

PREVALENCE OF GOATPOX DISEASE IN PUNJAB PROVINCE OF PAKISTAN

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ABSTRACT

The present study was conducted to investigate the prevalence of pox infection in goats in Pakistan. The skin samples were collected from different locations of Northern, Arid and Southern regions of Punjab. From northern region, the total number of samples collected from slaughter houses, tanneries, goats and hide markets were 3438, 5038, 2841 and 4135 respectively. From arid regions the total samples number collected were 1873, 935, 3313 and 1110 respectively. From southern regions the total samples collected were 2243, 1758, 3745 and 1045 respectively. The prevalence of capripox virus was highest in arid region followed by southern region and northern regions. The data were analyzed by age and sex on the basis of clinical manifestation and postmortem lesions found in the infected animals. Prevalence was more in adults as compared to the kids. Female goats were more sensitive than male goats. The histopathological examination was performed and the characteristic changes were recorded. For goat pox the prevalence between the regions and samples collecting spots was highly significant ($P < 0.05$).

Key words: Goatpox, Histopathological changes, Postmortem Lesions, Punjab Province, Pakistan.

INTRODUCTION

Goats were among the first animals to be domesticated by humans and being herded 9,000 years ago. They were believed to be descended from the wild goat, bezoar. Worldwide, more people eat the meat and drink the milk of goats than any other species (Livestock Census India, 2006). Goats hold an important place in the economy of small farmers in various regions of the world. The world goat population has shown the highest increase among the food animals, reflected by a population of 790 millions heads during 2005. This results from the adaptability and survival rate of this animal under harsh conditions, climatic stress and poor management support in the tropical and sub tropical regions.

Goats add extensively to the Pakistan economy by sustaining livelihood and supplementing the income of small farmers. In last three years from 2006 to 2009 the goat population increased from 55.2 to 58.3 millions (Economic Survey 2009). Similarly the gross production of goat meat increased by 5.42% during this period. Goat skins produced in 2006-2007 were 21283 millions and this increased to 22452 millions in 2008-2009. For getting proper quality of milk, meat and skin a healthy goat with proper genetic potential for growth, lactation and fertility is required to be supported with appropriate feeding and management strategies.

The harsh conditions and economic constraints prevailing in the goat raising areas expose goats to

nutritional, managemental and thermal stress leading to prevalence of diseases, low productivity and poor product quality. Out of the total world goat population 94% are found in developing countries around the Mediterranean, Asia and Africa. Goat pox is the most serious of the pox diseases of livestock and can cause heavy production losses. The economic losses occur in terms of mortality, reduced productivity and lower quality of wool and leather (Parthiban *et al.*, 2005). The disease is a serious threat to the goat farming community in the endemic area and is associated with trade restrictions following outbreaks. *Capri pox* virus causes a severe and highly contagious disease in goats which is listed in Group 'A' diseases of the OIE (Carn, 1993 & World Animal Health 1996).

The *Capripox* genus of the family *Poxviridae* is comprised of sheep pox virus (SPV), goatpox virus (GPV) and lumpy skin disease of sheep, goat and cattle, respectively. GPV causes goat pox disease characterized by high morbidity and mortality. The mortality rate is about 100% in kids and 50% in adult goats. The disease is prevalent both in the rainy and winter seasons, but the mortality is highest in the rainy season due to the humid environment conducive for the rapid transmission of virus (Khan, 2005).

The current status of GPV in India was reported by (Bhanuprakash *et al.*, 2006). They found that the incubation period was about 5-14 days. The virus persisted for at least three months in the wool, hair and scabs of infected animals, up to six months in the

environment, and was readily spread by fomites. Indirect spread by fomites or insects resulted in rapid spread over a large area. In endemic areas spread occurred mainly in summer. The disease transmission occurs through direct contact, communal grazing and shared watering. In an African study the *Capripox* was a highly contagious diseases of goat characterized by an initial rise in temperature up to 40–42°C, increase pulse and respiratory rate, edema of eyelids, in appetite, arched back, lacrimation, coughing, salivation, nasal discharge leading to crust formation, pneumonia, hypersensitivity, constipation and scanty urine (Afshar *et al.*, 1986).

Our investigations in the region has shown a prevalence of goat pox in the northern and southern Punjab of Pakistan associated with a variety of defective qualities of skin, mortality and decreasing productivity (Chaudhry *et al.*, 2008). The present study was conducted to determine the prevalence of the disease in slaughter houses, tanneries, goats and hide markets of the arid, southern and northern regions of Punjab in Pakistan.

MATERIALS AND METHODS

Collection of data: The animals, data and samples were collected from slaughter houses, tanneries, goats and hides markets of the northern, arid and southern regions Punjab. The slaughter houses are located in the big cities of Punjab. The number of animals slaughtered daily in these slaughter houses range from 500 to 700 goats and about 400 to 600 cattle and buffalos. At slaughter houses the animals are kept in open sheds where the antimortem examination of the goat pox suspected animals was carried out and then offered for slaughter. In antimortem examination the pox lesions were recorded on the oral commissure, hairless areas like ears, under side of the tail, pereneal region and udder. At postmortem the pox lesions were recorded in visceral organs and skin. At antimortem the scabs and biopsy samples were taken, and the skin tissue samples from infected sites were collected at postmortem. These samples were preserved for future histopathological study.

At goat markets, the animals suspected for goat pox were examined carefully and a complete history was recorded from the owner about the disease. The diagnosis of goat pox disease was done on the basis of clinical observations of pox lesions and the clinical signs exhibited by the sick animals. At goat markets, no postmortem findings were noted.

Hide markets are the collection points of raw material (skins and hides) from various areas of the province. The data collected at hide markets was in the form of examination of skins. The examination of 6290 skins was performed. The pox infection on the skin was identified by the presence of granular scars on the under side of the skin. At hide market it requires more experience to differentiate the granular pox lesions from

other skin damages like healed wounds leaving scars, tick infestation which cause pinhole spots at the point of their attachment and secondary bacterial infections. Skin tissue samples of the pox infected skins were collected for histopathological examination.

A total of 7731 skins suspected for goat pox were examined carefully. The diagnosis of goat pox disease was done on the basis of clinical observation of pox lesions as done at the hide market. Hundred skin tissue samples of infected site were collected for histopathological examination.

This study was undertaken to provide adequate information regarding prevalence of goat pox in Punjab. The study was based on a retrospective survey of slaughter houses, tanneries, and goat and hide markets in various regions of the province. Different approaches were adopted to diagnose the disease. In the goat market and slaughter houses, the animals were closely examined both physically and clinically. The detailed physical and clinical examination of the diseased animal was documented. In slaughter houses the disease was further studied and confirmed by examining the lesions in different organs. While in hide markets and tanneries the disease was diagnosed with the help of skilled graders and detail examination of the skin lesions.

RESULTS

Prevalence in markets: The overall prevalence of pox disease in goat was 5%, 5.79% and 5.34% in Northern irrigated, arid and southern irrigated regions respectively (Table, 1). The characteristics pox lesions were observed on the oral commissure, hairless areas like ears, under side of the tail, perennial region and udder. The animals showed high fever, slight anorexia, lacrimation, slight coughing and diarrhea. The animals were declared positive on the basis of these clinical signs. The pox infection on the skin in hide markets was identified by the presence of granular nodules and scars on the under side of the skin. The prevalence of pox recorded in the hide markets shows a trend of high presence 7.29% in arid region followed by 6.22% and 3.84% in southern and northern irrigated regions (Table, 1).

Prevalence in slaughter house and tanneries: In slaughter houses the confirmation of pox disease was made on the basis of both antemortem and postmortem examinations. On antemortem examination similar pattern of lesions were observed as described in goat markets. On postmortem examination the typical pox lesions were observed in alimentary canal, lungs and underneath the skin. These lesions were nodular and gray. The high prevalence of goat pox 9.93% was present in arid region followed by 8.69% and 7% in southern and northern irrigated regions (Table, 1). In tanneries the pox lesions were identified on the basis of method as adopted

in hide markets. The over all prevalence of pox in goat was 3.96%, 4.06% and 4.09% (Table, 1).

Regional prevalence: When the data was examined by collection it was observed that all the regions and collection points showed significant difference ($P < 0.05$). The highest prevalence among the regions was noted in arid region and among the sample collection spots in slaughter houses (Fig.1)

Age and Sex wise prevalence: The prevalence based on the clinical manifestation among the male and female reflect that the over all prevalence of goat pox was highest in female goat as compared to male (Table, 2). The prevalence based on postmortem among the male and female reflect that the over all prevalence of goat pox was highest in female goats as compared to males (Table, 3). The prevalence based on clinical manifestation among the adult and kid reflect that the over all prevalence of goat pox was highest in adults as compared to kids (Table 2).

The prevalence based on postmortem among the adult and kid reflect that the over all prevalence of goat pox was highest in adults as compared to kids (Table 3).

Histopathological Examination: Histopathological examination was carried out on tissues of skin, lungs, trachea, liver, kidneys heart, spleen and intestines collected during the sampling and the following histopathological changes were observed. The epidermis of the skin shows hydropic degeneration and ruptured vesicles at some places exposing the dermis. In the stained section dermis showed edema, proliferation of fibroblasts and accumulation of the cellular exudates. Extravasations of erythrocytes and coagulative necrosis with effusion of inflammatory cells intermixed with tissue debris was noticed in hypodermis. There was sloughing of cilia of epithelial layer of trachea with mild hemorrhages and extensive leukocytic infiltration in the

goats infected with intra tracheal route. Lungs showed the signs of emphysema, hemorrhages, alveolitis and leukocytic infiltration. The alveolar septa were thickened and the alveolar spaces were filled with fibrin. The bronchi, bronchioles, and terminal bronchioles showed different degrees of epithelial hyperplasia, necrosis, and hydropic degeneration. In acute cases of infected goats there was rupture and distortion of alveoli.

The section of lymph nodes showed varying degree of hemorrhages, edema and perivascular cuffing of leukocytic cells. Diffused multi focal necrotic changes with hyperplasia of the lymphoid elements were the main and consistent findings in the lymph node tissue sections. These changes were observed more in the paracortical sinuses and to a lesser degree, the medullary sinuses spreading into surrounding lymphoid tissue of lymph nodes draining organs with goat pox lesions. Vasculitis with thrombosis in the regional lymph nodes was noticed. These lesions were also observed in the medistinal lymph nodes. There were diffused areas of necrosis, streaks of hemorrhages, leukocytic infiltration and numerous inclusion bodies in histiocytic cells in the section of spleen. There were mild hemorrhages, hydropic degeneration of centroacinar hepatocytes with hyperplasia of the bile duct epithelium and perivascular infiltrations of portal triads with macrophages, lymphocytes, were seen in the livers. Focal areas of necrosis of hepatocytes with leukocytic infiltration were noticed.

The kidneys showed mild multi focal necrotic foci, proliferative glomerulonephritis infiltrated with mononuclear cells of varying degrees which were confined to the cortex. Sloughing of villi, hemorrhages and leukocytic infiltration were noticed in the sections of intestines. The heart was normal in all goats except a few having mild hemorrhages.

Table1. Distribution of data on morbid samples and positive cases for goat pox across collection spots and regions.

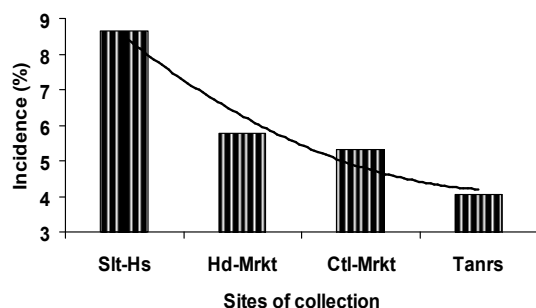
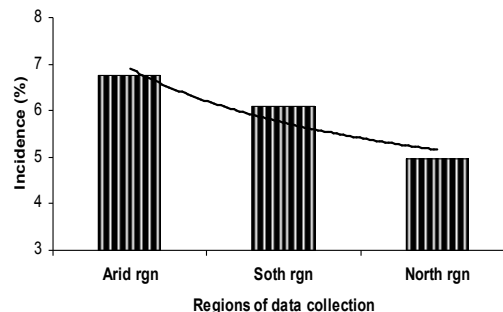
Area of study	Northern irrigated Region		Arid Region		Southern irrigated Region	
	Total No of samples	Positive %age	Total No of Samples	Positive %age	Total No of Samples	Positive %age
Slaughter houses	3438	7%	1873	9.93%	2243	8.69%
Goats Market	2841	5%	3313	5.79%	3745	5.34%
Tanneries	5038	3.96%	935	4.06%	1758	4.04%
Hide Markets	4135	3.84%	1110	7.29%	1045	6.22%

Table 2: Prevalence of goat pox on the basis clinical manifestation in different regions

Group	Northern region Positive %	Arid region Positive %	Southern region Positive %
Male	47.22	44.97	39.64
Female	52.76	55.02	60.35
Adult	72.03	63.36	70.77
Kid	27.96	36.13	29.22

Table 3. Prevalence of goat pox on the basis of postmortem in different regions

Group	Northern region Positive %	Arid region Positive %	southern region Positive %
Male	50.08	63.81	38.27
Female	75.04	73.01	69.2
Adult	74.87	69.79	46.66
Kid	29.21	32.4	24.2

**Figure 1: Incidence of goat pox virus across various collection sites.****Figure 2: Incidence of goat pox virus across various regions.**

DISCUSSION

Pox infection is a very common disease of goats in Pakistan and causes huge economic losses to the farming community, leather industry and national GDP. This disease causes high morbidity and mortality in small ruminants. The present data collected have provided a reliable indication of the extent and severity of goat pox disease in Punjab. In the survey of goat markets and slaughter houses it was observed that the animals suffering from a clinical disease showed classical signs including high grade fever, anorexia, mild cough, lesions in the form of vesicles, macules, papules, pustules and scabs on the hairless areas of animals. Diarrhea was also observed in some animals and was more pronounced in kids and lambs. These findings were correlated with previous studies (Kitching *et al.*, 1986, 1987b, 1989; Kitching and Taylor, 1985a). The incidence of disease was more at slaughter houses as compared to other collection spots probably due to attraction of sick/culled animals for slaughtering purposes.

The pox disease in tanneries and hide market was diagnosed on the basis of nodular and granular lesions which were light brown to dark brown in appearance underneath the skin. These lesions were in different sizes and some times cover the large area of skin causing huge losses to the leather industries. These findings were matched with the study of Chaudhary *et al.*, 2009. In the present findings the overall prevalence of pox disease in Punjab was 5.67% which was comparable with the finding of study by Garner *et al.*, (2000). Furthermore it was observed that the trend of disease was slightly more in arid region as compared to other two

regions. This increase might be due to the harsh environment, poor managerial conditions, communal grazing practices and non availability of proper feeding which predisposes the animal to the disease. In the present study the gross and histopathological findings in the experimental goats observed were similar to the findings of those reported previously by (Plowright *et al.*, 1959; Krishnan, 1968; Murray *et al.*, 1973; Merza and Mushi, 1990; Milli *et al.*, 1991; Gulbahar *et al.*, 1999). It is well established that histopathological lesions of goat pox involve mainly the skin, lungs, trachea and lymph nodes, while heart, kidneys, liver and intestine involve to lesser extent. These findings are matched with the results of (Gulbahar *et al.*, 1999).

The histopathological changes found in the section of skin tissues sections had characteristic appearance of the pox lesions. The dermal nodules of skin usually had hydropic degeneration of keratinocytes. Microvesicles of different sizes filled with pink fluid were also observed in the dermis. Vasculitis and infiltration of macrophages in the dermis were the predominant changes (Abbas *et al.*, 2007). Proliferation of the endothelial cell lining the subcutaneous small blood vessels and excessive proliferation of fibroblasts, characteristic of pox lesions was also observed (Afshar *et al.*, 1986 and Eltayb *et al.*, 2003). These changes were characterized by necrosis of vessel cell, aggregation of leukocytic cells in the lumen of vessel wall, surrounding adventitia and thrombosis. Extravasations of erythrocytes and coagulative necrosis were found in dermis and subcutaneous tissue. Many intra-cytoplasmic inclusion bodies were seen in the skin tissue sections. The same

were also reported by Kitching (1994) and Eltayb *et al.*, (2003).

Lungs showed signs of emphysema, hemorrhages, alveolitis and leukocytic infiltration. The alveolar septa were thickened and the alveolar spaces were filled with fibrin. The bronchi, bronchioles, and terminal bronchioles showed different degrees of epithelial hyperplasia, necrosis, and hydropic degeneration, with squamous cell metaplasia. In acute cases of infected goats there was rupture and distortion of alveoli. The some chronic cases inflammatory cells like macrophages, lymphocytes and fibroblast replaced the acute inflammatory cells. The interstitial septa were more thickened and extensive fibrous tissues were present. Large intracytoplasmic inclusion bodies were more visible in lungs in the latter stage of disease. These findings are similar to those reported earlier Gulbahar *et al.*, 2000, Afshar *et al.*, 1986, Gulbahar *et al.*, 2006). The section of lymph nodes showed varying degree of hemorrhages, edema and perivascular cuffing of leukocytic cells. Diffuse multi focal necrotic changes with hyperplasia of the lymphoid elements were the main and consistent findings in the lymph node tissue sections of infected goats. These changes were observed more in the Paracortical sinuses and to a lesser degree, the medullary sinuses spreading into surrounding lymphoid tissue of lymph nodes draining organs with goat pox lesions. Proteinaceous edematous fluid, macrophages, few plasma cells and neutrophils were observed in the medullary sinuses of mesenteric lymph nodes of the goat in the latter stage of disease. There were diffused areas of necrosis, streaks of hemorrhages, leukocytic infiltration and numerous inclusion bodies in histiocytic cells of spleen (Abbas *et al.*, 2007 and Gulbahar *et al.*, 2000).

During the present study it was found that other visceral organs like liver, kidneys and intestine also showed different histopathological changes about which little research work has been documented. The Liver showed varying degrees of histopathological changes. These lesions were mild hemorrhages, hydropic degeneration of centroacinar hepatocytes with hyperplasia of the bile duct epithelium and perivascular infiltrations of portal triads with macrophages and lymphocytes. Focal areas of necrosis of hepatocytes with leukocytic infiltration and intracytoplasmic inclusion bodies of varying sizes were observed in hepatocytes.

The kidneys showed mild multi focal necrotic foci, proliferative glomerulonephritis infiltrated with mononuclear cells of varying degrees which were confined to the cortex as has been reported by Gulbahar *et al.* (2000). Sloughing of villi, hemorrhages and leukocytic infiltration were noticed in the sections of intestines. These lesions were more pronounced in the goats that suffering from diarrhea. The heart was normal in all goats except few mild hemorrhages were noticed in few goats.

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