept separately and all the ewes were managed together in the pasture during the day.

Table 3.1. Nutrient content of concentrate feeds

Content	Concentrate feed types			
	Sheep milk feed	Yearling lambs fattening feed	Lamb starter feed	Lamb growth feed
Dry matter (%)	88	88	88	88
Crude protein (%)	13	12	18	16
Crude cellulose (%)	14	9	10	10
Ash (%)	9	9	7	10
Vitamin A (IU/Kg)	5000	7000	15000	6000
Vitamin D3 (IU/Kg)	800	700	3000	750
Vitamin E (Mg/Kg)	30	25	30	15
Calcium (%)	0.6-1.2	0.6-1.6	0.8-2	0.8-2
Phosphor (%)	0.4	0.4	0.5	0.5
Metabolic energy (Kcal/kg)	2400	2750	2800	2500

In winter, the sheep were cared for and fed in the barn on the pasture. Animals were given 600 grams of yearling lambs fattening feed + 200 grams of barley and 1kg of alfa alfa hay twice a day from the first 3 months of pregnancy. In the last period of pregnancy, 700 grams of concentrate feed + 300 grams of barley and 1 kg of alfa alfa hay was given. Sheep were offered free fresh water in automatic drinkers.

During the lactation period the ewe were fed sheep milk feed according to nutrition requirements of small ruminants (NRC).

Sheep and lambs were then transferred to a specially designed lamb growth chamber (Figure 3.1) for few days after lambing then transferred to creep feeding area. The creep feeding area is a separated unit where the lambs are taken for add libitum lambs starter feed, the alfa alfa hay and fresh water after lambing. Also this area offer free movement option for lambs to move from ewe to suckling area but restricted for the ewe to enter creep feeding area. After the age of one month, the lambs were fed lamb growth feed + alfa alfa hay until weaning age.



Figure 3.1. Lamb growth chamber

3.4 Reproductive Performance of Ewes

One month after the mating date, pregnancy in sheep was determined by ultrasound pregnancy examination. The mating period, duration and time was taken into account in this study. The rates of pregnancy, infertility rate, birth rate, fecundity, litter size, total birth weight, total weaning weight.

Before the mating all the ewe and ram identification number, starting and finishing mating time were recorded. The research center mating season started in September to late October, the mating process continued for about two months. According to mating season the lambing took place from February to March. The mating type that was used

in this research was the pen mating (groups mating) where the ram were put in a pen of ewes to facilitate their mating.

Reproductive performance of the ewe was calculated according to (Kaymakci, 2012).

The pregnancy rate (PR) was to determine the number of ewes that got pregnant after mating which was be determined by

$$\text{PR\%} = \text{Number of ewes pregnant} / \text{Number of ewes mated} \times 100 \quad (3.1)$$

Lambing percentage (LP) was used to determine the number of lambs born compared to the number of ewes that mated.

$$\text{LP (\%)} = \text{Number of lambs born} / \text{Number of ewes that mated} \times 100 \quad (3.2)$$

$$\text{Infertility rate (IR): (number of ewes not giving birth/ number of ewes suitable for mating) } \times 100 \quad (3.3)$$

Fecundity (FEC) was also measured; this measured number of lambs that were produced by an ewe. It is expressed as

$$\text{FEC\%} = \text{Number of lamb born} / \text{Number of ewes lambed} \times 100 \quad (3.4)$$

Total birth weight at lambing (TBWL) and total live weight at weaning (TLWW)

3.5 Growth Performance of Lambs

Depending on the mating all lambs were born from February to the end of March. When the lambs were born, they were dried, the lambs were taken care of, and they were provided with sufficient colostrum as soon as possible after two hours of birth. Lambs were tagged with ear tag made of plastic for identification. The date of birth, type of birth, sex and mother identification number were kept on record. The lamb's weights were determined after 24 hours of lambing. The lambs and mothers were kept in the 2 square meter maternity chambers for one week at least.

The lambs were weaned at 3 months in this study, the weight of Akkaraman and Bafra lambs at birth, 30, 60 and 90 days were determined. Average daily live weight gain birth to 30, 60 and 90 days was calculated, sex, birth type, age and genotype were considered as fix factors.

Survival rate (SR) of the lambs was also tested but from within time of lambing to duration of weaning because the research was from lambing to weaning age. The survivability of the lambs was determined by Kaymakci (2012).

$$SR\% = \text{Number of lamb weaned} / \text{Number of lamb born alive} \times 100 \quad (3.5)$$

3.6 Lamb Body Measurement

Ewe body measurement were taken after shearing from Akkaraman and Bafra ewes, from 40 head ewes, 20 each randomly, and their live weight were weighed. Body measurements and body weights were taken from rams used Akkaraman (6 heads) and Bafra (6 heads) breeding rams, together with testicle measurements.

The body measurements of the lambs were taken by the use of a measuring tape which was recorded in centimeters (cm) in which lambs were held and restrained to avoid error in measurements. The point of reference for measurement of body was determined from the method of Searle et al. (1989).

The body measurements of the breeds used in the study were taken were body length (BL), chest depth (CD), height at rump, (HR), cannon circumference (CC), chest circumference (CCFR), body height (BH), rump circumference (RC), ear length (EL), ear width (EW) with the use of measuring tape.

The measurement of rams used for breeding rams were also taken for scrotum length (SL), scrotum circumference (SC), testicle length (TL), testicle circumference (TC) and testes volume (TV) with measuring tape and a vernier caliper, respectively. The length and diameter of the testis was measured with a caliper. It was measured in centimeters (cm) as the largest diameter of the testes and scrotum after pushing the testes firmly into

the scrotum. The scrotal length was measured with a Vernier caliper as the distance between the tip of the scrotal sack and its neck.

The testis volume was estimated as suggested by Godfrey et al. (1988);

$$\text{Testes volume (cm}^3\text{)} = 0.0396 \times (\text{testis length average}) \times (\text{circumference of scrotum})^2 \quad (3.6)$$

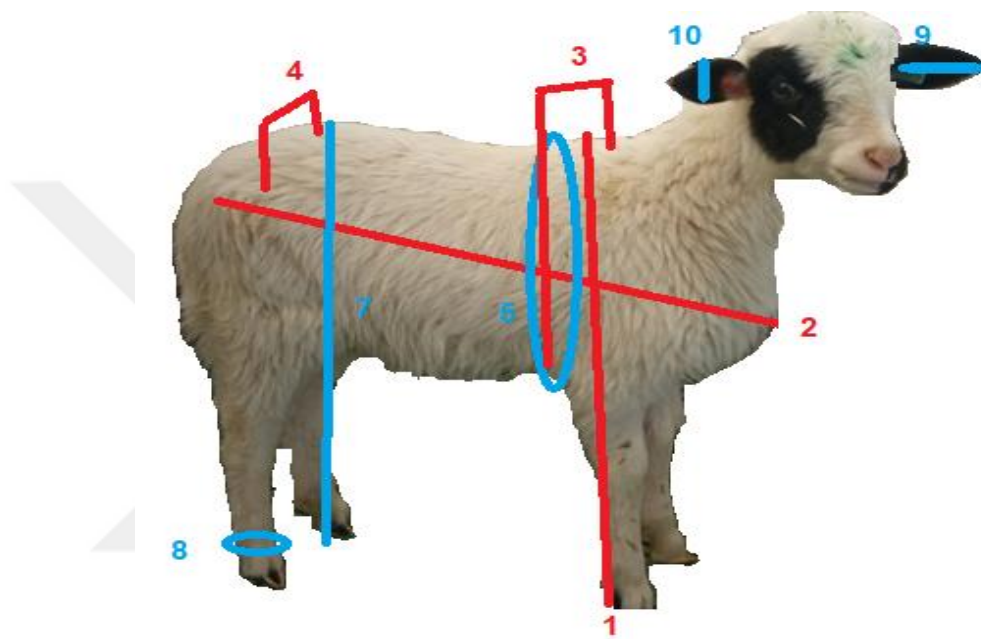


Figure 3.2. Lamb body measurement (1. Body height, 2. Body length, 3. Chest depth, 4. Rump circumference, 5. Chest circumference, 7. Height at rump, 8. Cannon circumference, 9. Ear length, 10. Ear width)

3.7 Statistical Analysis

In this study the statistical analysis was done using SPSS package software (SPSS 24). The effect of genotype, age of dam, sex and birth type on the live weight and body measurements, as well as the statistical significance among the means were analyzed by using the General Linear Model (GLM) procedures. The birth weight was considered as a covariance effect on the first month, second month and third months of the lambs. However, the relationship between birth weight and 30, 60 and 90 days body weights were not found to be linear and regression curves were not similar for these characteristics. Therefore it was excluded from this model.

The statistics model for the growth performance;

$$Y_{hklm} = \mu + B_h + X_j + P_k + T_l + e_{hklm} \quad (3.7)$$

Where;

Y_{hklm} = Observed in the level h of the genetic group, level j of lamb sex, level k of dam age, level l of birth type and μ = the overall mean;

B_h = Fixed effect of h^{th} genotype group (h= Akkaraman, Bafra)

X_j = Fixed effect of j^{th} sex (j= male, female)

P_k = Fixed effect of k^{th} ages (k= 2, 3, ≥ 4)

T_l = Fixed effect of l^{th} type of birth (1; single, 2; twin, 3; triplet)

e_{hklm} = Random error

The analysis of the reproductive performance and lamb survival rate was done by using the Mann Whitney U test (Alpar 2016).

CHAPTER IV

RESULTS

4.1 Some Reproductive Performance of Ewes

The reproductive parameter of both groups of animals used in the study i.e. Akkaraman and Bafra is shown in Table 4.1. Akkaraman ewe and Bafra genotype were exposed to rams for mating in the breeding season. Our study shows that a total number of 102 heads Akkaraman ewe breed were exposed to rams for mating and 87 heads were determined pregnant and 15 ewes were determined infertile after pregnancy test. The 87 heads Akkaraman ewes gave birth to 114 heads live lambs, single (60), twin (27) lambs respectively, while the Bafra genotype, a total number of 60 Bafra ewes genotype were exposed to rams for mating and 40 were determined pregnant and 20 ewes were determined infertile after pregnancy test. The 40 heads Bafra ewes gave birth to 70 heads live lambs, single (14), twin (22) and triplets (4) lamb respectively. The number of dead lamb recorded in the study was Akkaraman (1) and Bafra (6) mainly because Akkaraman are more tolerant than Bafra irrespective of the management. Akkaraman had a higher lambing rate (85.29%) than Bafra (66.67%) ($P<0.05$).

Infertility rate in the study was recorded as 14.71% in Akkaraman and 33.33% in Bafra genotype ($P<0.05$), which shows Bafra had a higher infertility rate compared to Akkaraman, though Akkaraman had a higher population almost twice as Bafra which was used in the study. The Fecundity rate was found as 1.12 in Akkaraman and 1.17 in Bafra ($P>0.05$). The litter size was found as 1.31 in Akkaraman and 1.75 lambs in Bafra ($P<0.05$).

The study shows that number of single lambing in Akkaraman (68.97) is higher than Bafra (35%) ($P<0.05$), while the number of twin lambing in Akkaraman (31.03%) is lower than Bafra (55%) ($P<0.05$) and Bafra genotype was the only subject that produced triplets (10%).

The total birth weight (TBW) of Akkaraman breed was found (6.72 kg) which was higher than Bafra (6.50 kg) ($P>0.05$) which shows that breed is not statistically

significant in the total birth weight. TBW of Akkaraman breed found was (46.65 kg) which was higher than Bafra (45.52 kg) ($P>0.05$) which shows that breed is also not statistically significant in the total weaning weight just like the TBW.

Table 4.1. Some reproductive parameters of ewes

Parameters	Akkaraman	Bafra	
Exposed Ewes	102	60	
Ewes Lambded	87	40	
Infertile Ewes	15	20	
Lambs Birthed	114	70	
Single Birth	60	14	
Twin Birth	27	22	
Triplet Birth	0	4	
No of Live Lambded	114	70	
Single	60	14	
Twins	54	44	
Triplets	0	12	
Dead Lambs	1	6	
Weaning Lambs	113	64	
Percentage	%	%	p value
Lambing rate (%)	85.29	66.67	0.0060
Infertility rate (%)	14.71	33.33	0.0001
Fecundity	1.12	1.17	0.7800
Litter size	1.31	1.75	0.0001
Twining rate (%)	31.03	55.00	0.0100
Single rate (%)	68.97	35.00	0.0001
Triplet rate (%)	-	10.00	-
TBW (kg)	6.72	6.50	0.783
TWW (kg)	46.65	45.52	0.735

TBW: Total Birth Weight, TWW: Total Weaning Weight

4.2 Lamb Growth Performance

Under the sheep breeding management condition of the ASARAC the average monthly live weight from the first to the weaning age of lambs was an important consideration to this part of study. The analysis of variance for factors affecting month's weight was given in Table 4.2, with least square means and effect of investigated factors were significant ($P<0.05$) and non-significant ($P> 0.05$) for average live weight of the months.

The growth performance from the birth in this study was increasing with increasing day to the month of weaning age. The overall weight of the birth weight in the study was 4.05 ± 0.05 kg, while in the first, second and third months were 7.98 ± 0.11 kg, 22.32 ± 0.44 kg and 29.57 ± 0.61 kg respectfully. In the birth weight the genotype of Bafra mean weight (3.72 ± 0.04 kg) was lower than Akkaraman breed (4.98 ± 0.03 kg) this is due to the fact that Akkaraman breed are heavier than Bafra. Growth performance of lamb on birth type and sex at the 60th and 90th day was found in this study to be significant ($P < 0.05$) the male had higher growth performance compared to the female while also the single born lamb have higher growth performance than the twin or triplet.

Table 4.2. Least square means ($\pm$ SE) for the different age of lamb live weight (kg)

Factors	n	BW	N	30 th day	N	60 th day	N	90 th day
Genotype		**		Ns		**		**
Akkaraman	114	4.98 ± 0.03	111	8.09 ± 0.18	111	25.12 ± 0.73	111	35.00 ± 1.01
Bafra	70	3.72 ± 0.04	64	7.88 ± 0.14	64	19.52 ± 0.58	64	24.14 ± 0.81
Dam age		**		Ns		**		Ns
2 years	52	$3.80 \pm 0.06c$	48	7.69 ± 0.21	48	21.14 ± 0.84	48	28.58 ± 1.17
3 years	22	$4.39 \pm 0.16b$	21	8.06 ± 0.21	21	22.22 ± 0.82	21	29.15 ± 1.13
≥ 4 years	110	$4.86 \pm 0.05a$	106	8.19 ± 0.14	106	23.61 ± 0.56	106	30.98 ± 0.78
Birth type		**		**		**		**
Single	74	4.80 ± 0.07^a	72	8.65 ± 0.13	72	24.68 ± 0.52	72	31.59 ± 0.72
Twin	98	4.38 ± 0.07^b	92	8.09 ± 0.11	92	21.53 ± 0.47	92	28.15 ± 0.65
Triple	12	3.67 ± 0.08^c	11	7.21 ± 0.31	11	20.76 ± 0.24	11	28.97 ± 1.79
Sex		ns		Ns		**		**
Female	91	4.54 ± 0.07	86	7.92 ± 0.13	86	21.53 ± 0.52	86	27.39 ± 0.72
Male	93	4.46 ± 0.07	89	8.05 ± 0.11	89	23.12 ± 0.54	89	31.74 ± 0.75
Overall Mean	184	4.05 ± 0.05	175	7.98 ± 0.11	175	22.32 ± 0.44	175	29.57 ± 0.61

BW: Birth Weight. A,b,c: same column different letter is significant, **: $P < 0.05$ and ns: non-significant

Lamb growth performance from birth to weaning age at different factors is shown in Figure 4.2.

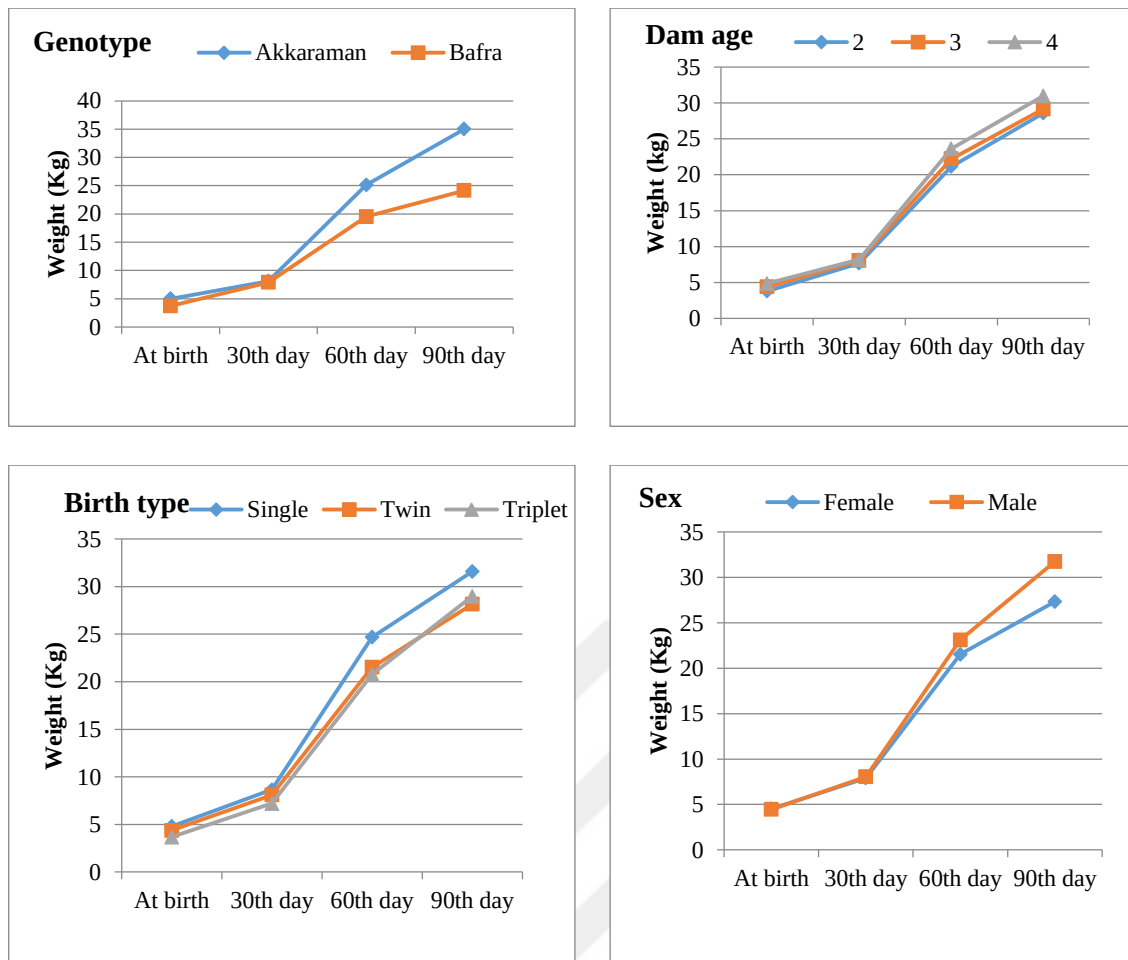


Figure 4.1. Lamb growth performance from birth to weaning age at different factors

4.3 Daily Live Weight Gain of Lambs

The average daily live weight gain of lambs from the birth to the weaning age was a factor also covered on the study. The analysis of variance for factors affecting daily weight was given in table 4.3. with Least Square Means and effect of factors in the first month live weight gain genotype and birth type were significantly affected ($P < 0.05$), on the other hand dam age and sex were not significantly affected ($P > 0.05$). Genotype, dam age, birth type and sex effect on second months live weight gain was found statistically significant ($P < 0.05$), at the same time the third month live weight gain showed that dam age wasn't important ($P > 0.05$), however the Genotype, sex and birth type were important ($P < 0.05$). The average mean daily live weight gain of lambs in the first month was 0.123 ± 0.01 kg and the second month was 0.301 ± 0.01 kg while the third month was 0.281 ± 0.01 kg in this study.

The Akkaraman breed with daily live weight gain of (0.107±0.01 kg) was slightly less than the Bafra genotype with (0.138±0.01 kg) in the first month of age; this may be due to high milk produce from ewes because the Akkaraman are not known to be dairy sheep breed compare to Bafra genotype. The second month DLWG of the Akkaraman (0.337±0.01 kg) was better than the Bafra (0.264±0.01 kg), and also the third month value Akkaraman (0.335±0.01 kg), Bafra (0.227±0.01 kg). The effect of birth type on the average DLWG in the first, second and third month of age in this result was significant (P<0.05).

Table 4.3. Least square means (±SE) for daily live weight gain of lambs (kg)

Factors	N	30 th day	n	60 th day	n	90 th day
Genotype		**		**		**
Akkaraman	111	0.107±0.01	111	0.337±0.01	111	0.335±0.01
Bafra	64	0.138±0.01	64	0.264±0.01	64	0.227±0.01
Dam age		Ns		**		Ns
2 years	48	0.114±0.01	48	0.280±0.01	48	0.270±0.01
3 years	21	0.128±0.01	21	0.301±0.01	21	0.277±0.01
≥4 years	106	0.126±0.01	106	0.321±0.01	106	0.295±0.01
Birth type		**		**		**
Single	72	0.142±0.01	72	0.340±0.01	72	0.302±0.01
Twin	92	0.127±0.01	92	0.288±0.01	92	0.265±0.01
Triple	11	0.99±0.01	11	0.274±0.02	11	0.275±0.01
Sex		Ns		**		**
Female	86	0.121±0.00	86	0.287±0.01	86	0.257±0.01
Male	89	0.124±0.01	89	0.314±0.01	89	0.304±0.01
Overall Mean	175	0.123±0.01	175	0.301±0.01	175	0.281±0.01

**P<0.05, ns: non-significant.

The effect of sex in the first month DLWG was not significant (P>0.05) but in the second and third month was significant (P<0.05). In this study, it was found that the male sex lamb had more average DLWG than the female lambs.

The daily age-live weight gain of the lambs based on genotype is shown in Figure 4.2.

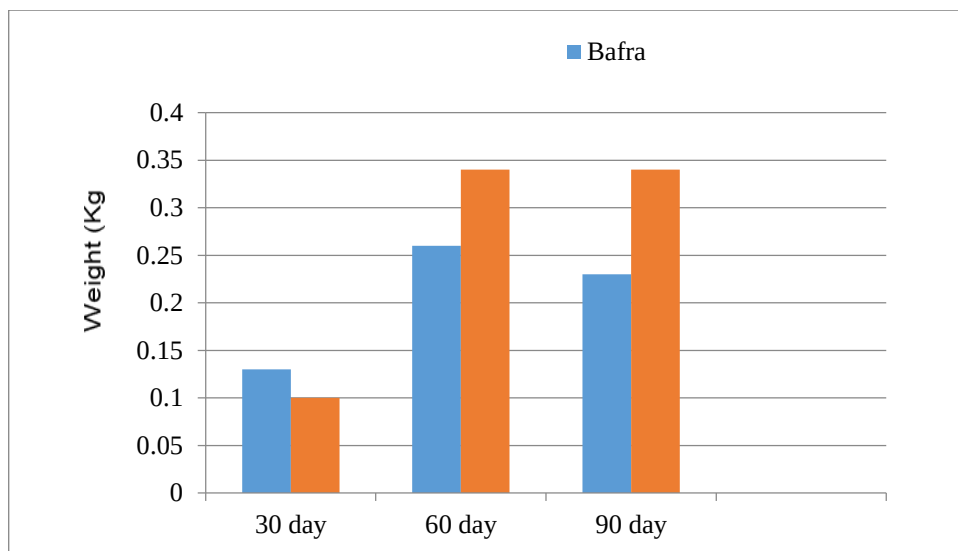


Figure 4.2. The daily age-live weight gain of the lambs based on genotype

4.4 Lamb Survival Rate

The Mann Whitney U test result for survival rate of lambs is given in Table 4.4.1. Akkaraman breed had a survival rate of 99.1% while Bafra genotype had 91.4% ($P < 0.05$) this may be due to the fact that the Akkaraman breed has a higher tolerant rate than the Bafra genotype, hence the survivability is justified. The age of the dam ($P > 0.05$) shows that the lambs from ewe with 2 years age and above had 92.3% survival rate while the lambs from ewe with 3 years age and above had 100% survival rate and lambs from ewe of with 4 years of age had 97.3% survival rate, which shows that older ewes lambs had higher survival rate which may be because of good management, ewes good production of essential mineral elements with age to the lambs etc.

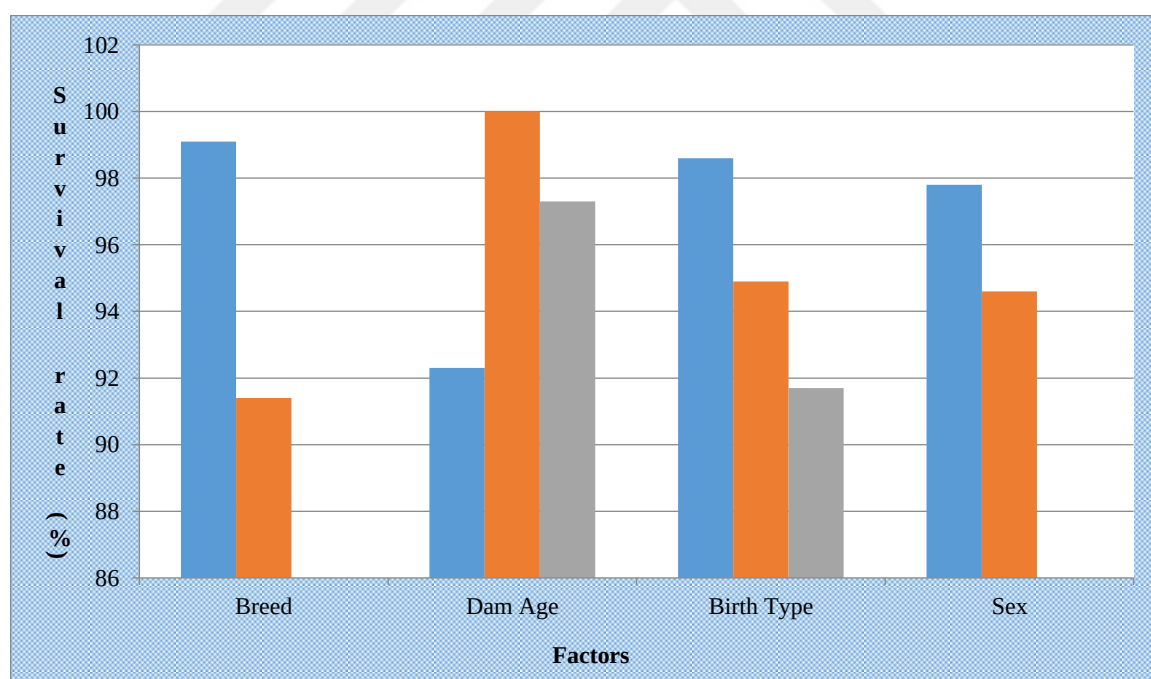
Table 4.4. Survival rate of lambs at weaning age (90 days)

Factors	n	Survival rate (%)
Genotype		**
Akkaraman	114	99.1
Bafra	70	91.4
Dam age		Ns
2 years	52	92.3
3 years	22	100
≥4 years	110	97.3

Table 4.4. (continue) Survival rate of lambs at weaning age (90 days)

Factors	n	Survival rate (%)
Birth type		Ns
Single	74	98.6
Twin	98	94.9
Triple	12	91.7
Sex		Ns
Female	91	97.8
Male	93	94.6
Overall mean	184	96.2

In birth type ($P>0.05$) the single lambs had a survival rate of (98.6%), twin (94.9%) and triplet with (91.7%) which shows that the single lambs got more care and nutrients from the mother hence have the highest number of survival than the twin and triplet lambing respectively. The sex of lambs ($P>0.05$) showed that the female with (97.8%) had more survival rate than the male with (94.6%). Lamb survival rate based on factor is shown in Figure 4.3.

**Figure 4.3.** The lamb survival rate different factors

4.5 Body Measurements of Lambs

The average body measurement of lambs from the first to the weaning of lambs was important in this study. The descriptive statistics of the result for factors of lamb body measurements was given in Table 4.5. Lambs body measurement was found to be increasing with different age in this study.

4.5.1 First month body measurement of lambs

The mean and standard deviation for body measurement of both sexes are reported by breed of lambs, i.e Akkaraman and Bafra in Table 4.5. noticed both sexes of Akkaraman breed (male and female) had a higher mean than the sexes of the Bafra genotype within all the parameters that were tested. According to chest circumference the Akkaraman male lambs had a mean of (60.75 cm) and the female lambs had (57.90 cm) while the Bafra male lambs had a mean of (47.70 cm) and the female lambs had (47.05 cm), according to body length also the Akkaraman lambs had a higher body measurement taken in this study than the Bafra lambs with the male of Akkaraman (47.10 cm) female (45.30 cm) and Bafra male (39.30 cm) female (36.00 cm). The chest depth also shows that the Akkaraman lambs had a higher body measurement than the Bafra lambs with Akkaraman lambs male (20.50 cm), female (20.30 cm) while Bafra male lambs (18.85 cm), female lambs (18.45 cm). However, within the breed the measurement shows that the male lambs had higher body measurements than the female lambs. The rump circumference of the Akkaraman male lambs (60.55 cm) was greater than the female lambs (59.10 cm), the body height also showed that the Akkaraman male lambs (54.65 cm) was also greater than the female lambs with (53.25 cm), the height at rump also showed that the male lambs Akkaraman (54.40 cm) was greater than the female lambs (52.10 cm). In the Bafra genotype lambs it also shows that the male had higher body measurements than the female lambs according to this study body height male lambs (46.20 cm) and female lambs (45.90 cm), cannon circumference male lambs (6.20 cm) and female lambs (6.20 cm).

Table 4.5. Descriptive statistics for first month body measurement of lambs (cm)

Body Measurement	Sex (n=20/20)	Akkaraman(n=40)		Bafra (n=40)			
		Mean	Sd	CV,%	Mean	Sd	CV,%
Ear length	Female	11.05	1.050	9.50	8.35	0.489	5.86
	Male	11.30	0.865	7.65	8.45	0.605	7.16
Ear width	Female	5.95	0.510	8.58	5.15	0.366	7.11
	Male	6.65	0.671	10.09	5.15	0.366	7.11
Body length	Female	45.30	3.011	6.65	36.00	5.938	16.50
	Male	47.10	9.130	19.38	39.30	4.646	11.82
Rump circumference	Female	59.10	6.965	11.79	46.90	5.964	12.72
	Male	60.55	7.864	12.99	47.10	4.191	8.90
Height at rump	Female	52.10	3.447	6.62	45.55	2.417	5.31
	Male	54.40	5.481	10.08	47.10	2.490	5.29
Chest circumference	Female	57.90	4.447	7.68	47.05	3.332	7.08
	Male	60.75	6.904	11.37	47.70	3.294	6.91
Chest depth	Female	20.30	2.227	10.97	18.45	0.887	4.81
	Male	20.50	2.283	11.13	18.85	1.348	7.15
Cannon circumference	Female	7.50	0.827	11.03	6.05	0.224	3.70
	Male	7.50	0.946	12.61	6.20	0.410	6.62
Body height	Female	53.25	4.667	8.76	45.90	2.936	6.40
	Male	54.65	4.475	8.19	46.20	3.365	7.28

CV: coefficient of variation, Sd: Standard deviation

Table 4.5. shows that according to genotype all the factors were significant ($P<0.05$). The birth type, however, ear length, chest circumference, cannon circumference, body length, rump circumference, chest depth and body height of lambs were not significant ($P>0.05$), while ear width and height at rump were significant ($P<0.05$). Meanwhile, according to sex ear length, chest circumference, chest depth, cannon circumference, body length, rump circumference, and body height of lambs were not significant ($P>0.05$), while the other parameters ear width and height at rump were all found to be significant ($P<0.05$) for average body measurements of the lambs.

In the first month body measurement of the lambs, between the breed of Akkaraman and Bafra genotype it was seen in this study that Akkaraman had all the highest measurement parameters ear length (11.18 ± 0.12 cm), ear width (6.30 ± 0.08 cm), body length (46.20 ± 0.97 cm), rump circumference (59.83 ± 0.99 cm), height at rump (53.25 ± 0.56 cm), chest circumference (59.33 ± 0.74 cm), chest depth (20.40 ± 0.28 cm), cannon circumference (7.50 ± 0.11 cm) and body height (53.95 ± 0.60 cm) than the Bafra genotype with ear length (8.48 ± 0.13 cm), ear width (5.17 ± 0.09 cm), body length (37.88 ± 1.05 cm), rump circumference (47.63 ± 1.08 cm), height at rump (46.88 ± 0.61 cm), chest circumference (47.96 ± 0.79 cm), chest depth (18.74 ± 0.31 cm), cannon circumference (6.16 ± 0.12 cm) and body height (46.60 ± 0.66 cm)

It was also seen in this study that the single lambs had more body measurements than the multiple births lambs (twin and triplet) regardless of breed, the ear length of single lambing had a mean of $(9.97 \pm 0.15 \text{ cm})$ which is higher than the multiple lambing $(9.69 \pm 0.11 \text{ cm})$ with an average mean of $(9.83 \pm 0.09 \text{ cm})$, the chest depth also showed that the single lambing $(19.75 \pm 0.34 \text{ cm})$ was higher than multiple $(19.39 \pm 0.25 \text{ cm})$ with an average mean of $(19.57 \pm 0.21 \text{ cm})$, the body length also showed that the single lambing mean $(42.45 \pm 1.17 \text{ cm})$ was higher than multiple $(41.63 \pm 0.87 \text{ cm})$ with average mean of $(42.04 \pm 0.71 \text{ cm})$.

The sex also indicated that the male lambs had larger mean body measurements than the female lambs in the study. The lambs rump circumference showed that the male lambing mean $(54.11 \pm 1.02 \text{ cm})$ was higher than female $(53.34 \pm 1.02 \text{ cm})$ with average mean of $(53.73 \pm 0.74 \text{ cm})$, the cannon circumference showed that the male lambing mean $(6.86 \pm 0.11 \text{ cm})$ was higher than female $(6.79 \pm 0.11 \text{ cm})$ with an average mean of $(6.83 \pm 0.08 \text{ cm})$, the height at rump showed that the male lambs mean $(51.00 \pm 0.57 \text{ cm})$ was higher than female lambs $(49.13 \pm 0.58 \text{ cm})$ with an average mean of $(50.06 \pm 0.42 \text{ cm})$.

Table 4.6. Least square means ($\pm$ SE) for first month measurements of lambs body (cm)

Factors	n	Ear Length	Ear Width	Body Length	Rump Circumference	Height at rump	Chest Circumference	Chest Depth	Cannon Circumference	Body Height
Genotype		**	**	**	**	**	**	**	**	**
Akkaraman	40	11.18 $\pm$ 0.12	6.30 $\pm$ 0.08	46.20 $\pm$ 0.97	59.83 $\pm$ 0.99	53.25 $\pm$ 0.56	59.33 $\pm$ 0.74	20.40 $\pm$ 0.28	7.50 $\pm$ 0.11	53.95 $\pm$ 0.60
Bafra	40	8.48 $\pm$ 0.13	5.17 $\pm$ 0.09	37.88 $\pm$ 1.05	47.63 $\pm$ 1.08	46.88 $\pm$ 0.61	47.96 $\pm$ 0.79	18.74 $\pm$ 0.31	6.16 $\pm$ 0.12	46.60 $\pm$ 0.66
Birth type		Ns	Ns	Ns	Ns	**	Ns	Ns	ns	ns
Single	29	9.97 $\pm$ 0.15	5.78 $\pm$ 0.10	42.45 $\pm$ 1.17	54.82 $\pm$ 1.20	51.07 $\pm$ 0.68	54.71 $\pm$ 0.89	19.75 $\pm$ 0.34	6.88 $\pm$ 0.13	51.28 $\pm$ 0.73
Multiple	51	9.69 $\pm$ 0.11	5.69 $\pm$ 0.08	41.63 $\pm$ 0.87	52.58 $\pm$ 0.89	49.06 $\pm$ 0.51	52.58 $\pm$ 0.66	19.39 $\pm$ 0.25	6.77 $\pm$ 0.09	49.27 $\pm$ 0.54
Sex		Ns	**	Ns	Ns	**	Ns	Ns	ns	ns
Female	40	9.74 $\pm$ 0.13	5.56 $\pm$ 0.09	40.77 $\pm$ 0.99	53.34 $\pm$ 1.02	49.13 $\pm$ 0.58	52.79 $\pm$ 0.76	19.43 $\pm$ 0.29	6.79 $\pm$ 0.11	49.88 $\pm$ 0.62
Male	40	9.91 $\pm$ 0.12	5.91 $\pm$ 0.08	43.30 $\pm$ 0.98	54.11 $\pm$ 1.02	51.00 $\pm$ 0.57	54.49 $\pm$ 0.75	19.72 $\pm$ 0.29	6.86 $\pm$ 0.11	50.67 $\pm$ 0.62
Overall Mean	80	9.83 $\pm$ 0.09	5.74 $\pm$ 0.06	42.04 $\pm$ 0.71	53.73 $\pm$ 0.74	50.06 $\pm$ 0.42	53.64 $\pm$ 0.54	19.57 $\pm$ 0.21	6.83 $\pm$ 0.08	50.28 $\pm$ 0.45

** : $P < 0.05$, ns: non-significant

4.5.2 Second month body measurement of lambs

The average body measurement of second month of lambs was important in this study. The descriptive statistics of the result for factors of lamb body measurements were given in Table 4.5.

The mean and standard deviation for lambs body measurement of both sexes are reported by breed of lambs. i.e. Akkaraman and Bafra lambs in Table 4.5. In this study it was noticed that both sexes of Akkaraman lambs had a higher mean than the sexes of the Bafra lambs genotype within all the parameters that were tested. According to chest circumference the Akkaraman male lambs had (73.75 cm) and the female lambs had (74.40 cm) while the Bafra male lambs (61.35 cm) and the female lambs had (57.35 cm), according to body length also the Akkaraman lambs had a higher body mean measurement taken in this study than the Bafra lambs with the male of Akkaraman lambs (63.40 cm) female lambs (61.95 cm) and Bafra male lambs (52.30 cm) female lambs (49.60 cm). The chest depth also shows that the Akkaraman lambs had a higher body mean measurement than the Bafra lambs with Akkaraman male lambs (24.50 cm), female lambs (24.35 cm) while Bafra male lambs (22.40 cm), female lambs (20.25 cm). However, within the breed the measurement shows that the male lambs sex had higher body measurements than the female lambs sex except in the Akkaraman breed rump circumference and chest circumference which showed that the female lambs body measurement was slightly higher than the male lambs. The rump circumference of the Akkaraman male lambs (77.05 cm) was lesser than the female lambs (77.20 cm), the body height showed that the Akkaraman male lambs (61.35 cm) was greater than the female lambs with (59.80 cm), the height at rump also showed that the male Akkaraman lambs (61.70 cm) was greater than the female lambs (59.50 cm). In the Bafra genotype it also shows that the male lambs had higher body measurements than the female lambs according to this study body height male lambs (53.70 cm) and female lambs (50.70 cm), cannon circumference male lambs (7.20 cm) and female lambs (6.95 cm).

Table 4.7. Descriptive statistics for second month body measurement of lambs (cm)

Body Measurement	Akkaraman (n=40)				Bafra (n=40)		
	Sex (n=20/20)	Mean	Sd	CV,%	Mean	Sd	CV,%
Ear Length	Female	11.45	0.510	4.45	8.80	0.410	4.65
	Male	11.55	0.759	6.57	9.10	0.641	7.04
Ear Width	Female	6.75	0.444	6.57	5.00	0.000	0.00
	Male	6.75	0.444	6.57	5.35	0.489	9.14
Body Length	Female	61.95	3.720	6.00	49.60	3.169	6.38
	Male	63.40	4.185	6.60	52.30	4.001	7.65
Rump Circumference	Female	77.20	5.979	7.74	56.45	5.753	10.19
	Male	77.05	7.605	9.87	62.70	4.747	7.57
Height at rump	Female	59.50	3.220	5.41	51.15	3.438	6.72
	Male	61.70	3.080	4.99	54.35	3.746	6.89
Chest Circumference	Female	74.40	6.261	8.41	57.35	3.964	6.91
	Male	73.75	7.144	9.68	61.35	5.081	8.28
Chest Depth	Female	24.35	4.043	16.60	20.25	1.164	5.74
	Male	24.50	3.818	15.58	22.40	1.847	8.24
Cannon Circumference	Female	8.35	0.875	10.47	6.95	0.224	3.22
	Male	8.45	0.686	8.11	7.20	0.523	7.26
Body Height	Female	59.80	1.795	3.00	50.70	2.364	4.66
	Male	61.35	2.978	4.85	53.70	3.541	6.59

CV: coefficient of variation, Sd: Standard deviation

Table 4.7. shows according to genotype all the factors were significant ($P<0.05$). According to lambs birth type however, ear length, ear width, chest circumference, cannon circumference and body height were significantly affected ($P<0.05$), while body length, rump circumference, height at the rump, chest depth were not significant ($P>0.05$). Meanwhile, according to lambs sex ear length, ear width, chest circumference, chest depth, cannon circumference were not significantly affected ($P>0.05$), while the other parameters body length, rump circumference, height at rump and body height were all found to be significant ($P<0.05$) for average body measurements of the lambs.

In the second month body measurement of the lambs, between the breed of Akkaraman lambs and Bafra lambs genotype it was seen in this study that Akkaraman lambs had all the highest measurement parameters ear length (11.50 ± 0.09 cm), ear width (6.75 ± 0.06 cm), body length (62.68 ± 0.59 cm), rump circumference (77.13 ± 0.98 cm), height at rump (60.60 ± 0.52 cm), chest circumference (74.08 ± 0.89 cm), chest depth (24.42 ± 0.48

cm), cannon circumference (8.40 ± 0.09 cm) and body height (60.58 ± 0.42 cm) than the Bafra lambs genotype with ear length (9.05 ± 0.09 cm), ear width (5.25 ± 0.07 cm), body length (51.32 ± 0.64 cm), rump circumference (60.35 ± 1.06 cm), height at rump (53.28 ± 0.56 cm), chest circumference (60.23 ± 0.97 cm), chest depth (21.47 ± 0.52 cm), cannon circumference (7.18 ± 0.10 cm) and body height (52.68 ± 0.46 cm).

Single lambs had larger body measurements than the multiple lambs birth (twin and triplet) regardless of breed, the ear length of single lambing had a mean of (10.46 ± 0.11 cm) which is higher than the multiple lambing (10.09 ± 0.08 cm) with an average mean of (10.28 ± 0.07 cm), the chest depth also showed that the single lambing (23.21 ± 0.58 cm) was higher than multiple lambing (22.68 ± 0.43 cm) with an average mean of (22.95 ± 0.35 cm), the body length also showed that the single lambing mean (57.67 ± 0.72 cm) was higher than multiple lambing (56.32 ± 0.53 cm) with average mean of (56.99 ± 0.44 cm).

The sex indicated that the male lambs had larger mean body measurements than the female lambs in the study. The rump circumference showed that the male lambs mean (70.23 ± 0.99 cm) was higher than female lambs (67.25 ± 1.00 cm) with an average mean of (68.74 ± 0.72 cm), the cannon circumference showed that the male lambs mean (7.87 ± 0.09 cm) was higher than female lambs (7.71 ± 0.09 cm) with an average mean of (7.79 ± 0.07 cm), the height at rump showed that the male lambs mean (58.27 ± 0.53 cm) was higher than female lambs (55.62 ± 0.53 cm) with average mean of (56.94 ± 0.38 cm).

Table 4.8. Least square means ($\pm$ SE) for second month measurements of lambs body (cm)

Factors	n	Ear Length	Ear Width	Body length	Rump Circumference	Height at Rump	Chest Circumference	Chest Depth	Cannon Circumference	Body Height
Genotype		**	**	**	**	**	**	**	**	**
Akkaraman	40	11.50 $\pm$ 0.09	6.75 $\pm$ 0.06	62.68 $\pm$ 0.59	77.13 $\pm$ 0.98	60.60 $\pm$ 0.52	74.08 $\pm$ 0.89	24.42 $\pm$ 0.48	8.40 $\pm$ 0.09	60.58 $\pm$ 0.42
Bafra	40	9.05 $\pm$ 0.09	5.25 $\pm$ 0.07	51.32 $\pm$ 0.64	60.35 $\pm$ 1.06	53.28 $\pm$ 0.56	60.23 $\pm$ 0.97	21.47 $\pm$ 0.52	7.18 $\pm$ 0.10	52.68 $\pm$ 0.46
Birth type		**	**	Ns	Ns	**	**	Ns	**	**
Single	29	10.46 $\pm$ 0.11	6.13 $\pm$ 0.07	57.67 $\pm$ 0.72	70.15 $\pm$ 1.18	57.91 $\pm$ 0.62	68.76 $\pm$ 1.08	23.21 $\pm$ 0.58	7.97 $\pm$ 0.12	57.49 $\pm$ 0.51
Multiple	51	10.09 $\pm$ 0.08	5.87 $\pm$ 0.06	56.32 $\pm$ 0.53	67.33 $\pm$ 0.88	55.97 $\pm$ 0.46	65.55 $\pm$ 0.81	22.68 $\pm$ 0.43	7.60 $\pm$ 0.09	55.76 $\pm$ 0.38
Sex		Ns	Ns	**	**	**	Ns	Ns	Ns	**
Female	40	10.18 $\pm$ 0.09	5.91 $\pm$ 0.06	55.98 $\pm$ 0.61	67.25 $\pm$ 1.00	55.62 $\pm$ 0.53	66.36 $\pm$ 0.92	22.38 $\pm$ 0.49	7.71 $\pm$ 0.09	55.51 $\pm$ 0.43
Male	40	10.37 $\pm$ 0.09	6.08 $\pm$ 0.06	58.02 $\pm$ 0.60	70.23 $\pm$ 0.99	58.27 $\pm$ 0.53	67.95 $\pm$ 0.91	23.52 $\pm$ 0.49	7.87 $\pm$ 0.09	57.74 $\pm$ 0.43
Overall Mean	80	10.28 $\pm$ 0.07	5.99 $\pm$ 0.05	56.99 $\pm$ 0.44	68.74 $\pm$ 0.72	56.94 $\pm$ 0.38	67.15 $\pm$ 0.66	22.95 $\pm$ 0.35	7.79 $\pm$ 0.07	56.63 $\pm$ 0.31

** $\cdot$ P<0.05, ns: non-significant

4.5.3 Lamb body measurement for the third month

The mean and standard deviation for body measurement of both sexes are reported by breed of lambs. i.e. Akkaraman lambs and Bafra lambs in Table 4.8. In this study, it was discovered that both sexes of Akkaraman lambs breed had a higher mean and standard deviation than the sexes of the Bafra lambs genotype within all the parameters that were tested.

The chest depth also shows that the Akkaraman lambs had a higher body mean measurement than the Bafra lambs with Akkaraman male lambs (33.03 cm), female lambs (31.65 cm) while Bafra male lambs (24.40 cm), female lambs (26.05 cm). According to Chest circumference the Akkaraman male lambs had (82.35 cm) and the female lambs had (78.25 cm) while the Bafra male lambs (69.75 cm) and the female lambs had (64.20 cm), according to body length also the Akkaraman lambs had a higher body measurement taken in this study than the Bafra lambs with the male of Akkaraman lambs (65.35 cm) female lambs (61.85 cm) and Bafra male lambs (60.80 cm) female lambs (58.30 cm). However, within the breed the measurement shows that the male lambs sex had higher body measurements than the female lambs sex except in the ear width and chest depth in the Bafra genotype in which the male lambs had less body measurement than the female lambs in this study.

The rump circumference of the Akkaraman male lambs (84.05 cm) was greater than the female lambs (78.75 cm), the body height also showed that the Akkaraman male lambs (69.60 cm) was also greater than the female lambs with (66.65 cm), the height at rump also showed that the male Akkaraman lambs (68.30 cm) was greater than the female lambs (65.05 cm). Bafra genotype shows that the male lambs had higher body measurements than the female lambs according to this study except for the chest depth and ear width as stated earlier, body height for male lambs (62.65 cm) and female lambs (58.60 cm), cannon circumference male lambs (8.75 cm) and female lambs (8.15 cm) while the ear width for the female Bafra lambs was found to be (5.85 cm) which was slightly higher than the male lambs (5.80 cm) and the chest depth for female lambs (26.05 cm) which was slightly higher than the male lambs (24.40 cm).

Table 4.9. Descriptive statistics for third month body measurement of lambs (cm)

Body Measurement	Sex (n=20/20)	Akkaraman (n=40)			Bafra (=40)		
		Mean	Sd	CV,%	Mean	Sd	CV,%
Ear Length	Female	13.40	0.82	6.13	10.30	0.865	8.39
	Male	13.55	0.76	5.60	10.50	0.688	6.55
Ear Width	Female	7.10	0.31	4.34	5.85	0.366	6.26
	Male	7.40	0.50	6.79	5.80	0.410	7.08
Body Length	Female	61.85	5.27	8.53	58.30	4.846	8.31
	Male	65.35	7.36	11.27	60.80	4.938	8.12
Rump Circumference	Female	78.75	7.63	9.69	65.50	5.395	8.24
	Male	84.05	5.83	6.93	73.05	7.316	10.02
Height at rump	Female	65.05	3.71	5.70	56.05	3.137	5.60
	Male	68.30	3.91	5.72	58.50	3.220	5.50
Chest Circumference	Female	78.25	5.71	7.30	64.20	4.916	7.66
	Male	82.35	8.07	9.80	69.75	5.646	8.10
Chest Depth	Female	31.65	1.73	5.47	26.05	2.395	9.19
	Male	33.03	2.89	8.75	24.40	3.378	13.84
Cannon Circumference	Female	9.25	0.79	8.50	8.15	0.366	4.50
	Male	9.45	0.60	6.40	8.75	0.550	6.29
Body Height	Female	66.65	3.60	5.40	58.60	4.406	7.52
	Male	69.60	4.64	6.66	62.65	4.738	7.56

CV: coefficient of variation, Sd: Standard deviation

Table 4.9. shows Least Square Means and effect of factors were determined. According to genotype all the factors were significant ($P<0.05$). According to birth type of lambs however, ear length, ear width, rump circumference and chest depth were not significantly affected ($P>0.05$), while body length, height at rump, chest circumference, cannon circumference and body height were significant ($P<0.05$). Meanwhile according to lambs sex ear length, ear width and chest depth were not significantly affected ($P>0.05$), while the other parameters body length, rump circumference, height at rump, chest circumference, cannon circumference and body height were all found to be significant ($P<0.05$) for average body measurements of the lambs.

In the weaning age (90 days), body measurement of the lambs, between the breed of Akkaraman lambs and Bafra lambs genotype, it was seen in this study that Akkaraman lambs had all the highest measurement parameters, ear length (13.00 ± 0.16 cm), ear width (7.25 ± 0.07 cm), body length (63.55 ± 0.86 cm), rump circumference (81.23 ± 1.05 cm), height at rump (66.55 ± 0.55 cm), chest circumference (80.23 ± 0.92 cm), chest depth (32.45 ± 0.35 cm), cannon circumference (9.35 ± 0.09 cm) and body height (68.05 ± 0.65 cm) than the Bafra lambs genotype with ear length (10.42 ± 0.17 cm), ear width (5.80 ± 0.07 cm), Body length (60.58 ± 0.93 cm), rump circumference (69.65 ± 1.14 cm),

height at rump (57.81 ± 0.59 cm), chest circumference (68.23 ± 0.99 cm), chest depth (27.91 ± 0.38 cm), cannon circumference (8.53 ± 0.10 cm) and body height (61.49 ± 0.70 cm).

It was also seen in this study that the single lambing had more body measurements than the multiple lambing (twin and triplet) regardless of breed except the ear width in which multiple lambing (6.57 ± 0.06 cm), was higher than the single lambing (6.48 ± 0.08 cm) with average mean of (6.53 ± 0.05 cm). the ear length of single lambing had a mean of (11.75 ± 0.19 cm) which is higher than the multiple lambing (11.67 ± 0.14 cm) with average mean of (11.71 ± 0.12 cm), the chest depth also showed that the single lambing (24.66 ± 0.59 cm) was higher than multiple lambing (24.12 ± 0.44 cm) with an average mean of (24.39 ± 0.36 cm), the body length also showed that the single lambing mean (63.94 ± 1.04 cm) was higher than multiple lambing (60.19 ± 0.77 cm) with an average mean of (62.07 ± 0.63 cm).

The sex also indicated that the male lambs had larger mean body measurements than the female lambs in the study. The rump circumference showed that the male lambs mean (78.62 ± 1.07 cm) was higher than female lambs (72.25 ± 1.08 cm) with an average mean of (75.44 ± 0.77 cm), the cannon circumference showed that the male lambs mean (9.14 ± 0.09 cm) was higher than female lambs (8.74 ± 0.09 cm) with average mean of (8.94 ± 0.07 cm), the height at rump showed that the male lambs mean (63.59 ± 0.56 cm) was higher than female lambs (60.77 ± 0.56 cm) with average mean of (62.18 ± 0.40 cm).

Table 4.10. Least square means ($\pm$ SE) for third month measurements of lamb's body (cm)

Factors	n	Ear Length	Ear Width	Body Length	Rump Circumference	Height at Rump	Chest Circumference	Chest Depth	Cannon Circumference	Body Height
Genotype		**	**	**	**	**	**	**	**	**
Akkaraman	40	13.00 $\pm$ 0.16	7.25 $\pm$ 0.07	63.55 $\pm$ 0.86	81.23 $\pm$ 1.05	66.55 $\pm$ 0.55	80.23 $\pm$ 0.92	32.45 $\pm$ 0.35	9.35 $\pm$ 0.09	68.05 $\pm$ 0.65
Bafra	40	10.42 $\pm$ 0.17	5.801 $\pm$ 0.07	60.58 $\pm$ 0.93	69.65 $\pm$ 1.14	57.81 $\pm$ 0.59	68.23 $\pm$ 0.99	27.91 $\pm$ 0.38	8.53 $\pm$ 0.10	61.49 $\pm$ 0.70
Birth type		Ns	Ns	**	Ns	**	**	ns	**	**
Single	29	11.75 $\pm$ 0.19	6.48 $\pm$ 0.08	63.94 $\pm$ 1.04	76.11 $\pm$ 1.27	63.16 $\pm$ 0.66	76.51 $\pm$ 1.11	24.66 $\pm$ 0.59	9.08 $\pm$ 0.11	66.35 $\pm$ 0.78
Multiple	51	11.67 $\pm$ 0.14	6.57 $\pm$ 0.06	60.19 $\pm$ 0.77	74.76 $\pm$ 0.94	61.21 $\pm$ 0.49	71.95 $\pm$ 0.83	24.12 $\pm$ 0.44	8.79 $\pm$ 0.08	63.19 $\pm$ 0.58
Sex		Ns	Ns	**	**	**	**	ns	**	**
Female	40	11.61 $\pm$ 0.16	6.46 $\pm$ 0.07	60.61 $\pm$ 0.88	72.25 $\pm$ 1.08	60.77 $\pm$ 0.56	71.86 $\pm$ 0.94	24.66 $\pm$ 0.50	8.74 $\pm$ 0.09	63.05 $\pm$ 0.67
Male	40	11.81 $\pm$ 0.16	6.59 $\pm$ 0.07	63.52 $\pm$ 0.87	78.62 $\pm$ 1.07	63.59 $\pm$ 0.56	76.59 $\pm$ 0.94	24.12 $\pm$ 0.50	9.14 $\pm$ 0.09	66.49 $\pm$ 0.66
Overall Mean	80	11.71 $\pm$ 0.12	6.53 $\pm$ 0.05	62.07 $\pm$ 0.63	75.44 $\pm$ 0.77	62.18 $\pm$ 0.40	74.23 $\pm$ 0.68	24.39 $\pm$ 0.36	8.94 $\pm$ 0.07	64.77 $\pm$ 0.48

**: $P < 0.05$, ns: non-significant

4.6 Body Measurement and Live Weight of Matured Sheep

Under the management condition of Nigde Omer Halisdemir University Ayhan Sahenk Agricultural Research and Application Centre, the body measurement and live weight of matured sheep was an essential concern in this study.

Table 4.11. Descriptive statistics for matured body measurement of sheep (cm)

Body Measurements	Sex	Akkaraman (n=27)				Bafra (n=25)			
		n	Mean	Sd	CV,%	n	Mean	Sd	CV,%
Body Height	Female	20	74.35	1.76	3.98	20	70.45	2.44	3.46
	Male	7	84.29	14.16	14.84	5	77.00	7.78	10.10
Body Length	Female	20	70.95	4.47	6.65	20	66.25	3.34	5.04
	Male	7	93.71	8.67	7.90	5	87.80	2.17	2.47
Cannon Circumference	Female	20	8.80	0.41	5.84	20	8.35	0.49	5.86
	Male	7	11.29	0.95	9.51	5	10.20	0.84	8.20
Chest Circumference	Female	20	101.70	3.92	8.68	20	88.85	6.18	6.96
	Male	7	126.29	5.96	10.31	5	107.40	9.81	9.14
Chest Depth	Female	20	33.80	1.79	5.95	20	31.25	1.02	3.26
	Male	7	45.14	4.53	9.97	5	41.60	3.51	8.43
Ear Length	Female	20	15.20	0.89	15.69	20	11.50	1.00	8.70
	Male	7	14.29	3.25	20.89	5	11.80	0.84	7.09
Ear Width	Female	20	8.95	0.69	16.16	20	6.85	0.75	10.88
	Male	7	8.43	1.27	14.71	5	7.20	0.45	6.21
Height at rump	Female	20	74.25	3.61	5.06	20	70.05	2.24	3.19
	Male	7	91.71	6.63	9.20	5	82.40	7.09	8.61
Rump Circumference	Female	20	108.30	4.71	8.82	20	94.45	6.40	6.78
	Male	7	127.14	7.97	14.07	5	102.60	14.47	14.10
Live Weight	Female	20	69.18	7.53	23.23	20	46.42	6.40	13.78
	Male	7	118.34	15.74	26.99	5	74.96	16.42	21.91

CV: Coefficient of variation, Sd: Standard deviation

The Least Square Means for sheep body measurement is presented in Table 4.11. the genotype had a significant effect ($P<0.05$), on all the factors live weight, ear length, ear width, body length, rump circumference, height at rump, chest circumference, chest depth, cannon circumference and body height. All the parameters used in this study between the breed of Akkaraman sheep and of Bafra sheep genotype showed that the Akkaraman breed sheep had the higher mean difference compared to the Bafra sheep genotype. The mean ear length of Akkaraman breed sheep (14.87 ± 0.30 cm) was found higher than (11.44 ± 0.33 cm) of Bafra genotype sheep with the overall mean ear length found as (13.15 ± 0.24 cm), the rump circumference also showed that (116.60 ± 1.54 cm) of Akkaraman sheep breed was greater than (100.34 ± 1.65 cm) of Bafra genotype sheep, the cannon circumference also showed that (9.98 ± 0.12 cm) of Akkaraman sheep breed was greater than (9.38 ± 0.13 cm) of Bafra genotype sheep, the mean body height of the

Akkaraman sheep breed (78.96 ± 1.21 cm) was higher than that of Bafra sheep genotype with (74.30 ± 1.29 cm) with the overall mean body height found as (76.63 ± 0.96 cm).

Meanwhile, the sex body measurement sheep showed that it had no significant effect ($P > 0.05$) on ear length and ear width, while it had significant effect ($P < 0.05$) on other parameters live weight, body length, rump circumference, height at rump, chest circumference, chest depth, cannon circumference and body height.

All the parameters used in this study showed that the male body measurement parameters were found higher than the female except the ear length and ear width in which the female had higher mean result than the male. The mean live weight of the male ram was found at (97.98 ± 3.04 kg) was higher than that of female ewes with (57.80 ± 1.66 kg) with the overall live weight found as (77.89 ± 1.73 kg).

The mean ear length of the female ewe was (13.35 ± 0.23 cm) was found slightly higher than male ram (12.97 ± 0.42 cm) with the overall mean ear length of (13.15 ± 0.24 cm), the mean ear width of the female ewe was (7.90 ± 0.13 cm) was found higher than (7.76 ± 0.23 cm) of the ram with the overall mean ear width found as (7.83 ± 0.13 cm), the mean body height of the ram (78.96 ± 1.21 cm) was higher than that of ewe (74.30 ± 1.29 cm) with the overall mean body height found as (76.63 ± 0.96 cm), the mean cannon circumference of the ram (10.78 ± 0.17 cm) was higher than that of ewe (8.56 ± 0.09 cm) with the overall mean body height found as (9.68 ± 0.09 cm), the mean height at rump of the ram (87.39 ± 1.22 cm) was higher than that of ewe (72.15 ± 0.67 cm) with the overall mean body height found as (79.77 ± 0.69 cm), the mean chest circumference of the ram (117.23 ± 1.71 cm) was higher than that of ewe (95.28 ± 0.93 cm) with the overall mean body height found as (106.25 ± 0.97 cm).

Table 4.12. Least square means ($\pm$ SE) for measurements for Genotype and sex of sheep

Body Measurements	Genotype		Overall Mean	P
	Akkaraman (n=27)	Bafra (n=25)		
Live Weight (kg)	91.60 $\pm$ 2.18	64.19 $\pm$ 2.34	77.89 $\pm$ 1.73	**
Ear Length (cm)	14.87 $\pm$ 0.30	11.44 $\pm$ 0.33	13.15 $\pm$ 0.24	**
Ear Width (cm)	8.78 $\pm$ 0.17	6.88 $\pm$ 0.18	7.83 $\pm$ 0.13	**
Body Length (cm)	82.21 $\pm$ 0.97	77.23 $\pm$ 1.04	79.72 $\pm$ 0.77	**
Rump Circumference (cm)	116.60 $\pm$ 1.54	100.34 $\pm$ 1.65	108.47 $\pm$ 1.22	**
Height at Rump (cm)	82.45 $\pm$ 0.88	77.09 $\pm$ 0.94	79.77 $\pm$ 0.69	**
Chest Circumference (cm)	113.36 $\pm$ 1.23	99.15 $\pm$ 1.31	106.25 $\pm$ 0.97	**
Chest Depth (cm)	39.37 $\pm$ 0.48	36.59 $\pm$ 0.51	37.98 $\pm$ 0.38	**
Cannon Circumference (cm)	9.98 $\pm$ 0.12	9.38 $\pm$ 0.13	9.68 $\pm$ 0.09	**
Body Height	78.96 $\pm$ 1.21	74.30 $\pm$ 1.29	76.63 $\pm$ 0.96	**
	Sex		Overall Mean	P
	Female (n= 40)	Male (n=12)		
Live Weight, kg	57.80 $\pm$ 1.66	97.98 $\pm$ 3.04	77.89 $\pm$ 1.73	**
Ear Length (cm)	13.35 $\pm$ 0.23	12.97 $\pm$ 0.42	13.15 $\pm$ 0.24	Ns
Ear Width (cm)	7.90 $\pm$ 0.13	7.76 $\pm$ 0.23	7.83 $\pm$ 0.13	Ns
Body Length (cm)	68.60 $\pm$ 0.74	90.84 $\pm$ 1.35	79.72 $\pm$ 0.77	**
Rump Circumference (cm)	101.36 $\pm$ 1.17	115.56 $\pm$ 2.14	108.47 $\pm$ 1.22	**
Height at rump (cm)	72.15 $\pm$ 0.67	87.39 $\pm$ 1.22	79.77 $\pm$ 0.69	**
Chest Circumference (cm)	95.28 $\pm$ 0.93	117.23 $\pm$ 1.71	106.25 $\pm$ 0.97	**
Chest Depth (cm)	32.53 $\pm$ 0.36	43.43 $\pm$ 0.66	37.98 $\pm$ 0.38	**
Cannon Circumference (cm)	8.56 $\pm$ 0.09	10.78 $\pm$ 0.17	9.68 $\pm$ 0.09	**
Body Height (cm)	72.40 $\pm$ 0.92	80.86 $\pm$ 1.68	76.63 $\pm$ 0.96	**

** : P<0.05, ns: non-significant

4.7 Testicular Measurement of Rams

Under the management condition of Nigde Omer Halisdemir University Ayhan Sahenk Agricultural Research and Application Centre, the live body testicle measurement of rams from both breed was an important consideration to this part of study. The Least Square Means for factors of ram testicular measurements was given in Table 4.13.. The scrotum length of the Akkaraman ram breed was (18.71 $\pm$ 0.35 cm) which is larger than (18.60 $\pm$ 0.42 cm) of the Bafra ram genotype, the scrotum circumference of the Akkaraman ram breed was (31.57 $\pm$ 1.06 cm) which is larger than (30.20 $\pm$ 1.25 cm) of the Bafra ram genotype, the testicle length of the Akkaraman ram breed was (6.66 $\pm$ 1.14 cm) which is larger than (6.34 $\pm$ 1.17 cm) of the Bafra ram genotype, the testicle circumference of the Akkaraman ram breed was (17.57 $\pm$ 1.41cm) which is larger than (15.60 $\pm$ 1.67 cm) of the Bafra ram genotype and the testes volume of the Akkaraman ram breed was (266.52 $\pm$ 22.28 cm³) which is larger than (230.83 $\pm$ 26.36 cm³) of Bafra ram genotype. With least square means and effect of investigated factors were found not to be significant (P>0.05) for the rams of both breeds. The result of this study in the

testicular measurements between the breeds showed that the Akkaraman ram breed had larger testicular traits than the Bafra ram genotype. However, the measurement did not significantly affect the testicular traits of both breeds.

Table 4.13. Least square means ($\pm$ SE) for testicular measurements of rams

Testicle traits	Akkaraman (n=7)	Bafra (n=5)	P
Scrotum length (cm)	18.71 $\pm$ 0.35	18.60 $\pm$ 0.42	Ns
Scrotum circumference (cm)	31.57 $\pm$ 1.06	30.20 $\pm$ 1.25	Ns
Testicle length (cm)	6.66 $\pm$ 1.14	6.34 $\pm$ 1.17	Ns
Testicle circumference (cm)	17.57 $\pm$ 1.41	15.60 $\pm$ 1.67	Ns
Testes volume (cm ³)	266.52 $\pm$ 22.28	230.83 $\pm$ 26.36	Ns

ns:non significant (P>0.05)

CHAPTER V

DISCUSSION

5.1 Reproductive Performance of Ewes

Many studies had been performed on the assessment of reproductive performance of different sheep breeds (Yalcin and Aktas, 1976; Vanli et al., 1990; Ozbey and Akcan, 2000; Esen and Ozbey, 2002; Mohammedi et al., 2013; Ozturk and Pembeci, 2016). The average lambing rate (LR), infertility rate (IR), single lambing rate (SLR) twinning rate (TWR), fecundity (FEC), litter size (LITS), total birth weight (TBW), total weaning weight (TWW) of the Akkaraman breed were 85.29%, 14.71%, 68.97, 31.03%, 1.12, 1.31, 6.72 kg and 46.65 kg from Table 4.1, while according to the Bafra genotype it was found to be 66.67%, 33%, 55%, 1.17, 1.75, 6.50 kg and 45.52 kg, and TRP (10%) respectively.

Ceyhan et al. (2019) in a study on Akkaraman sheep breed found that LR was 90.1%, which was higher than our value (85.29%) on Akkaraman and Bafra sheep (66.67%). The LR (85.29% Akkaraman) and (Bafra 66.67%) were found to have significant effect among the breeds ($P<0.01$). Kocakaya and Ozbeyaz (2019) in a research on Akkaraman sheep breed found the LR as 90.32% which controverts this finding. This study sheep LR found to be lower (94%) than the finding of Zom sheep by Seyrani et al. (2013). The sheep LR in this study between both breed was also found to be lower than (93.1%) in the study of Bafra sheep genotype by Gungor and Akcapinar (2013). The sheep LR of Akkaraman 85.29% was higher than the study on Ramlic sheep (69.4%) as reported by Ceyhan et al. (2010), while Bafra sheep LR 66.67% was lower than the study on Ramlic sheep (69.4%) by Ceyhan et al. (2010). LR value (86.38%) on Akkaraman sheep study by Ozturk and Buyuktekin (2018) was not in agreement with our finding.

Result of our research IR study was (14.71% Akkaraman), (33.33% Bafra) which significantly had effect ($P<0.01$) within sheep breeds and was different (30.6%) from a finding of Ceyhan et al. (2010) in a study of Ramlic sheep, in which high infertility could have been caused by the breed, mating season, supplementary feeding and management condition also the mating method. On the other hand, the rate (9.95) of

infertility in Akkarman sheep calculated by Ceyhan et al. (2019) is considerably lower than the finding of this study.

The result of FEC in this study was Akkaraman 1.12 and Bafra 1.17 lambs was found to not have significant effect ($P>0.05$) within the genotypes. Akcapinar et al. (2005) conducted a study on Bafra sheep genotypes and recorded a fecundity of 1.52 lambs which contradicts our study within both sheep group used. This result was higher than 1.09 lambs result of Seyrani et al. (2013) in Zom sheep and Ceyhan et al. (2019) in Akkaraman sheep. It was also higher than 0.79 lambs finding reported in Ramlic sheep by Ceyhan et al. (2010). FEC value found on Barki ewes 1.15 lambs by Abdallah et al. (2014) was not in agreement with our finding as it was higher than Akkaraman finding and lower than Bafra finding in our study. FEC was recorded on study of Kivircik sheep within in situ and ex situ production by Sezenlar et al. (2014) as 1.1 and 1.0 lambs which slightly corresponds with our value withing both groups. Reserach on Karakas sheep recorded a FEC value of 0.96 lambs by Bingol and Aygun (2013) which was less than our finding within both Akkaraman breed and Bafra sheep genotype.

Akkaraman LITS result on the study showed (1.31) and Bafra (1.75) lambs which was found to have significant effect ($P<0.01$) among the breed, LITS value of a research on Akkaraman breed finding was (1.46) which was advanced than our Akkaraman value (1.31) and less than our Bafra genotype value (Kocakaya and Ozbeyaz, 2019). Our LITS value contradict (1.17) result of Seyrani et al. (2013) in Zom sheep. It was also higher than (1.13) result of Ceyhan et al. (2010) in Ramlic sheep, while the Akkaraman LITS finding was lower than (1.67), value of Bafra by (Gungor and Akcapinar, 2013). LITS in the study of Akkaraman (1.12) and Chios and Akkaraman F_1 lambs (1.16) was reported differently than our study (1.31) and (1.75) by Unal Necmettin (2002). Ceyhan et al. (2019) connoted in a study on Akkaraman breed that LITS was (1.12) which was less than the findings of our study on Akkaraman (1.31) and (1.75) on Bafra crosbred sheep .In a study on Barki sheep LITS was found as (1.11) as reported by Abdalla et al. (2014) which slightly lesser than our finding. Gungor and Unal (2020) in a research on Bafra LITS (1.67) and Akkaraman breed LITS (1.27) is not in agreement with our finding due to the slight difference. Our LITS finding value on Bafra genotpe is higher than 1.54 and 1.67 in Bafra as reported in a previous research by (Halil et al., 2005) the reason may be due to different management, type of production etc.

The study result shown SLR in Akkaraman sheep breed (68.97) was higher than Bafra sheep genotype (35%). SLR value of Akkaraman sheep in this study was higher than (53.57%) result of Akkaraman sheep by Kocakaya and Ozbeyaz (2019). Similar study on Bafra sheep genotype (Adiguzel and Aksoy, 2015) reported that SLR was (37.66%) which was marginally closer than the Bafra sheep SLR (35%) finding in this study. Gungor and Akcapinar (2013) in a study of Bafra sheep genotype also reported the SLR as (48.3%) which was higher than our findings of Bafra sheep genotype SLR but lower than our SLR finding on Akkaraman sheep breed. Akcapinar et al. (2005) denoted in a study that SLR on Bafra sheep genotype was (44.7%) which contradicts our findings on Bafra sheep SLR (35%) and Akkaraman sheep (68.97%). Ceyhan et al. (2010) proposed in a study of Ramlic sheep that SLR value was found at (87.6%) and was higher than our finding.

Result on the study showed Bafra sheep genotype had more TWR (55%) than the Akkaraman sheep breed (31.03%) and had significant effect ($P < 0.01$) within the genotypes in the study. Bafra sheep genotype TWR of Akcapinar et al. (2005) valued at (44.0%) was less than Bafra sheep TWR of this result and higher than Akkaraman TWR of this result. Ceyhan et al. (2010) reported TWR value of Zom sheep at (12.4%), this finding was not in agreement with our finding. A study on Akkaraman sheep breed by Kocakaya and Ozbeyaz (2019) discussed TWR as (46.62%). Gungor and Akcapinar (2013) study on Bafra genotype found TWR at (38.3%) which was slightly higher than our finding in Akkaraman sheep and less TWR in Bafra sheep findings. A study denoted by Adiguzel and Aksoy (2015) on Bafra sheep genotype showed TWR at (57.28%) which was slightly close to our Akkaraman sheep breed value and higher than Bafra sheep genotype value in our study. The result was lower than twin rate 94.41% according to what (Mustafa and Ozturk, 2018) found out in a previous study. This may be due to the number of Bafra sheep genotype used in the study. Ceyhan et al. (2019) in a study on Akkaraman sheep breed found that TWR was (20.8%) which was less than the finding of this study on Akkaraman sheep (21.03%) and (55%) on Bafra genotype respectively.

There was no triplet lambing rate finding in this study on the Akkaraman sheep genotype but (10%) triple lambing rate was found in Bafra sheep genotype in this study. Our TRP result (10%) was lower than (13.4%) on Bafra sheep study as reported by

Gungor and Akcapinar (2013). The Akkaraman sheep TRP result was zero which agrees with the finding of Ramlic sheep study by Ceyhan et al. (2010). The finding of this study was also higher than a previous study of Bafra sheep genotype (4.75%) by Adiguzel and Aksoy (2015). Akcapinar et al. (2005) also reported that the TRP of Bafra sheep was (11.3%) which was slightly higher than our result (10%).

The ewe's pregnancy, the care she gives to her offspring after they are born and her capacity to make enough milk all have an impact on the viability of the lamb. It is also connected to the lamb's birth weight.

Between Akkaraman and Bafra ewe used in this study a number of male lamb birth was recorded at 93 lambs and 91 female lambs with an average percentage of 73.22% and 71.65%. The difference between the percentages of the sex was in agreement with the results reported by Unal et al. (2003) for Karayaka and Bafra sheep, Koncagul et al. (2013) for Zom sheep, Aktas et al. (2014) for Akkaraman sheep, and Ozturk and Pembeci (2016).

The results reported by Yavarifard et al. (2015) for total live weight at birth (4.35 kg) and total live weight at weaning (28.4 kg) in Mehraban sheep lambs and Mohammadi (2020) for Iran-Black sheep lambs (5.86 34.33 kg) are considerably lower than the values obtained for Akkaraman and Bafra lambs in this study. This may be due to care and feeding, breed and age at weaning.

5.2 Lamb Growth Performance

Numerous environmental (dam age, birth type, year, season, sex etc.), epigenetic and genetic influence (genotype) all supposedly have effect on lamb growth. In this research in the birth weight growth performance was found to be affected by the genotype, dam age and birth type ($P < 0.05$) while it wasn't affected by sex because it was not significant statistically ($P > 0.05$), with overall mean growth performance of 4.05 ± 0.05 kg. The result of this study lambs birth weight, 30, 60 and 90 days are 4.05 kg, 7.98 kg, 22.32 kg, and 29.57 kg is in agreement with Sakar and Erisek (2019) of Akkaraman lambs which is slightly similar with our result; with average birth weight 4.26 kg, average mean weight for second month 22.11 kg, and average weaning weight 30.14 kg.

Our lambs BW finding (4.05 kg) was less than the findings on Akkaraman lambs (4.39 kg) and Savak lambs (4.32 kg) by Unal, N (2002). The lambs BW result of this study (4.05 kg) was closely similar to the finding of Zom lambs BW (4.0 kg) by Seyrani et al. (2013). Gungor and Unal. (2020) study on Akkaraman lambs and Bafra crossbred lambs reported that BW and third month were (4.24 kg) and (27.51 kg) was closely similar with our findings (4.05 kg) and (29.57 kg) The result is also in agreement with the findings of some other studies except that sex was not significant in the birth weight of this study (Adiguzel et al., 2000; Ozcan et al., 2001; Unal et al., 2006) all found that the lamb growth performance was affected by genotype, age of dam, sex and type of birth. Gungor and Akcapinar (2013) with Bafra lambs crossbred shows result of 3.17 kg which was less than our finding (4.05 kg). Birth weight with an average mean of 4.05 ± 0.05 kg which ranged between 3.67 ± 0.08 , and 4.98 ± 0.03 kg based on the type of birth, dam age, genotype and sex of lambs. This result is slightly similar 3.60 ± 0.07 kg, and 4.40 ± 0.04 kg to findings in previous studies by (Dugunes et al., 1968). Ceyhan et al. (2019) in a study on Akkaraman breed found the lambs birth weight value at (4.23 kg) which was slightly higher than our finding (4.05 kg). Noyan and Ceyhan (2021) studied on Akkaraman breed and found the lambs BW as (4.07 kg) which was slightly higher than our result. Some findings reported that the lambs birth weight was significantly affected by dam age, sex of lamb and birth type; lambs from less aged ewes, females and multiple lambing i.e. twin or triplets were lighter. However in this study the lambs birth weight was significantly affected by dam age, genotype and birth type which was similar so some studies of Morkaraman lambs by (Boztepe and Ozturk, 1994) and Hemsin lambs by (Ozturk et al., 1996) and was different from another result Koyuncu et al. (2001). In this study the birth weight was heavier in female lambs than male lambs which was found similar in a previous study on Anatolian Merino sheep (Akkaya and Elicin, 1984) but was different in other studies (Arslan et al., 2003; Koyuncu et al., 2001; Ozturk et al., 2012).

The lambs mean weight in the first month of this study (7.98 kg) was lower than (11.63 kg) as reported in a research on Norduz lambs by Hasan Celiykyurek (2022) and was higher in the 60 day and 90 day compared to (17.29 kg), (24.51 kg) by Hasan Celiykyurek. (2022). A study performed by Sezenlar et al. (2014) on Kivircik sheep discovered the lambs mean average birth weight of in situ production as (4.2 kg) and ex situ production as (3.7 kg) which somehow contradicts our finding value (4.05 kg), it

was also reported that lambs mean weaning weight of Kivircik lambs at 90 days was (25.4 kg) on in situ production and (24.9 kg) on ex situ production which was not in agreement with our weaning weight value (29.57 kg).

Second month lambs live weight result however, the lambs growth performance was affected significantly by all the factors the birth type, sex, dam age and genotype ($P<0.05$). The overall mean growth performance of the second month in this study was 22.32 ± 0.44 kg. The effect of genotype significantly affected the second month lambs growth performances, which mean the Akkaraman lambs breed grew a bit better (25.12 ± 0.73 kg) than the Bafra lambs genotype (19.52 ± 0.58 kg).

Our lambs average weaning weight result (29.57 kg) was higher than the Zom lambs (22.06 kg) reported by Seyrani et al. (2013). Gungor and Unal (2020) proposed a study on Bafra genotype and Akkaraman breed lambs WW (27.51 kg) which was less than our study (29.57 kg). Ceyhan et al. (2019), on a study with Akkaraman sheep reported that lambs WW at 90 days was reported as (23.05 kg) which was less than our finding (29.57 kg). Noyan and Ceyhan (2021) in a study of Akkaraman breed also found lambs weaning weight average to be (24.18 kg) which was slightly less than our finding (29.57 kg). A study on Bafra crossbred lamb also shows that WW was found by (Gungor and Akcapinar, 2013) as 22.85 kg.

The effect of birth type on birth weight in this study was significant and similar to the findings of Akkaraman, Ramlic Karacabey Merino, Morkaraman, Awassi, Anatolian Merino sheep and Konya Merino by (Arslan et al., 2003; Boztepe and Ozturk, 1994; Ceyhan et al., 2010; Ozturk et al., 2012).

The dam age also significantly affected the lamb growth performance which mean the lambs from the older ewes had higher performance than the lambs from the younger ewes with mean live weight as found in this study as (23.61 ± 0.56 kg), (22.22 ± 0.82 kg) and (21.14 ± 0.84 kg) respectively. Dam age, birth type were significantly affected by BW on the study of Akkaraman breed as reported (Noyan and Ceyhan, 2021) which agrees with our finding.

The sex was also statistically significant to the lamb growth performance which shows that in this study the male lambs had greater performance in the second month (23.12 ± 0.54 kg) than the female lambs (21.53 ± 0.52 kg). Ceyhan et al. (2010) reported study on Ramlic sheep BW of male lambs (4.63 kg) and female lambs (4.20 kg) which contradicts our value male lambs (4.46 kg) and female lambs (4.54 kg).

The birth type also significantly affected the growth performances which mean the lambs from the single lambing (24.68 ± 0.52 kg) had higher performance than the lambs from the multiple lambing (21.53 ± 0.47 kg) and (20.76 ± 0.24 kg) respectively.

The study of the data reveals that environmental factors including the year of lambing, the form of operation, the form of birth, the gender of the lamb and age of the ewes have an impact on the advancement and growth of the lamb prior to the age of weaning.

The lambs average weaning weight in this study was found as 29.57 ± 0.61 kg, the effect of ewe age on the weaning weight was statistically not significant ($P > 0.05$), but weight was higher in the lambs from older ewes which agree with findings reported in some previous studies (Boztepe and Ozturk, 1994; Arslan et al., 2003) and was contradicted with other studies which showed that ewe age had significant effect on the weaning weight (Vanli et al., 1985). This is accounted for by the fact that periodic variations in environment and managerial variables exist.

The effect of sex on the weaning weight was significant ($P < 0.05$) and this result showed that the male lambs were heavier than the female lambs, which is similar to studies by (Arslan et al., 2003; Ceyhan et al., 2010; Daskiran et al., 2010; Ozturk et al., 2012) however, there is another study which found out that effect of sex was not significant on the weaning age as reported by Duzgunes et al. (1968).

Birth type effect on the weaning weight was significant ($P < 0.05$) in this study which was similar to a research made on Anatolian Merino sheep, Awassi, Akaraman, Konya Merino sheep, Mokaraman, Karacabey Merino sheep, by (Arslan et al., 2003; Boztepe and Ozturk, 1994; Ceyhan et al., 2010).

The effect of genotype significantly had effect to the weaning weight ($P<0.05$) in which the Akkaraman lambs breed had with 35.00 ± 1.01 kg was heavier than the Bafra lambs genotype with 24.14 ± 0.81 kg, which result was slightly similar to a previous study Akkaraman lambs 31.39 ± 0.37 kg and Bafra lambs 23.51 ± 0.30 kg by Omer and Necmettin (2020).

5.3 Daily Live Weight Gain of Lambs

The average daily live weight gain (ADLWG) of lambs from the birth to the weaning age Least Square Means was prepared in Table 4.3. In the ADLWG of the first month genotype and birth type were significant ($P<0.05$) while sex and dam age did not significantly affect ($P>0.05$) ADLWG with overall mean of 0.123 ± 0.01 kg. The result showed that from the birth to the first 30 days the lambs had an average of 0.123 kg. Which agree with a study that the genotype and birth type significantly affect the ADLWG of lambs (Vanli et al., 1985; Arslan et al., 2003), which mean the single lambing grows more daily live weight when compared to the multiple lambing and the Akkaraman breed grows more daily live weight than the Bafra genotype in the study. Seyrani et al. (2013) performed a study on Zom sheep which result in ADLWG of the lambs first month was (0.2 kg), the value was higher than our finding (0.123 kg). The result also showed that the dam age and sex did not statistically had effect on the daily live weight gain of the lambs. However this result contradicts a previous finding that states all factors significantly affect the lambs daily live weight (Vanli et al., 1985; Arslan et al., 2003). The study shows that the older ewes lamb were gaining better daily live weight than the younger ewes with the result showing 0.128 ± 0.01 kg from four years dam, 0.126 ± 0.01 kg from three years dam and 0.114 ± 0.01 kg from two years dam. The result also showed that the male lambs had better average daily live weight gain than the female lambs.

In the second month, ADLWG of all the factors significantly affected the live weight growth. Genotype, birth type, sex and dam age significantly had effect ($P<0.05$) on the daily live weight with overall mean of 0.301 ± 0.01 kg, which was reported on previous studies by (Vanli et al., 1985; Arslan et al., 2003) and is in agreement with this study. The Akkaraman lambs showed higher mean weight (0.337 ± 0.01 kg) than the Bafra lambs (0.264 ± 0.01 kg) according to the genotype. According to age of dam the ewe

with high years lambs were having better weight than the lambs of younger ewes (0.321 ± 0.01 kg), (0.301 ± 0.01 kg) and (0.280 ± 0.01 kg) respectively.

According to the birth type the single lambing had better daily live weight mean than the multiple lambing (0.340 ± 0.01 kg), (0.288 ± 0.01 kg) and (0.274 ± 0.02 kg). According to sex the male lambs had better (0.314 ± 0.01 kg) mean daily live weight than the female lambs (0.287 ± 0.01 kg) which was in agreement with previous findings of Morkaraman lambs by (Vanli et al., 1985; Arslan et al., 2003). Ceyhan et al. (2010) conducted a study on Ramlic sheep with ADLWG at weaning age is (0.287 kg) which was slightly synonymous to our value (0.281 kg).

Weaning age 90 days ADLWG genotype, birth type and sex were significant ($P < 0.05$) and dam age did not significantly had effect on the daily live weight gain ($P < 0.05$). The daily live weight was found with overall mean of 0.281 ± 0.01 kg.

The birth type significant affected the daily live weight gain on the weaning month in this study. The ADLWG of single lambing (0.302 ± 0.01 kg) were found higher than the twin lambing (0.265 ± 0.01 kg) and triplet lambing (0.275 ± 0.01 kg) in this study which is possible because the ewes that have single lambing tend to care only for the single lamb unlike the twin and triplets where multiple lambs depend on a single ewe. Thereby the single lambs have more daily live weight gain than the multiple lambs. The result is in agreement with the findings of Zandi lambs studies by (Dixit et al., 2001; Kalantar, 2003) all found that the body weight of single born through the ages with their average daily live weight were found higher than the twin and triplet lambs.

The dam age in this study showed that it was not statistically significant to the average daily live weight gain of the lambs however; the lambs from the older ewes (0.321 ± 0.01 kg) had higher daily live weight when compared to the lambs of younger ewes (0.301 ± 0.01 kg) and (0.280 ± 0.01 kg) which contradicts with the findings of Morkaraman research by Arslan et al. (2003).

The sex of lambs had effect significantly in the average daily live weight gain of the lambs. In this study it was seen that the male lambs had better mean average live weight (0.304 ± 0.01 kg) than the female lambs (0.257 ± 0.01 kg) which was in agreement of the

results found in Morkaraman lambs studies made by (Arslan et al., 2003; Vanli et al., 1985). Ceyhan et al. (2010) also performed a similar research on Ramlic sheep which resulted that the male lambs (0.304 kg) had higher ADLWG than the female lambs (0.270 kg) which agrees with the finding of our study. On the other hand, the value of ADLWG at weaning (0.208 kg) obtained in Akkaraman lambs by Ceyhan et al. (2019) is considerably lower than the value obtained for Akkaraman lambs. However, the statistically significant result of birth type, sex and age of dam on average live weight gain is different from the insignificant finding of this study for age of dam. The value of ADLWG at weaning (0.222 kg) obtained by Noyan and Ceyhan (2021) for Akkaraman lambs was considerably lower than the value obtained for Akkaraman lambs of this study, but similar to the significant effect of birth type, sex and age of dam in the present study.

5.4 Survival Rate of Lambs

In sheep breeding the survival rate (SR) of lambs is an important factor especially mostly before the age of weaning. Many factors of environment and genetics tends to affect the rate of survival of lambs which include the lamb sex, the lamb genotype, the dam age, birth type, weight of birth etc. the rate of survival of lambs is usually low after lambing in the first weeks especially when the weight of birth is high and low and usually develop till the weaning age or when the colostrum supply is deficient from the parent sheep.

In this study the Akkaraman sheep breed had the lowest liter size with their lambs having the highest survival rate with 99.1% while the Bafra sheep genotype had the highest liter size with their lambs having the lowest survival rate with 91.4%. This shows that the survival rate of the lambs was significantly affected by the genotype ($P<0.05$).

Result on the SR of Akkaraman lambs breed (99.1%) and Bafra lambs genotype (91.4%) in this study was found higher than the Bafra lambs result (84.1%) as reported by Gungor and Akcapinar (2013). Gungor and Unal (2020) experimented on a similar research which result was slightly similar than ours SR of Akkaraman lambs (94.23%) and Bafra lambs SR (89.89%). The SR of Ramlic lambs (94.9%) as reported in a study

by Ceyhan et al. (2010) was slightly similar to Bafra lambs genotype of this result but lesser than Akkaraman lambs SR of this study. Unal (2002) study on Akkaraman lambs SR was found at 91.3% which was lower than our value (99.1%) on Akkaraman lambs and also reported finding on Savak lambs breed with SR of 92% which contradicts our result. A study on Kivircik lambs SR by Sezenlar et al. (2014) showed that the SR of in situ lambs were 96.4% an SR of ex situ lambs were 90% which was close to our SR values.

The survival rate however wasn't significantly not affected by the dam age, birth type or sex of the lambs ($P>0.05$). The sex ($P>0.05$) showed that the female lambs with (97.8%) had more survival rate than the male lambs with (94.6%).

The result is in agreement with the findings of some other studies (Akcapinar et al., 2002; Unal et al., 2002; Unal et al., 2006) all which states that genotype affects the survival rate of lambs and dam age, birth type and sex of the lambs doesn't affect the survival rate of lambs.

Single lambing born had significant higher surviving rate than the twin and triple lambing born in this study which is also in agreement with previous study on Morkaraman and Akkaraman lambs by Akcapinar and Kadak (1982) and for certain crossbred and pure sheep (Odabasioglu et al., 1996; Ceyhan et al., 2011) however, lower surviving rate was reported on Akkaraman lambs (Akcapinar and Kadak, 1982). This difference in the survival rate of lambs within different researches may be due to the different management condition, management expertise, season of lambing, type of sheep breed etc.

The survival rate between the two lambs sex was closely similar to each other in the finding of this study and was seen to be not significant within the sex, which agrees with a finding in some previous studies by (Aydogan and Gul, 1992; Halil et al., 2005; Ozcan et al., 2003; Unal, 2000; Unal et al., 2003).

The male lambs showed less survival rate in the study compared to the female lambs which was in agreement in the finding of previous study (Akcapinar et al., 2000). This

may be because female lambs stay near their dams more often than male lambs as reported by (Gaudin et al., 2015) in a previous study.

The breed, lamb growth technique used in the farm, feeding period, birth type, sex of lambs and season may all play a role in the difference between the findings about the lamb survival rate from this study and other studies.

5.5 Body Measurements of Lambs

Body measurements of lambs were taken from 40 Akkaraman lamb breeds and 40 Bafra lambs genotypes in each month from birth consecutively to the weaning age (90 days). Body measurement is an important sign for body development (Kilic and Ozbeyaz, 2011). The lamb measurement was found to be increasing with age in this study which was in agreement with previous studies by (Al-Tarayrah and Tabbaa 1999; Balduzi, 1984; Shresta et al., 1984).

The overall average mean of lamb in this study in the first month, second month and third month was found to be less than the results found in previous studies by (Ambarcioglu et al., 2017; Necmettin 2022; Seyrani et al., 2012; Topal and Mecit, 2004). The result difference may be due to the difference in age of animal study material used and difference in breed.

In the first month lamb body measurements, according to genotype all the factors significantly affected ($P < 0.05$) the lamb body measurement within the breeds. It shows that in this study the mean lamb body measurement of Akkaraman lamb breed was higher than the Bafra lamb genotype. With Akkaraman lamb ear length (11.18 ± 0.12 cm) chest circumference (59.33 ± 0.74 cm), cannon circumference (7.50 ± 0.11 cm) chest depth (20.40 ± 0.28 cm) all higher than Bafra lamb genotype ear length (8.48 ± 0.13 cm) chest circumference (47.96 ± 0.79 cm) cannon circumference (6.16 ± 0.12 cm), chest depth (18.74 ± 0.31 cm) respectively. This result agreed with the finding of Unal (2022), in the study of Akkaraman lamb that the Akkaraman breeds are a largely variety of breed compared to other certain genotypes such as Bafra. The result was also in agreement with the findings of Gungor and Unal (2019), in the study of Akkaraman and

Bafra lambs that all the body measurement parameters of Akkaraman lamb were higher than that of Bafra lamb genotypes in the weaning age (90 days).

Ambarcioglu et al. (2017), performed a similar study on body measurements with Karacabey Merino lambs on the weaning age which findings was BL (56.19 cm), CD (94.33 cm), BH (68.41 cm), CCFR (94.33 cm) which was significantly similar to our research BL (62.07 cm), CD (24.39 cm), BH (64.77 cm), CCFR (74.23 cm).

The lamb birth type in this study statistically had no effect ($P>0.05$) on the body measurements of the lambs except the height at rump where it was significant ($P<0.05$) but was seen in the study that the single lambing had more body measurement than the multiple born lambing. The result showed that the single lambing had higher body measurement than the multiple lambing in all the parameters used i.e. single lambing body length (42.45 ± 1.17 cm), chest depth (19.75 ± 0.34 cm), and rump circumference (54.82 ± 1.20 cm) was higher than the multiple lambing body length (41.63 ± 0.87 cm), chest depth (19.39 ± 0.25 cm), rump circumference (52.58 ± 0.89 cm).

The overall average mean parameters used in this study were less than the study reported by Topal and Macit (2004), on Morkaraman lamb, which could be due to the difference in age of animal study materials.

The sex in this study did not significantly had effect ($P>0.05$) on all the parameters except the ear width and height at rump where it had significant effect ($P<0.05$) on lambs body measurement. The result showed that the male lamb had higher body measurement than the female lamb in all the parameters used i.e. male lamb body length (43.30 ± 0.98 cm), chest depth (19.72 ± 0.29 cm), rump circumference (54.11 ± 1.02 cm) was higher than the female lamb body length (40.77 ± 0.99 cm), chest depth (19.43 ± 0.29 cm), rump circumference (53.34 ± 1.02 cm). The result in this study was in agreement with a study by Seyrani et al. (2012) on Zom sheep which shows that the male lamb had higher body measurement than the female lamb.

The second month lamb body measurements of the study according to genotype, Akkaraman lamb breed and Bafra lamb genotype, all the factors were significant ($P<0.05$). Akkaraman lamb breed was higher than the Bafra lamb genotype, with

Akkaraman lamb ear length (11.50 ± 0.09 cm), chest circumference (74.08 ± 0.89 cm) cannon circumference (8.40 ± 0.09 cm) chest depth (24.42 ± 0.48 cm) all higher than Bafra lamb genotype ear length (9.05 ± 0.09 cm), chest circumference (60.23 ± 0.97 cm), cannon circumference (7.18 ± 0.10 cm) and chest depth (21.47 ± 0.52 cm) respectively. Result contrast finding of Unal (2022) in the study of Akkaraman lambs breed measurements. The result was also in agreement with the findings of Gungor and Unal (2020), in the study of Akkaraman lambs breed and Bafra lambs genotype that all the parameters of Akkaraman lambs were higher than that of Bafra lambs.

According to birth type however, ear length, ear width, chest circumference, height at rump, cannon circumference and body height were significantly affected ($P < 0.05$), while body length, rump circumference and chest depth were not significant ($P > 0.05$), but was seen in the study that the single lambs had more body measurement than the multiple born lambs. The result showed that the single lambing had higher body measurement than the multiple lambing in all the parameters used i.e. single lambing body length (57.67 ± 0.72 cm), chest depth (23.21 ± 0.58 cm), and rump circumference (70.15 ± 1.18 cm) was higher than the multiple body length (56.32 ± 0.53 cm), chest depth (22.68 ± 0.43 cm), rump circumference (67.33 ± 0.88 cm). This could be due to the fact that the single lambs had more care from the ewe sheep more than the multiple birth lambs which share nutrient from a single ewe sheep.

Sex of the lambs groups parameters, ear length, ear width, chest circumference, chest depth and cannon circumference were not significantly affected ($P > 0.05$), while the other parameters body length, rump circumference, height at rump and body height were all found to be significant ($P < 0.05$) for average body measurements of the lambs. The result showed that the male lamb sex had higher body measurement than the female lambs in all the parameters used i.e. male lambs body length (58.02 ± 0.60 cm), chest depth (23.52 ± 0.49 cm), rump circumference (70.23 ± 0.99 cm) was higher than the female lambs body length (55.98 ± 0.61 cm), chest depth (22.38 ± 0.49 cm), rump circumference (67.25 ± 1.00 cm). The result in this study was in agreement with a study by Seyrani et al. (2012) on Zom sheep which shows that the male lambs had higher body measurement than the female lambs.

The weaning month (90 days) lambs body measurements of this study connotes that Akkaraman lambs breed and Bafra lambs genotype, all the factors were significant ($P<0.05$). Which show that the Akkaraman lambs breed was higher than the Bafra lambs genotype, with Akkaraman lambs breed ear length (13.00 ± 0.16 cm) chest circumference (80.23 ± 0.92 cm) cannon circumference (9.35 ± 0.09 cm) chest depth (32.45 ± 0.35 cm) all higher than Bafra lambs genotype ear length (10.42 ± 0.17 cm) chest circumference (68.23 ± 0.99 cm), cannon circumference (8.53 ± 0.10 cm), chest depth (27.91 ± 0.38 cm) respectively.

Unal and Necmettin (2002), proposed a study on Akkaraman and Savak lambs then found a result which was different to the values of this study. They found out the Akkaraman lambs BL (53.61 cm), CCFR (69.65 cm), CD (24.91 cm) which was close but, oppose this study findings Akkaraman lambs BL (63.55 cm), CCFR (80.23 cm) and CD (32.45 cm). The result was also in agreement with the findings of Gungor and Unal (2020), in the study of Akkaraman and Bafra lambs that all the parameters of Akkaraman were higher than that of Bafra.

Meanwhile according to sex; ear length, ear width and chest depth were not significantly affected ($P>0.05$), while the other parameters body length, rump circumference, height at rump, chest circumference, cannon circumference and body height were all found to be significant ($P<0.05$) for average body measurements of the lambs in the third month. The result showed that the male lambs sex had higher body measurement than the female lambs in all the parameters used except the chest depth i.e. male body length (63.52 ± 0.87 cm), chest depth (24.12 ± 0.50 cm), rump circumference (78.62 ± 1.07 cm) was higher than the female body length (60.61 ± 0.88 cm), chest depth (24.66 ± 0.50 cm), rump circumference (72.25 ± 1.08 cm). The result in this study was in agreement with a study by Seyrani et al. (2012) on Zom sheep which shows that the male lambs had higher body measurement than the female lambs. A study on West African Dwarf sheep in Nigeria by Sowande and Sobola (2008) agrees with our findings that quotes male being higher lamb body measurments at weaning age than females.

The lamb birth type result moreover, chest circumference, body length, height at rump, cannon circumference and body height were significantly affected ($P<0.05$), while ear length, ear width, rump circumference and chest depth were not significant ($P>0.05$),

but was seen in the study that the single lambs had more body measurement than the multiple born lambs. The result showed that the single lambing had higher body measurement than the multiple lambing in all the parameters used i.e. single lambing body length (63.94 ± 1.04 cm), chest depth (24.66 ± 0.59 cm), and rump circumference (76.11 ± 1.27 cm) was higher than the multiple lambing body length 60.19 ± 0.77 cm), chest depth (24.12 ± 0.44 cm), rump circumference (74.76 ± 0.94 cm). This could be due to the fact that the single birth lambing had more care from the ewe sheep more than the multiple birth lambing which share nutrient from a single ewe sheep.

5.6 Body Measurements and Live Weight of Matured Sheep

Body measurement of sheep is an important factor to consider in body development (Kilic and Ozbeyaz, 2011). Body measurements and live weight of ewe were taken from 20 head Akkaraman ewe genotypes and 20 head Bafra ewe genotypes after lambing.

The Least Square Means for sheep body measurement is presented in Table 4.12, the genotype have a significant effect ($P < 0.05$), on all the factors live weight, ear length, ear width, body length, rump circumference, height at rump, chest circumference, chest depth, cannon circumference and body height. In the result of this study it was shown that the parameters of Akkaraman ewe breed were higher than the Bafra ewe genotype. Akkaraman ewe parameters; live weight (91.60 ± 2.18 kg), ear length (14.87 ± 0.30 cm), ear width (8.78 ± 0.17 cm), body length (82.21 ± 0.97 cm), rump circumference (116.60 ± 1.54 cm), height at rump (82.45 ± 0.88 cm) were all higher than the mean body measurement of the Bafra ewe; live weight (64.19 ± 2.34 kg), ear length (11.44 ± 0.33 cm), ear width (6.88 ± 0.18 cm), body length (77.23 ± 1.04 cm), rump circumference (100.34 ± 1.65 cm), height at rump (77.09 ± 0.94 cm).

Yilmaz et al. (2011). Performed a familiar study to this study on Kangal-Akkaraman and found prominent results LW (66.4 kg), HR (75.8 cm), BL (65.07 cm), CD (35.0 cm), CCFR (98.8 cm), EL (17.16 cm), EW (10 cm) and CC (9.5 cm) which were all less than the mean average of our study except EL and EW, the average mean in this study of some Akkaraman ewe body measurements parameters results LW (77.89 kg), HR (79.77 cm), BL (79.72 cm), CD (37.98 cm), CCFR (106.25 cm), EL (13.15 cm), EW (7.83 cm) and CC (9.68 cm). The overall average mean of some body parameters in this

result body length (79.72 ± 0.77 cm), chest depth (37.98 ± 0.38 cm), chest circumference (106.25 ± 0.97 cm), body height (76.63 ± 0.96 cm), was higher than a result on Karacabey Merino sheep by Ambarcioglu et al. (2017).

Moreover, the sheep sex body measurement showed that it had no significant effect ($P > 0.05$) on ear length and ear width, while it had significant effect ($P < 0.05$) on other parameters live weight, body length, rump circumference, height at rump, chest circumference, chest depth, cannon circumference and body height. The result showed that all the ram parameters were higher than the ewe except for ear length (13.35 ± 0.23 cm) and ear width (7.76 ± 0.23 cm) and ram with (12.97 ± 0.42 cm) and (7.76 ± 0.23 cm) this result was in agreement with a study on Zom sheep by Seyrani et al. (2012) which found that the ram HR (75.51 cm), BL (66.1 cm), CD (34.4 cm), CCFR (99.8 cm) was higher than the mean average of the ewe body measurements.

5.7 Testicular Measurement of Rams

The testicle traits of rams in this study did not significantly affect the breed ($P > 0.05$). According to the result the Akkaraman ram breed testicular traits were higher than the Bafra ram genotype testicular traits, for Akkaraman ram breed; scrotum length (18.71 ± 0.35 cm), scrotum circumference (31.57 ± 1.06 cm), testicle length (6.66 ± 1.14 cm), testicle circumference (17.57 ± 1.41 cm) and testes volume (266.52 ± 22.28 cm³) were higher than Bafra ram value testicular traits scrotum length (18.60 ± 0.42 cm), scrotum circumference (15.60 ± 1.67 cm), testicle length (230.83 ± 26.36 cm), testicle circumference (17.57 ± 1.41 cm) and testes volume (266.52 ± 22.28 cm³). The result in this study of both breed for SC was similar to a previous study on Savak Akkaraman ram (32.98 ± 0.28 cm) by Yagci and Bas (2021), Chios ram (32.1 cm) by Ozturk et al. (1996) and 2-4 years old Karayaka rams (32.5 cm) by Aslan et al. (2019), which were all higher than the values reported for genotypes such as Akkaraman (30.7 cm) Ozturk et al. (1996) 206 days old Kivircik male lambs (26.88 cm) by Ozdemir and Altin (2002), Karayaka rams (29.80 cm) by Kulaksiz et al. (2010).

SL of the study (18.71 cm) Akkaraman ram breed and (18.60 cm) Bafra genotype rams is higher than Awassi (17.63 cm) by Odabasioglu et al. (1992), Konya Merino (12.33 cm) by Aygun and Karaca (1995).

The SC, SW and SL did not significantly affect the breed in this study which was not in agreement with another study of Savak Akkaraman testicular characteristics and their relationship with live weight by Yagci and Bas (2021).



CHAPTER VI

CONCLUSION

The research center where data was obtained was semi intensive managed i.e. the sheep are fed indoor and also allowed to graze outside for pasture, indoor feeding provide fresh water and access to move freely within the barn.

This study concluded a result on the lamb growth performance, survivability of lambs from birth to weaning age (90 days) and sheep productive performance between Akkaraman and Bafra genotype. The results portraits Akkaraman breed had higher lambing percentage (85.29%) than Bafra (66.67%) and the difference among the groups was significant ($P<0.01$). The fecundity rate was higher in Bafra (1.17) than Akkaraman (1.12) and had no effect significantly ($P>0.05$), while litter size was also higher in Bafra (1.75) than Akkaraman (1.31) and had effect significantly ($P<0.01$) in the group. Twinning rate was higher in the Bafra than the Akkaraman and also had significant effect within the groups ($P<0.01$). Single lambing rate was found higher in the Akkaraman breed than Bafra and was also affected significantly ($P<0.01$). TBW and TWW were higher in Akkaraman breed in this study (6.72 kg), (46.65 kg) than Bafra TBW (6.50 kg) and TWW (45.52 kg) and did not had effect significantly ($P>0.05$) on TBW and TWW between the genotypes respectively.

The survival rate of lambs was higher in Akkaraman (99.1%) than in Bafra genotype (91.4%) and had effect significantly on the groups. The female lambs had higher survival rate than the males lambs, the single lambs born had higher survival rates than the multiple born lambs.

Akkaraman lambs were found to have lower growth performance than Bafra lambs between birth and 30 days. This may be due to the high milk yield of Bafra ewes. However, at 60 and 90 days, Akkaraman lambs had better growth performance than Bafra lambs. This may be related to the introduction of creep feeding to the lambs.

It was found that the highest live weight gain in Akkaraman (0.337 kg) and Bafra (0.264 kg) lambs was between birth and 60 days. It was concluded that more attention should be paid to the care and feeding of lambs between birth and 60 days.

Body measurement of lamb within the three months from birth to weaning age was found to be increasing with age and months. Ear length, ear width, rump circumference, cannon circumference, chest depth, body height, height at rump, chest circumference and body length were the parameters measured in this study and all increased with age and time.

Matured sheep body measurement and live weight was also studied in this research and was found that the parameters had effect significantly ($P < 0.01$) within the breeds. The Akkaraman breeds body measurements were found higher than the Bafra genotypes. Between sex however, ear length and ear width were not significant and were higher in the female sex than the male sex, other parameters were higher in the male sex.

Testicular measurement for rams used in mating for this study was also taken and analyzed and was not significant ($P > 0.05$) within the breeds.

The result of this study found that Bafra genotype was more productive than Akkaraman breed in productivity with Bafra genotype having more fecundity rate and litter size rate. LITS in Bafra was found at (1.75) and (1.31) in Akkaraman. Akkaraman was more in survival rate than Bafra genotype with a Akkaraman having (99.1%) survival rate while Bafra had (91.4%) survival rate. This is due to the fact that Akkaraman is a local breed which could survive on different weather condition unlike the Bafra crossbred genotype which should be handled with good management. Multiple lambing was higher in Bafra genotype than Akkaraman and Akkaraman ewes had higher single lambing than the Bafra genotype.

It was concluded that Bafra genotype ewes had higher litter size than Akkaraman breed ewes, but Akkaraman breed lambs had higher values of important traits such as live weight, body measurements and survival than Bafra lambs.

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