Journal of Veterinary Medicine and Health

Ranabhat et al., J Vet Med Health 2022, 6:4

Research Article Open Access

A study on Sero Prevalence of Peste Des Petits Ruminants (PPR) in Goats of Surkhet District, Nepal

Ranjana Ranabhat[1]*, Dhurba DC[2], Jeevan Adhikari[3] and Krishna Raj Pandey[4]

[1]Agriculture and Forestry University, Chitwan, Nepal
[2]Directorate of Livestock and Fisheries Development, Bagamati Province, Nepal
[3]Department of Veterinary Surgery and Pharmacology, Agriculture and Forestry University, Chitwan, Nepal
[4]Veterinary Laboratory, Surkhet, Nepal

Abstract

A cross- sectional study was carried out from October, 2019 to December, 2019 in Surkhet district of Nepal. A set of questionnaires was developed, pre-tested and then survey was carried out. A total of 184 goat blood serum samples were collected. PPRV circulating antibodies in goat serum samples were detected from c- ELISA kit. The data were collected, coded, computed and analyzed by SPSS version 20.0 and MS- EXCEL 2013. Chi- square test was used to find out the association investigated risk factors and the ELISA positive and negative animals. The study showed that 59.78% (110/ 184) of goat serum samples were positive to PPR. Significantly higher sero prevalence ($p<0.05$) was found in age group less than 1 year (71.6%) compare to age group more than 1 year (49%). Likewise, significantly higher sero- prevalence was found in goat reared under semi- intensive husbandry practice (70.2%) as compare to intensive husbandry practice (48.9%). The risk of female goats testing positive for PPRV antibodies was found higher (61.7%) than male goat (57.8%) but not significantly associated ($P> 0.05$). In addition, local breed of goats were more likely positive to PPRV antibodies (62%) as compare to improved breed (57.6%) but no significant association was found between breed and test result.

Keywords: PPR; Goat; Antibodies; Husbandry; Surkhet

Introduction

Nepal has two-third of the population directly engaged in agriculture. Livestock contribute 11% in national Gross Domestic Products (GDP) and 26.8% in Agriculture AGDP [1-8]. Nepal has biodiversity of topography of land and climates where livestock farming exists in all the regions; however most of the farmers raise small numbers of livestock in small land holdings [9-11]. Mainly in developing countries, small ruminants (sheep and goats) are ubiquitous and important for subsistence, income generation and poverty alleviation of the human population [7]. Goat sector is an emerging industry in Nepal with two distinct pattern of goat production- intensive and semi- intensive system. Goats are economically important and an integral component of rural farming to landless and marginal farmers in many countries including Nepal, where this species is an important source of meat and milk for human. *Peste des petits ruminants* (PPR) are an acute or sub-acute viral disease of small ruminants. It is also called as pseudo rinderpest of small ruminants; pest of small ruminants; goat plague; pest of sheep and goat; stomatitis pneumoenteritis syndrome; contagious pustular stomatitis and pneumoenteritis complex [1]. It is severe highly contagious, notifiable, and transboundary disease affecting mainly small domestic ruminants (Saeed et al. 2018) [14]. It is caused by the peste des petits ruminant's virus (PPRV) of the genus *Morbillivirus* belonging to the family *Paramyxoviridae* [9]. PPR is transmitted through direct contact with infected animal or contaminated food and water with secretion and excretion of infected animal [5]. Pyrexia, nasoocular discharge, respiratory tract infection leading to pneumonia, ulcerations, and inflammation of the gastrointestinal tract leading to severe diarrhea are the major clinical findings of this disease [10]. The Food and Agriculture Organization (FAO) and World Organization for Animal Health (OIE) have declared 2030 target for PPR eradication from the world. The morbidity and mortality of PPR is reported to go up to 100% and 90%, respectively, and sometimes in endemic area the mortality may be as low as 20% [1-11].

Materials and Methods

Study area

The cross- sectional study was conducted from January, 2019 to March, 2019 in Surkhet district. Within Surkhet district 3 different municipality (Lekhbesi Municipality, Bheriganga Municipality and Barahatal Rural municipality) were selected. It is located on latitude of 28° 20' to 28° 58' N and the longitude of 80° 59' to 82° 2' E Figure1.

Study design

From October, 2019 to December, 2019 the cross-sectional serological test was conducted. Study area was selected based on goat population density. Competitive ELISA was performed according to standard protocol of manufacturer – ID vet, France.

Sampling method

Openepi, version 3 was used for sample size determination.

$n = [DEFF*Np(1-p)]/ [(d2/Z21-\alpha/2*(N-1) +p*(1-p)]$

By taking the expected prevalence of 50% at a 95% level of confidence and a ±5% desired level of precision in the formula; sample sizes of 384 were determined for the study but due to time and monetary constrain only 184 serum sample were collected.

***Corresponding author:** Ranjana Ranabhat, Agriculture and Forestry University, Chitwan, Nepal, E-mail: ranju.ranabhat30@gmail.com

Received: 13-Jun-2022, Manuscript No: jvmh-22-64333, **Editor assigned:** 15-Jun-2022, PreQC No: jvmh-22-64333(PQ), **Reviewed:** 29-Jun-2022, QC No: jvmh-22-64333, **Revised:** 04-Jul-2022, Manuscript No: jvmh-22-64333(R), **Published:** 11-Jul-2022, DOI: 10.4172/jvmh.1000155

Citation: Ranabhat R, Dhurba DC, Adhikari J, Pandey KR (2022) A study on Sero Prevalence of Peste Des Petits Ruminants (PPR) in Goats of Surkhet District, Nepal. J Vet Med Health 6: 155.

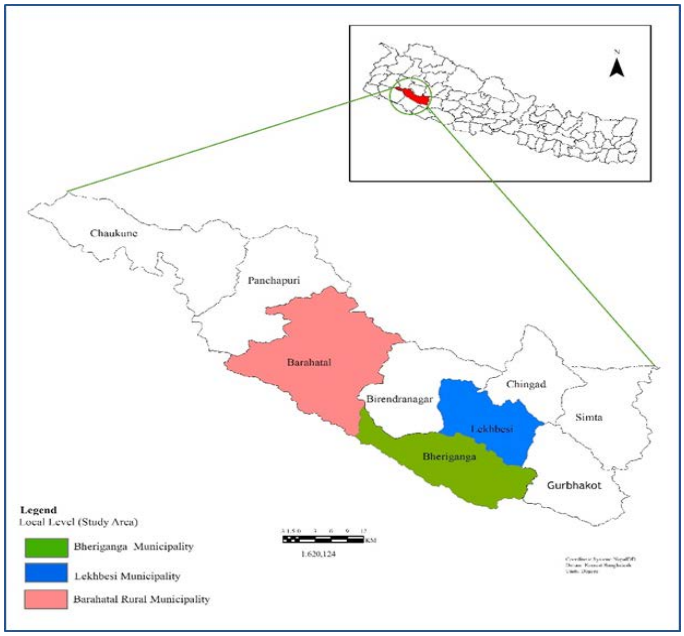

Figure 1: Study area.

Sample collection

Using 5 ml sterile syringe blood samples were collected from the jugular vein of goats. The blood samples were stored overnight at room temperature for serum separation and transferred into a sterile serum vial after separation, the sera samples were stored at -20°C until a laboratory test was performed.

Laboratory test

The sample collected was tested by using c- ELISA as protocol provided by the manufacturer- ID. Vet. This c- ELISA test detects antibodies against the PPR virus in goat serum.

Data management and analysis

Data analysis was done by using SPSS version 20 software (IBM SPSS Statistics 20). A Chi-square test was used to identify the association between risk factors and prevalence. The confidence level was held at 95% and $P < 0.05$ was set for statistical significance. The study area was mapped using GIS software Arc GIS 10.5. The test was validated if the mean value of the Negative Control O.D. (ODNC) is greater than 0.7; ODNC> 0.7 and the mean Positive Control O.D. (ODPC) is less than 30% of the ODNC.; ODPC / ODNC< 0.3. For each sample, the competition percentage (S/N%) was derived from S/N% = $\frac{OD\ sample}{ODNC} \times 100$. If the S/N% ≤ 50% the test was positive and if S/N% > 60% the test was negative to PPR virus.

Data analysis

The data obtained from the study were stored and coded accordingly using Microsoft Excel-2013. The collected data were analyzed by the Statistical Package for Social Sciences (SPSS) version 20.0 and analysis by using 2-tailed Chi-square test was conducted to find out the association between the investigated risk factors and the ELISA positive and negative animals. The prevalence was expressed in percentage. Significance was determined when $p<0.05$.

Results

Elisa test

A total of 184 sera sample were collected from goat for detection of PPR circulating antibodies against PPR infection. All the goat sera samples collected as above were subjected to ELISA test and the result obtained is presented below (Figure 2) Out of 184 Goat serum samples of Surkhet district 110/184 (59.78%) were found positive to PPR antibodies by ELISA test.

Age wise sero-positivity

The total goat sera samples were grouped into two categories, less than 1 year and more than 1 year. Out of the total sample of goat having age group less than 1 year 71.6% were positive, and 49% of goat having age group more than 1 year were positive. There was significant difference in the sero- positivity of PPR according to age group ($\chi^2 = 9.782$, $p < 0.05$). The age wise PPR status is shown in (Figure 3).

Sex wise sero-positivity

The total 184 goat serum samples collected from Surkhet district were grouped according to sex in to female (94) and male (90). 61.7% female and 57.8% males were found positive PPR on competitive ELISA test. There was no significant difference in the sero-positivity of PPR according to sex group ($\chi^2 = 0.295$, $p > 0.05$). The sex wise PPR status in goat is shown in (Figure 4).

Breed wise sero-positivity

The total goat were grouped according to breed as local and improved. Khari breed was included within local breeds and Boer, Jamunapari and their cross were included under the improved breed. The total 184 goat sera samples collected from Surkhet district were grouped according to breed in to local (92) and improved (92). 57.6% improved and 62 local were found positive to PPR on ELISA test. There

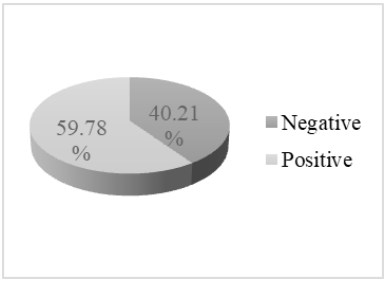

Figure 2: Sero-positivity of PPR in goat.

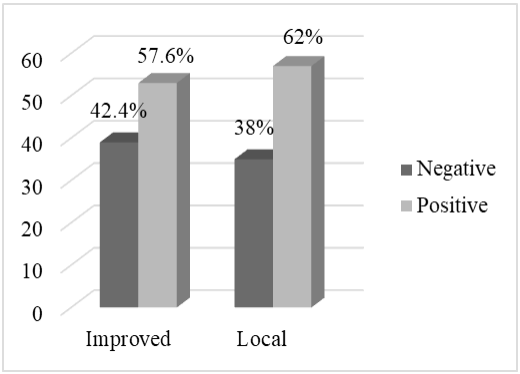

Figure 3: Age wise status of PPR in goat.

was no significant difference in the sero- positivity of PPR according to breed ($\chi^2 = 0.362$, $p > 0.05$). The breed wise PPR status in goat is shown in (Figure 5).

Husbandry system wise sero-positivity

The husbandry system was grouped in to two- Intensive and Semi intensive. Out of 184 goat sera samples 90 sample were collected from goat reared in intensive system and 94 sample were collected from goat reared in semi-intensive system. 48.9% goat reared in intensive system and 70.2% goat reared in semi- intensive system were found positive to PPR on ELISA test. There was significant difference in the sero-positivity of PPR according to husbandry system ($\chi^2 = 8.696$, $p < 0.05$). The husbandry system wise PPR status in goat is shown in (Figure 6).

Discussion

Out of 184 goat serum sample 59.78% (110/184) were found to be positive in the PPR c-ELISA kit. Study reported a sero-positivity of PPR in goat was 82.60% [3]. Similarly, in Kassala state of Sudan out of 372

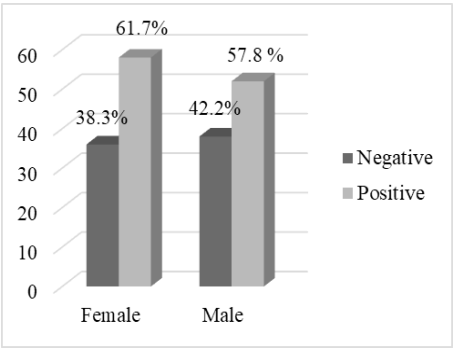

Figure 4: Sex wise PPR status in goat.

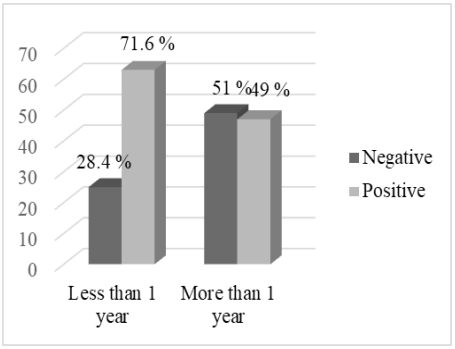

Figure 5: Breed wise PPR status in goat.

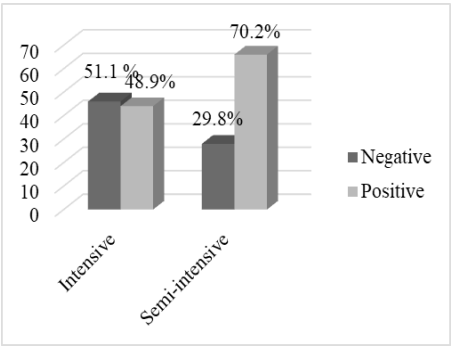

Figure 6: Farming System wise PPR status in goat.

goat serum sample 40.5% were found positive to PPR by using c-ELISA kit [14]. This study is in close approximation with the result of studies done in Sudan where they have reported 61.8% [1] but it was found that relatively lower prevalence 22.3% found in Panjab Province of Pakistan [2]. Significantly higher sero- positivity was found in age group less than 1 year (71.6%) as compare to age group more than 1 year (49%). In contrast to this finding PPR occurrence in adults is significantly higher in adult (> 12 month) followed by young (4-12 months) and sucklers (1-3 months) i.e., 95.90%, 79.72% and 69.86% respectively (Acharya et al. 2018) [3]. Kids over 4 months and under 1 year of age are most susceptible to the disease [12]. In different age groups the prevalence in animals less than six months old was 52.25%, from seven months to two years is 49.1% and that above two years old 65.5% [14]. In Bangladesh one study in black Bengal goat found that young goats are more susceptible to PPR than adult i.e., up to 6-month, 7–12-month, 13-19 month, above 19-month were18.18%, 42.30%, 22.22% and 12.50%, respectively [13]. Similarly, the prevalence was significantly higher, 31.06% in young (4-12 month) than more than 1 year i.e., 10.15% [15]. Slightly higher prevalence was found in female than male but there is no significance association between sex and sero positivity to PPR. It was found that 61.7% female and 57.8% males were found positive PPR on competitive ELISA test. The sex wise distribution of sero-prevalence of PPR among goat shows statistically significantly higher in female (87.50%) than in males (70.45%) [3]. Similarly female goats are significantly higher sero positive to PPR than male goat i.e., 25.6% and 5.1% respectively [2]. Moreover, PPR sero prevalence was higher in females 70.4% as compared to male 51.4% [4]. The present study did not reveal significantly higher prevalence in local breed (62%) than in improved breed (57.6%). These findings are in contrast with previous results that reported in Syangja and Kaski districts of Nepal i.e., 90.62% in cross breed and 85.19% in Local breed (Khari) [3]. The results of the present study revealed that there is significantly higher positivity in goat reared in semi-intensive system (70.2%) than in goat reared in intensive system (48.9%). A similar study in Kassala state of Sudan showed that in different husbandry systems, the prevalence was 47.9%, 73.0% and 49.2% in intensive, open grazing and pastoral systems respectively [14]. In semi-intensive husbandry practices domestic animal i.e., goat may come in contact with wild animals which serve as a potential threat in transmission of the disease [2-15].

Conclusion and Suggestions

A cross-sectional study was carried out in Surkhet district to study on the sero-prevalence of PPR in goats. The sero- positivity rate in goat is 59.78%. There was no significance association of sex and breed with the occurrence of PPR but age group less than 1 year is significantly at higher risk than age group more than 1 year. Similarly, goats reared under intensive husbandry system are at lower risk of PPR than reared under semi- intensive husbandry system. In semi-intensive husbandry system, there is higher risk of PPR occurrence may be due to exposure of goat with wild animals and other infected animals including infected goats. This study showed that risk of PPR occurrence can be minimize through intensive husbandry practices. The awareness program should focus to adopt intensive husbandry practice to minimize the occurrence of PPR.

Acknowledgement

The authors wish to acknowledge Veterinary Laboratory, Birendranagar, and Surkhet for providing the space and continue support in research activities.

Conflict of interest

The author should declare no conflict of interest.

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