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The Epidemiology and Public Health Implications of Goat Tuberculosis in India are Examined

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Abstract

Small ruminants are significant and fundamental to the cattle sector in India. Goats are especially intriguing to Indians because of their ability to overcome challenges, their adaptability to different ecological regions, and the fact that they require little initial investment and minimal space for production. India has a large number of goats, but for a variety of reasons, they don't produce as much as is needed. The primary factors limiting the economic returns of goats are diseases. In India, TB is one illness that affects the health and productivity of goats. The chronic condition goat TB, from which the mycobacteria are discharged and infect other susceptible animals, is characterised by the development of granulomas, particularly in the respiratory tract and accompanying lymph nodes, Goat tuberculosis has an effect on public health in India since farmers there have a custom of consuming raw goat milk and its derivatives as well as having frequent or daily contact with their goats.

Keywords: Public health; India; Epidemiology; Mycobacteria; Tuberculosis; Agro-ecological zones

Introduction

The erogenous route was also used to spread the etiological agents from the animals in the herd with active cases to people. According to the inspections of the abattoirs, the sickness has been reported in a number of places around the country. Therefore, efforts should be taken to prevent the zoonotic spread of the illness, increase public knowledge of it, put into place a one-health approach to national tuberculosis control, and carry out more epidemiological studies. Livestock is a key and fundamental component of agriculture, which is the basis of the Indian economy. India is claimed to have the largest population of animals in Africa. There are 60.3 million cattle, 31.3 million sheep, and 32.7 million goats living in India's various agro-ecological zones [1].

Goats make up a large component of the domestic animal population in many nations, including India. They get notice due to their resistance to a variety of challenges or harsh climatic conditions. Goats are raised as a result in numerous rural areas of underdeveloped countries. Because of their shape, goat species can adapt to different climatic conditions more readily than other ruminant species, and as a result, they continue to be an essential source of income and nutrition for many poor and marginal farmers around the world [2]. Camels and goats have long been regarded as particularly important animals due to their exceptional traits, ease of handling, and independence from humans for sustenance. They also take in very small amounts of foodstuff. One of the most prevalent small ruminants raised in settings like degraded land, shrub land, and forests, where other species cannot live, is the goat. This helps to sustain excellent farming practises and reduces erosion and environmental damage in rural areas. In comparison to huge ruminants, they can also tolerate dry seasons much better [3].

Little ruminants in India supply raw materials, money, food, and nourishment for a variety of commercial ventures. They also fulfil a number of significant societal obligations, such as those related to inheritance, gifts for relatives in need, and wedding blessings. Women have significantly more control over small ruminants than other domesticated animal species, and they take an active role in controlling their health. In times of need, the animals usually provide both personal and family requirements with resources. Due to the increase in demand for small ruminant meat products both locally and internationally, small ruminant management now has more access to better markets [4].

India has a large number of small ruminant populations, however despite this, for a variety of reasons, it is unable to utilise the expected production. Illnesses are at the top of the long list of barriers preventing these modest ruminant economic returns. One of the ailments that small ruminants are susceptible to is tuberculosis. Many scientists believe that the zoonotic disease tuberculosis, a chronic condition, lowers goat production in many regions of India. The disease TB affects both humans and animals. Because of this, it has important zoonotic and reverse zoonotic importance. The transmission of M. tuberculosis from farmers to their camels, goats, and cattle was also confirmed in India [5].

Because more people in India own small ruminants and depend on them for existence, there is an urgent need to encourage efficient control strategies. These folks also like to consume uncooked animal products like milk and meat and live in close contact to their animals. This increases the risk that zoonotic diseases like tuberculosis will spread, which is harmful to the general public's health. The first step in assessing the risk and burden of disease transmission is therefore to ascertain the incidence of goat tuberculosis and other animal diseases. Although goat tuberculosis has been known to exist for a long time in a number of locations, there is a lack of information regarding its epidemiology and the impact it has on India's public health system on a national scale. The objectives of this review study include determining the zoonotic significance of goat tuberculosis, identifying goat tuberculosis prevention measures, and gathering the information that is currently available on the epidemiology of goat tuberculosis [6].

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TB in cattle and other mammals, infrequently in humans, is caused by the Mycobacterium tuberculosis (MTB) complex, a group of genetically similar bacteria that includes M. bovis. TB is a persistent, primarily respiratory infectious disease that affects mammals. bovis infection, cattle are the disease's natural host. The multiplicity of animal hosts makes it more challenging to eradicate tuberculosis in many animal species. Goats can be infected by M. tuberculosis, the major human TB pathogen, M. avium, and M. Kansasii, albeit they rarely cause caprine TB. A goat that has the M. TB complex, specifically the M. tuberculosis complex M. caprae, is the major instance [7].

Material and methods

The participants in this study comprised farmers residing in the Ludhiana situated in the state of Punjab, located in Central India. Agriculture served as the primary occupation for the majority of the population. Additionally, some participants were engaged in dairy production and livestock management. It was common for the farmers themselves or members of their families to be actively involved in the care and maintenance of these animals.

The range of animals reared by the farmers included the Indian breed of ox, cows, buffaloes, and calves. The tasks of milking the animals and assisting with the delivery of pregnant animals were also carried out by the household members. This close involvement with animal husbandry activities demonstrated the integral role played by the farmers in the care and management of their livestock. [8].

The study population under investigation was specifically located in a particular locality within Ludhiana district, situated in the Vidarbha region of Punjab. A significant portion of this population regularly consumed meat and other animal products as part of their diet. The endemic area exhibited a high crowding index, with small, poorly ventilated rooms accommodating an average of six to eight individuals. Additionally, the majority of the population faced challenges related to poor socioeconomic status and living conditions, including inadequate sanitation and substandard hygiene practices. Some households in the area were also involved in cattle and goat rearing [9].

Initially, a total of 433 participants were enrolled in the study. However, 84 individuals declined to provide blood samples and were subsequently excluded from the analysis. The remaining 349 participants who met the predefined inclusion criteria were selected as the study cohort. Among these individuals, pregnant women (n = 8), children below the age of 10 years (n = 18), and individuals with fungal or viral infections (n = 22) were further excluded from the study to ensure the homogeneity of the sample. In figure1 illustrates the inclusion/exclusion criteria employed during the recruitment process of the study population shown in (Figure 1).

By carefully selecting and screening the participants, the study aimed to investigate a specific group of individuals within the locality, taking into account relevant factors such as diet, living conditions, and health status [10].

Discussion

TB can transmit both directly (from animal to animal) and indirectly, particularly through aerosols. In organic trash or damp conditions, the organisms may persist for a very long time. When milk from animals with TB of the udder is provided, transfer from the dam to the kid is also a possibility. Additionally, goats act as "amplifier hosts," which means they can spread the disease to other goats as well as to other species that share their habitat, such humans. Once the disease has taken root inside a herd, it appears to spread throughout the animals swiftly. Goats may help with tuberculosis transmission and storage. Lack of testing (pre-movement tests, control programmes), as well as ignorance about the sickness, could allow the virus to infect other flocks and animal species. M. bovis has been shown to be contagious from goats to cattle [11].

Due to their high susceptibility, goats kept close to sick cow herds may have a prevalence of up to 70%. The respiratory system is typically the mode of transmission for tuberculosis. After entering through the respiratory system, the tuberculosis bacillus invades the neighbourhood lymph nodes, leading to the development of granulomas and the necrosis of the central lymph nodes. Abdominal involvement is occasionally observed, suggesting that eating anything could be a mechanism of transmission [12].

Herd TB positivity may be associated with risk elements such herd size, maintaining the herd with other livestock species, interacting with other herds, annual migratory dynamics, the recent introduction of new animals to the herd, and other risk elements. In India, the husbandry of both cattle and goats is common. Cattle can move quickly between farms and across boundaries. This strategy thereby increases the likelihood of M. bovis infection spreading within and between species. At countries like India where bovine TB is widespread, the mixed husbandry of small and large ruminants puts goats at special danger [13].

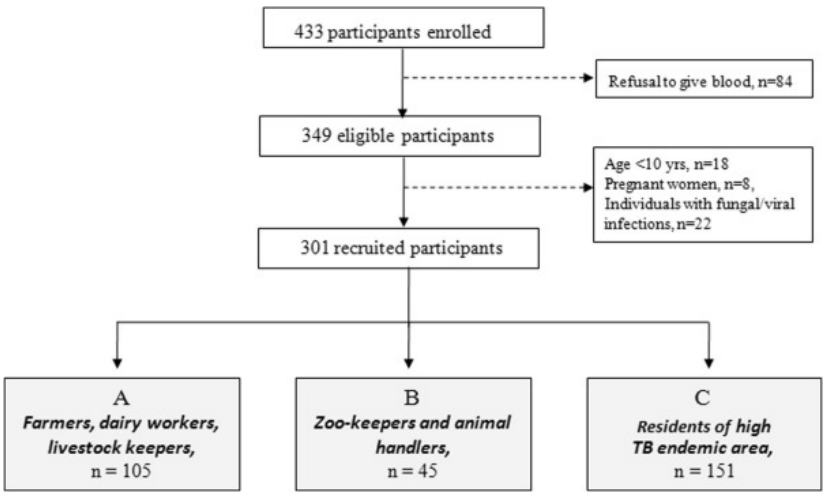

Figure 1: Prevalence of zoonotic tuberculosis and associated risk factors in Central Indian populations.

The two phases of tuberculosis spread within the body are the primary complex and post primary dissemination. The primary complex is made up of the lesion at the entry and the surrounding lymph node. A lesion at the point of entrance is indicative of an infection that is contracted through inhalation. When infection enters through the digestive tract, tonsillar and intestinal ulcers may form, although a lesion at the point of entrance is uncommon. The sole visible lesion is typically found in the pharyngeal or mesenteric lymph nodes. A noticeable primary focus occurs eight days after the pathogen infects the entry. After around two weeks, the lesions begin to calcify [14].

Granulation tissue, monocytes, and plasma cells surround the developing necrotic centre while the pathognomonic "tubercle" soon forms around it. 90% to 95% of the bacteria that create this primary focus originate in the respiratory system, and from there, they go to a nearby lymph node where they cause the growth of a lesion similar to it. Symptoms of post-primary dissemination from the original complex can include acute tuberculosis, solitary nodular lesions in various organs, or chronic organ tuberculosis caused by endogenous or external reinfection of tissues that develop an allergy to tuberculosis-protein. In the latter case, the local lymph node might not be involved [15].

It is difficult to diagnose TB because the clinical signs are not specific. Consideration should be given to TB in cases of chronic loss of appetite and condition, decreased milk production, and incapacitating illness, with or without respiratory symptoms. A persistent cough in goats may be a sign of TB if the respiratory illness has not resolved despite antibiotic treatment. Goats may have large lesions without obvious clinical signs because the disease is spread and affects the thorax (mediastinal lymph nodes, lungs, and pleura), belly (peritoneum, liver, spleen, and mesenteric lymph nodes), and rarely the superficial lymph nodes. The lymph nodes are also contained and have granular foci, purulent material that is creamy to caseous in colour and ranges in hue from yellow to orange. Respiratory lymph nodes are affected more commonly than hepatic or mesenteric lymph nodes. Examples of histopathologic traits include acid-fast organisms, core calcification and caseation that is ringed by epithelial cells, and fibrosis [16].

Caseous tubercles in the lung, liver, or spleen, as well as tuberculosis granulomas in one or more lymph nodes, were found during a post-mortem examination. The lungs and adjacent lymph nodes were more frequently reported to have caseous tubercles. Although goats and cattle also develop tubercles, these cases frequently resulted in huge abscesses filled with liquid white or cream pus. This pus frequently quickly eroded into the airways, increasing the risk that the disease would spread by aerosol. In areas of purple consolidation, multifocal lung lesions were frequently white or cream in colour. Small caseous lesions with mineralization to large caseous lesions in the mediastinal and bronchial lymph nodes were the different sizes of the lesions [17].

The disease is more prevalent in most species, despite the fact that the progression, location of lesions, and look of macroscopic lesions are similar to those documented for cattle. Granulomatous case calcareous lesions of various sizes are frequently found during necropsies in the pleura, liver, mesenteric lymph nodes, and respiratory system. (Lung and thoracic lymph nodes) Common caseous lesions in lymph nodes range in size from large lesions to minor foci. Caprine and bovine TB are closely related in terms of the immune response and clinical characteristics. Similar to dairy cattle, TB in goats and sheep often causes exudative granulomatous caseous severe damage to the lungs and adjacent lymph nodes, and is an untreatable disease [18].

Rarely, lymph nodes in the upper respiratory tract, the liver, the spleen, and the mesenteric region may also develop tuberculous lesions. The development of liquefactive necrosis and uncannily identical natural hollows within tuberculous granulomas in goats to those in human TB are constant goat traits. Histologically, the lesions match those discovered in both humans and animals. In tuberculous granulomatous necrotizing lesions, which have a fibrotic capsule, numerous big cells, foamy macrophages, lymphocytes, and a central caseous necrosis that is frequently mineralized, it is typical to notice these features. The caseous necrosis frequently contains very few acid-fast bacilli [19].

Caprine tuberculosis is diagnosed similarly to BTB with a few subtle differences. The gamma interferon (IFN) assay or the tuberculin skin test can both be used to identify TB in goats with a few straightforward modifications. Clinical signs that can be utilised to diagnose an illness include weight loss and mild respiratory symptoms such tachypnea, dyspnea, and abnormal lung sounds. The signs of decreased milk production and respiratory discomfort may be used to make a diagnosis [20].

Conclusion

In India, TB is endemic in both people and animals. Bovine tuberculosis has been extensively researched, whereas goat tuberculosis has not. goats' level of TB susceptibility. Because the goats' TB clinical signs are vague, the disease is widely transferred to humans and other animal species. Goats, especially in rural India, acquire up illnesses from being kept in close quarters with cattle during the day that they then spread to people at night by sharing a same shelter. Therefore, the goat has a significant impact on how important tuberculosis is to epidemiology and public health. Understanding the prevalence and epidemiology is crucial for controlling tuberculosis in goats as well as other hosts for this reason. In India, goat farmers only consider the medicinal advantages of goat products and are oblivious of zoonotic infections.

Conflict of Interest

None

Acknowledgment

None

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