

A Comparative Analysis of Cryptorchidism Occurrence across Sheep Varieties

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Abstract

Cryptorchidism is a common reproductive condition in sheep that can have a major effect on both fertility and the overall production of the herd. The purpose of this research was to determine the thorough comparative investigation of the prevalence incidence of cryptorchidism and its variants in sheep breeds. Data about the horn pattern and cryptorchidism of sheep breeds such as Hassan, Bellary, Kenguri and Mandya were gathered from shepherds' herds in the respective habitat tracts of those sheep breeds. Hassan and Mandya sheep were used in autopsy research and ultrasound scanning to determine the percentage of cryptorchid testes retained in the gastrointestinal, inguinal and ventral areas. In sheep from Bonpala and Hassan, bilateral cryptorchidism was greater. There was a discernible deficiency in the Bonpala and Hassan breeds as evidenced by the increased retention of cryptorchid testes in the abdominal region as opposed to the femoral and subcutaneous regions. This comparative investigation sheds light on the complex nature of sheep cryptorchidism. The development of focused breeding methods and management techniques aimed to reduce the occurrence of this reproductive condition and improve the general health and productivity of sheep populations depends on the comprehension of breed-specific characteristics and environmental factors.

Keywords: Sheep, Cryptorchidism, Breeds, Environmental Factor, Unilateral, Genetics

INTRODUCTION

Genetics is the cause of cryptorchidism, due to certain genetic characteristics and congenital conditions of the male ovine reproductive organs, such as cryptorchidism, testicular hyperplasia, perineal hypospadias and partial duplication of the male urogenital system some sheep breeds can be susceptible to the difficulty than alternatives. The frequency of cryptorchidism is impacted by reproductive approaches (1). Sheep meat is generated in a multitude of agricultural techniques, ranging from intense exterior agriculture to intense indoor farming, using animals of different ages at slaughter. Slaughter of suckling light lambs can take place in Europe as early as 4 weeks of age through adulthood. Essentially the other breed rises for meat; sheep meat quality is preferred in several countries and it is correlated with features of the production system, such as systems focused on dairy or grasslands (2). To sustain pure breeding and produce male lambs for farmers to purchase, several significant sheep breeds are kept alive. The majority of sheep varieties in India have developed naturally in response to agroecological circumstances, with a small quantity of artificial selection occurring to satisfy certain requirements. The majority of breeds have been given names based on important individuals and their region of origin (3). The health of sheep can be impacted by cryptorchidism. Animals with undeveloped testicles are inclined to sustain sexual collisions, as well as potentially greater that are vulnerable to genital cancers. Crypt orchid lambs are infertile and ineffective in reproduction, which makes animals unattractive in breeding procedures and health problems (4). Sheep reproduction suffers from

digestive system nematodes, which is manifested in a reduction in body weight increase, the delivery of inferior progeny and the mortality of young animals. Furthermore, the impact of human behavior on the epizootic condition of sheep parasites enhances the possibility of pathogen expansion and amplifies the potential risk of human and animal illnesses (5). The present research explores potential methods of protecting the sheep landraces in southern Italy's Basilicata region, with 248,352 sheep on 3621 farms, Basilicata is the sixth-largest area in the nation for the sheep industry. The main goals of these farms' management are to produce milk and meat, which are designated as Protected Designations of Origin (PDO). Furthermore, the ovine farms produce a beneficial effect on society and the environment on the region's interior and peripheral lands, which are at risk of desertion due to their macroeconomic and ecological problems (6). Native sheep in Ethiopia serve small holder farmers in a variety of ways, providing them with flesh, milk, cutaneous tissue, animal waste, coarse wool and long, hairy fleece, among other resources. They serve as a way to reduce risk in the event of crop failure. Therefore, to satisfy the demands of the growing human population, sheep production needs to be increased. To identify their owners, sheep are a breathing lender, a source of instant income once needed coupled with an insurance policy against loss of crops, particularly in areas with poor and unstable land production considering the erratic weather, significant subsidence, freezing and problems using water logging (7). The objective of the study is to describe major sheep breeds worldwide, each with distinctive features such as shape, color of coat, form of wool and adaptability to different climates.

The study (8) focused on contemporary sheep farming on commercially significant features like flesh and dairy products. Some breeds have seen notable increases in production as a result of effective breeding strategies based on quantitative genetics. But while strict selection boosts profits, it can decrease the number of the functional populace, especially if few exceptional rams and their offspring are utilized extensively. The study (9) described the age, breed, location and types of testicular anomalies that were recorded after an examination of the testicles of rams that were to be slaughtered. The corresponding testis was the one with anomalies along with its sub-cutis and abdominal each had one cryptorchid testis. The testicles mass and mid-testicular circumferences of the aberrant testis were ($p < 0.05$) lower than those of the normal testis. The aberrant testis's longitudinal length was shorter than the normal testis', although the difference was not significant ($p > 0.05$). According to the study, there are very few rams killed who have reproductive deformities. In the event undertaken, they could not be appropriate for breeding given that their organs are infertile.

The study (10) determined that male genital disorders resembling cryptorchidism are widespread and can have a genetic basis in goats and camelids. To prevent masculine behavior, cryptorchid animals should be castrated and excluded from breeding programs. The purpose of the work was to provide an overview of the lecture and process of laparoscopically assisted cryptorchidectomy in camelids from South America goats. In general anesthesia, a laparoscopic-assisted cryptorchidectomy was executed in each instance. A closed method was used to castrate the remaining scrotal testicle. No surgical complications occurred. The utility of the approach for cryptorchidectomy is supported by its ability to confirm the existence of cryptorchid testis without the need for a laparotomy, as well as by its thinner opening, minimal intra-abdominal tampering and lower risk of post-operative problems.

The study (11) described some of the variables influencing the native sheep breeds in Nigeria's optimal reproductive potential. 767 sheep of various breeds were examined in total. The following reproductive indicators were taken into account: body condition score (BCS), growth features, mating, birth/weaning measurements, litter sizes, death rates and reproductive issues. The study concludes that the DNA composition and ability of the four sheep breeds West African Dwarf Sheep, Balami, Yankasa and Uda as well as their crosses vary. The substantial amount of sheep farmers in the country who utilize a broad production technique has the potential to be the cause of the species' inadequate reproductive performance. The study (12) examined that almost everywhere in the globe, sheep are found. Goat populations, however, are higher in low-income (LRI) nations than in high-income (HRI) nations. Growing goats was less common in the early 20th century than the rearing of cattle or sheep. The modernization of

agriculture caused goat farming to become less popular and goat stock to decline, while the farming of cattle and sheep saw growth. But in the latter half of the 20th century, the global goat population grew, reversing the previous pattern.

The study (13) analyzed that testicular abnormal development syndrome is a distinctive harmful condition that was characterized by an extensive innovative reduction in male reproductive health over the last 50 years. The decline has resulted in the increased occurrence of quality of semen loss and a few related masculine genitalia abnormalities are believed to have an identical perinatal origin, including testicle germ-cell tumors, hypoglycemia and encryption. By describing each factor's independent impact on genetic and lifestyle variables, the section aimed to provide a summary of the available research from both animal and human studies regarding the relationship between early pregnancy interaction with compounds that transform hormones, including those with properties that are anti-androgenic, hormonal, or a combination of both and the formation of particular parts of testicular malformation syndrome, namely, hypospadias, cryptorchidism and testicular germ-cell cancer. The study (14) explained the testicular descent, of the scrotum was positioned and angled differently in mammals. Various selection pressures resulting from the necessity to provide circumstances optimal for sperm generation and storage, or to shield the male gonads from severe mental and biological disruption, have caused the following difference in testicular location in mammals. Animal tests can be found in six distinct locations, ranging from no descent from the embryonic position to a permanent descent into a pendant scrotum, similar to that of humans. It described various scrotal locations, pigmentations and morphological variations, emphasizing the diversity and abnormalities of certain species' scrota. The study (15) explained the lack of a consistent non-scrotal location for undescended testes in the initial descriptions of cryptorchidism indicated the presence of two or more illnesses. However, the general opinion remained that cryptorchidism is an isolated illness that is partially penetrant, has a modest heredity, manifests in males and can be reduced by eliminating the diseased male and female relations or intensified by inbreeding.

MATERIALS AND METHODS

The section includes the various sheep breeds identified in the world, each with distinctive qualities such as size, coat colors, variety of fiber wool and climate-related tolerance. There are many distinct types of sheep, as Figure (1) illustrates and Table (1) illustrates the variances of sheep in different regions, including the Eastern region, the Northern temperature region, the Northwest region and the Southern Peninsular region.



Figure (1). Varieties of sheep (Source: Author)

Table (1). Variances of sheep in different regions (Source: Author)

Eastern	Semi-arid and arid regions in the northwest	North Temperate	Peninsula in the South
Bhakarwal	Chokla	Bhakarwal	Bellary
Bonpala	Jaisalmer	Chargthangi	Hassan
Chottanagpuri	Malpura	Gaddi	Vembur
Ganjam	Sonadi	Gurez	Nellore
Garole	Munjal	Karnah	Daccani
Tibetan	jalauni	Kashmir Merinol	Rammand White
Kendrapara	Muzalfarnagari	Poonchi	Tiruchy Black
	Magra	Rampur Bushair	Coimbatore
	Kheri		Kanguri
	Marwari		Madras Red
	Patanwadi		Nilgiri
	Pugal		Mandya
			Kilakarsal

Sheep varieties in the Eastern region

North-east highland indicates Bihar, West Bengal and Orissa make up this area. The lower Gangetic basin, coastal plains and plateau locations obtain warm, humid weather; instead mountainous parts experience sub-temperate weather. This area is home to the Black Bengal, Ganjam and Khasi goat breeds (Assam hill goat). The majority of these breeds are raised for animal products.

Sheep varieties in the Northern temperature region

The Northern Temperate Region's sheep varieties have adapted to cold climates. During the cold seasons, their woolly coats assist them to retain body heat by behaving as protection. The nations of Uttarakhand, Jammu & Kashmir and Himachal Pradesh encompass the zone. It has an extremely frozen temperature with moderate to severe snowfall in the winter and strong monsoon rains. This area is home to the goat breeds Chegu, Changthangi and Gaddi. The region's cool highland valleys are inhabited by the sheep that produce valuable pashmina wool fibers.

Sheep varieties in the Northwestern region

The states of Rajasthan, Uttar Pradesh, Madhya Pradesh, Gujarat, Punjab and Haryana are included in this arid/semiarid climate zone. This area has the highest density of goat breeds. Some of the varieties are Surti, Zalawadi, Gohilwadi, Jamunapari, Barbari, Beetal, Jakhrana, Sirohi, Marwari, Kutchi and Mehsana. Additionally, in these instances, Uttar Pradesh is characterized by Jamunapari, Barbari, Jakhrana and Sirohi, where animals are raised for their meat and milk.

Sheep varieties in the southern peninsular region

The west coast of that zone has humid weather, whereas the center peninsular experiences semi-arid conditions. The territory includes sheep breeds from Osmanabadi, Sangamneri, KannaiAdu, as well as Malabari and it is comprised of the states of Tamil Nadu, Kerala, Karnataka, Andhra Pradesh and Maharashtra (16).

Cryptorchidism

The inability of one or both testis to erect in the scrotum at the typical period for a species is known as cryptorchidism. Cryptorchidism is discovered at birth or soon after. Testis tumors, abnormally high levels of testosterone and abnormal sperm production in the scrotal testis are instances of post-pubertal irregularities related to cryptorchidism. In general, a delayed presentation of testis dysfunction causes these issues, rather than an increase in abdominal warmth. Males that lack cryptorchids can exhibit such a form of fundamental syndrome of the testes. In the present text, Sharpe explores the possibility of widespread testicular dysgenesis syndrome (TDS). During the early stages of growth, ovaries descend through the abdominal cavity into the abdomen (17).

Genetic improvement of sheep

Sheep are raised in farm flocks or on ranges. Flocks consisting of 1,000 to 1,500 ewes are typical in range farming. Productivity in farming flocks tends to be minimal and an extraneous endeavor. Sheep are utilized as feeder lambs for the destroyed market or wool production. The majority of male lambs are castrated and lambs are docked. Several organizations emphasize producing rams for genuine reproduction. The sustainability of genetic improvements appears to be beneficial given the small population dimensions, solitary buck/ram flock, lack of animal identification, low farmer's fluency, scarcity of grazing areas and absence of treatment in the field. The farmer's intentions for breeding deserve to be included in consideration when setting up the nucleus. There might be an open or closed nucleus. Animals cannot migrate upstream from lower levels to the nucleus in an enclosed nucleus and all collecting occurs inside the nucleus. Conversely, animals of high merit can travel up to the nucleus for breeding when the nucleus is accessible (18).

Bilateral Cryptorchidism

Bilateral circumstances of cryptorchidism could have a hereditary component. These creatures with this feature deserve to be properly handled to prevent others from inheriting the genetic tendency, as the disease can be inherited. Infertility or sterility is caused by bilateral cryptorchidism in male sheep. The inability of the two ovaries to generate and distribute testosterone into the scrotum is a prerequisite for creation. The animals with bilateral cryptorchidism are destroyed or implemented from sheep breeding operations. This feature guarantees that remains adequate in health to reproduce contributes to the flock and prevents the genetic characteristics from spreading to the next generation (19).

Unilateral Cryptorchidism

The testicles develop inside the abdomen and descend into the scrotum before or after developing in standard male animal development, including sheep. The genital technique's healthy growth and operation depend on this descent. The most significant effect of unilateral cryptorchidism is on fertility, the undescended testicle could have health consequences. Testicles that persist in the abdomen can be susceptible to various illnesses, such as a higher chance of growth of tumors (19).

STATISTICAL ANALYSIS

To prevent data loss, standardized questionnaires were used to collect data both quantitative as well as qualitative, which was filtered and entered into Microsoft Office Excel daily. The latest version of the Statistical Software for Social Sciences (SPSS) was used to analyze all of the collected data. For the intent of preserving sheep and feature opinions, the following indices were determined:

The equation for calculating the indices is as listed below: the total ($3 \times$ no. of households considered first + $2 \times$ no. of households ranked second + $1 \times$ no. of individuals was identified third) for each rationale, standard, or decision separated by the total ($3 \times$ no. individuals identified first + $2 \times$ no. of communities placed second + $1 \times$ no. of populations listed third) for all criteria, requirements, or biases combined.

RESULT

Data collection

An extensive field study throughout their different allocation regions in Northern, Eastern and Southern India, a total of 477 animals belonging to 11 different breeds Bandur (Mandya), Kenguri, Bonpala, Poonchi, Balangir, Tibetan, Changthangi, Bellary, Rampur Bushair, Shahbadi, Hassan, were gathered. The study's animals used were representative of the first indigenous genotype. The animals considered conformed to the specifications of the Characterization of Domesticated Animals Biodiversity Initiative 10. The blood samples were taken from identical sheep spread over many flocks and localities for every breed. To determine if the samples gathered were unrelated, farmers were thoroughly interrogated. Blood samples were collected from 2015 to 2019. Microsatellite analysis was performed utilizing 477 samples, whereas the mitochondrial examination was conducted using the first 20–22 samples of each breed. The blood was sterilized with phenol–chloroform according to the standard protocol to extract genomic DNA. An analysis of the amount of DNA was conducted with a NanoDrop 1000 spectrometer (20).

Implications of sheep between bilateral and unilateral

A genetic tendency or associated circumstances are responsible for the substantial prevalence of both varieties of cryptorchidism in these breeds. The distinctions between unilateral and bilateral variants are depicted in Figure (2). In bilateral and unilateral cryptorchidism contain Mandya (65% and 60%), Bellary (84% and 65%), Changthangi (70% and 77%), Rampur Bushair (79% and 84%), Poonchi (80% and 69%), Bonpala (89% and 85%), Tibetan (55% and 79%), Shahbadi (75% and 86%), Balangir (79% and 91%), Kenguri (83% and 80%), Hassan (90% and 85%) are shown in Table (2).

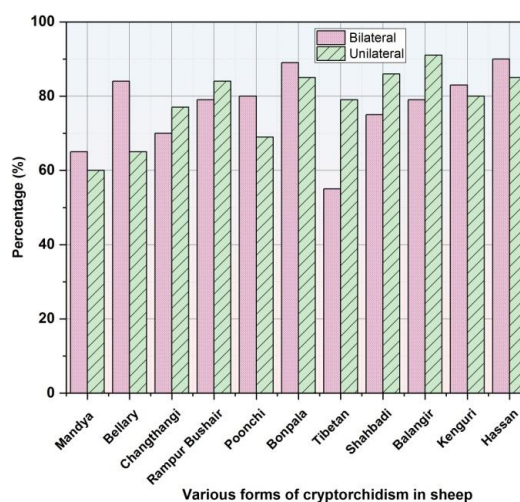


Figure (2). Differences between Bilateral and Unilateral (Source: Author)

Table (2). Numerical values of Bilateral and Unilateral (Source: Author)

Various forms of cryptorchidism in sheep	Bilateral Cryptorchid	Unilateral Cryptorchid
Mandya	65	60
Bellary	84	65
Changthangi	70	77
Rampur Bushair	79	84
Poonchi	80	69
Bonpala	89	85
Tibetan	55	79
Shahbadi	75	86
Balangir	79	91
Kenguri	83	80
Hassan	90	85

Integrating several sheep breeds for cryptorchidism

Figure (3) indicates that the left testicle descends into the scrotum regularly, but the right testicle fails to accomplish, the condition is referred as right cryptorchidism. The right cryptorchid can persist in the abdominal cavity or descend in an undescended position Mandya (65%), Balangir (60%), Changthangi (55%), Malpura (71%), Bonpala (80%) and Tibetan (85%). The condition of the descending left testicle can have an impact on fertility. The antithesis of right cryptorchidism is left cryptorchidism. In the present instance, the right testicle descends into the scrotum properly and the left testicle is unable to perform properly. Similar to right cryptorchidism, the condition of the descending right testicular has the potential to have fertilization such as Mandya (55%), Balangir (63%), Changthangi (70%), Malpura (75%), Bonpala (80%) and Tibetan (89%). Table (3) depicts the polled cryptorchid, Mandya (69%), Balangir (70%), Changthangi (74%), Malpura (81%), Bonpala (86%) and Tibetan (93%).

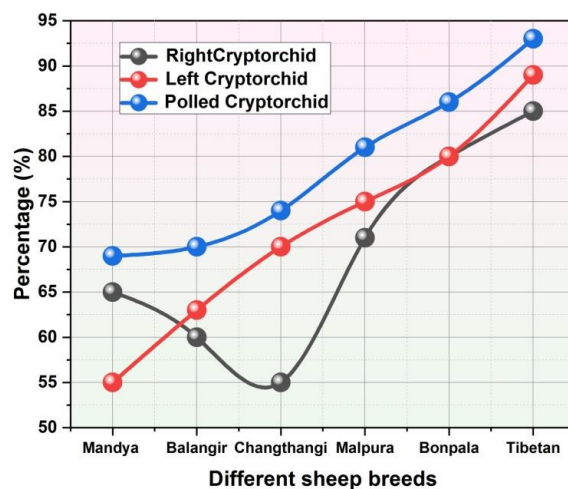
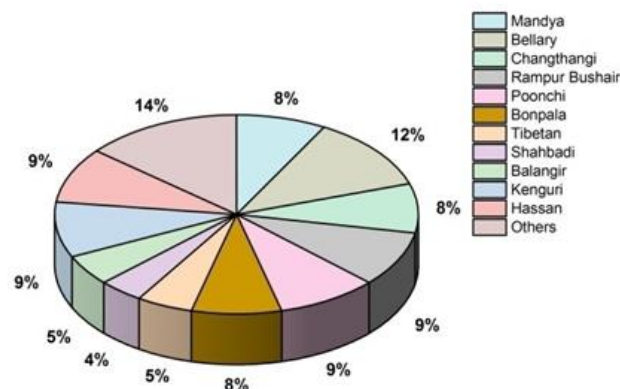
**Figure (3).** Various forms of cryptorchidism in sheep (Source: Author)

Table (3).Numerical forms of cryptorchidism in sheep (Source: Author)

Different sheep breeds	Percentage (%)		
	Right Cryptorchid	Left Cryptorchid	Polled Cryptorchid
Mandya	65	55	69
Balangir	60	63	70
Changthangi	55	70	74
Malpura	71	75	81
Bonpala	80	80	86
Tibetan	85	89	93

Illustrating various Breeds of Sheep

Table (4) indicates the various sheep types that are distributed or constitute a particular group of animals. Mandya contains (8%), Bellary contain (12%), Changthangi indicates (8%), Rampur Bushair denotes (9%), Poonchi contains (9%), Bonpala denotes (8%), Tibetan contains (5%), Shahbadi indicates (4%), Balangir denotes (5%), Kenguri denotes (9%), Hassan contains (9%) and other sheep breeds indicates (14%) are shown in the Figure (4).

**Figure (4).**Pie Chart illustrating various Breeds of Sheep (Source: Author)**Table (4).**Numerical values of various Breeds of Sheep (Source: Author)

Varieties of Sheep	Percentage (%)
Mandya	8
Bellary	12
Changthangi	8
Rampur Bushair	9
Poonchi	9
Bonpala	8
Tibetan	5
Shahbadi	4
Balangir	5

Kenguri	9
Hassan	9
Others	14

DISCUSSION

This study intended to conduct an extensive comparison of the frequency and incidence of cryptorchidism and its variations among various sheep breeds. Sheep farming relies on products including dairy products and meat that are important to the nation's economy. Effective breeding tactics based on quantitative genetics contributed to significant acquires in productivity for several breeds. The majority of manifestations of cryptorchidism are identified at birth or shortly thereafter. Testicular tumors, excessive testosterone levels and anomalous sperm generation in the scrotal testis are examples of post-pubertal abnormalities associated with cryptorchidism.

CONCLUSION

The study's findings contribute to developing an understanding of the appearance and genetic diversity of native Indian sheep breeds. In terms of disease resistance and climate tolerance, sheep varieties differ from one another. Data collected are beneficial to overseeing breeding programs, ensuring sustainable management practices and implementing initiatives to protect sheep's bilateral and unilateral sites. Several factors, such as the local ecosystem, agriculture standards and the intended utilization of sheep merchandise, impact the selection of a breed. In animal species, cryptorchidism is an abnormality where one or both testicles lack a descent into the scrotum. The results section contains identified as follows with Sheep Breeds Illustrated, Sheep Breeds Integrated for Cryptorchidism and Sheep Implications between Bilateral and Unilateral. The sheep revenues demonstrate these varieties; some are domesticated for animal flesh or two and others are modified to generate sheep's wool. Future research intends to concentrate on detecting sheep that have cryptorchidism, explicating the various sheep breeds and preventing testis lacking to enhance breed variabilities.

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