ECONOMIC IMPACT OF PESTE DES PETITS RUMINANTS IN GOATS OF SOUTH GUJARAT

R.B. Thakor, M.D. Patel, I.H. Kalyani and R.M. Patel

Department of Veterinary Medicine, College of Veterinary Science & AH,
Navsari Agricultural University, Navsari-396 450, Gujarat, India

Received 17-11-2015 ***Accepted 23-1-2016***

Corresponding Author : drmanish911@yahoo.com

ABSTRACT

The economic impact (monetary losses) of Peste des petits ruminants (PPR) was calculated based on an epidemiological study on PPR in nearly 10% of goat population of south Gujarat (213808) during a period from June 2014 to May 2015. A total economic loss due to PPR in goats was Rs.21,33,688. The important components like losses due to mortality, weight loss, treatment cost, reproductive failure, opportunity cost and milk loss having economic significance were covered. Among such economically important variables, a loss due to mortality in PPR affected goats was 70.52%, i.e. maximum to the tune of Rs.15,04,800 of overall economic losses due to PPR. The body weight loss was the second (10.45%) most important component affecting economic loss. The other components like milk loss, reproductive loss, treatment cost and opportunity cost contributed 1.60, 4.24, 8.61 and 4.61% of overall monetary losses due to PPR in goats. Therefore, it is concluded that the higher morbidity and mortality cause heavy economic losses to the farmers. Hence, disease surveillance at regular intervals and mass vaccination programmes are urgently needed to implement for control of PPR in goats of South Gujarat.

KEYWORDS: Goat, Monetary losses, PPR, South Gujarat

INTRODUCTION

Peste des petits ruminants (PPR) is an acute febrile viral disease in goats and sheep (Tariq *et al.,* 2014). The disease is highly contagious causing varying degree of morbidity and mortality in susceptible animals (Radostits et *al.,* 2007). Therefore, WHO has identified PPR as a notifiable and economically important transboundary viral disease of sheep and goats (Balamurugan et *al.,* 2010). The PPR is caused by a RNA virus belonging to the genus *Morbilli virus* and family *Paramyxoviridae* (Gibbs *et al.,* 1979) which is closely related to rinderpest, measles and canine distemper virus. The disease is transmitted by aerosal way, but may also spread through direct contact, contaminated water or feed and produce 10-100% morbidity and mortality (Aytiken et *al*., 2011). The disease is endemic in India with varying prevalence between 20-60% (Singh *et al*., 2004; Kataria *et al.,* 2007; Santhosh et *al.,* 2009). No epidemic of PPR had been reported in Gujarat till 2014. Recently, an outbreak of PPR from south Gujarat was reported (Sharma *et al.,* 2015). The disease has great economic importance on the basis of mortality, morbidity, losses through body wastage, poor feed efficiency, loss of meat, milk and milk product, wool losses and also offspring. The morbidity and mortality contribute mainly in overall losses due to PPR in India (Singh *et al*., 2014). Looking to above facts and importance of disease and limited available reports from Gujarat especially from South Gujarat, the present work on monetary losses due to PPR in goats of South Gujarat was planned.

MATERIALS AND METHODS

The work was carried out at the Department of Veterinary Medicine, College of veterinary science Navsari (Gujarat) between June 2014 and May 2015. Total population of goats in Navsari and Valsad districts was 213808. For random sampling purpose (@ 10%), approximately 8-10 different farmer's flocks from these two districts covering goat strength of 2210 were randomly selected to represent

the whole districts. All flocks included in the study were monitored throughout the year for occurrence of abortion, kidding pattern, milk production, morbidity and mortality. Serum samples were collected from all suspected cases of PPR based on clinical findings for calculating morbidity and mortality for economic analysis. Samples were collected in 6 ml vacutainers with serum clot activator (Vaccuttae®, Greiner bio-one, Austria) and stored at -20^{0}C till further use as per requirement. PPR C-ELISA kit (IDvet, FRANCE) was used for confirmatory diagnosis. During the present study, the overall monetary losses due to PPR in goats of south Gujarat were calculated using the standard mathematical formulae given by Singh *et al*. (2014) based on various components which are financially significantly accountable, viz., losses due to mortality, weight loss, reduced milk production, treatment cost and opportunity costs.

RESULTS AND DISCUSSION

The total economic loss is expressed as **T = A + B + C + D + E + F**

A. Mortality loss: Overall mortality losses were calculated using following formula:

A $=D_{AG}\ P_{AG}+ D_{YG}\ P_{YG} + D_{KG}P_{KG}= 228 \times 5400 + 49 \times 3600 + 54 \times 1800 =$ **Rs. 1504800**

The overall morbidity and mortality due to PPR were 71.26% and 42.65%, respectively. Both were higher in animals up to 6 months of age than 6-12 months and above 12 months. The details about age-wise morbidity, mortality and their market values are given in Table1. During the present study, losses due to mortality were worked out as Rs.1504800, which shared 70.52% of the total losses due to PPRV infection in goats of south Gujarat. Similarly, Sayeed *et al.* (2005) reported maximum (86.00%) contribution of mortality in total losses due to PPR in Bangladesh. Jindal *et al. (2005)* also estimated economic losses due to mortality in PPR affected small ruminants to the tune of Rs.60 lakhs in Haryana. Subsequently, Singh *et al.* (2009) reported loss of Rs.53345 and Rs. 12094 million due to mortality caused by PPR in goats and sheep of India, respectively. Thombare and Sinha (2009) also reported losses due to mortality in goats and sheep of 6 villages of Pune district of Maharashtra to the tune of Rs.43500 and Rs. 1218000, respectively. Singh *et al*. (2014) recently calculated economic losses due to PPR in India. The losses due to mortality were Rs.43.16 and Rs.14.24 lakhs in goats and sheep with 34.34 and 33.78% share of overall losses, respectively. Comparatively higher economic loss due to mortality was observed in the present study might be due to lack of awareness about PPR in goat farmers and subsequently insufficient treatment to affected goats.

Table1: Mortality and market values of goats in different age groups

Sr.No.	Parameters	Value
1	Number of dead animals more than 12 month of age ($D_{AG)}$	228
2	Number of dead animals between 6 to 12 month of age ($D_{YG)}$	49
3	Number of dead animals below 6 month of age ($D_{KG)}$	54
4	Probable market value more than 12 month of age ($P_{AG)}$(Rs.)	5400
5	Probable market value between 6 to 12 month of age ($P_{YG)}$(Rs.)	3600
6	Probable market value below 6 month of age ($P_{KG)}$(Rs.)	1800

B. Value of direct loss through reduction in milk yield:

The value of direct loss through reduction in milk yield was calculated using following formula:

B $= (I - D)\ P_L LZM= (553 - 331) \times 0.33 \times 0.15 \times 120.2 \times 26=$ **Rs. 34342**

During the study, value of direct loss through reduction in milk yield was calculated considering 15% losses in milk production in PPR affected does and other information as given in Table 2. The loss due to reduction in milk yield was Rs. 34342 with share of 1.60% of overall losses due to PPR. In lack of related published reports, only a single report of Singh *et al.* (2014) estimated loss of Rs.2.52 lakh due to reduced milk production in goats which shared 2.01% of overall losses due to PPR in goats of India.

Table 2: Values of different parameters used to calculate losses due to reduced milk production

Sr. No.	Parameters	Value	Source of information
1	Number of animals infected (I)	553	—
2	Number of animals died (D)	331	
3	Proportion of animals in lactation (%) ($P_{L)}$	33	—
4	Proportion of lactation lost (%) (L)	15	Singh *et al.* (2014)
5	Average annual milk yield in kg (Z)	120.2	Anonymous (2014)
6	Price of milk per kg (Rs.) (M)	26	Anonymous (2013)

C. Losses due to reproductive failure:

Losses due to reproductive failure were calculated using following formula:

C = C1 + C2

Where**, C1 = C11 + C12**

C11= [(12/KI) – {12/(KI +10)}] (I-D) P LA Z M

C11= [(12/9.5) – {12/ (9.5 +10)}] (553-331) ×0.33 × 0.21 ×120.2 × 26 = Rs.31144.91

C12 = [(12/KI) – {12/ (KI +10)}] (I-D) P LA NK PC

C12 = [(12/9.5) – {12/ (9.5 +10)}] (553-331) ×0.33 × 0.21 ×1.48 × 600 = Rs.8407.092

Therefore, **C1**= 41526.54 + 11209.56 = **Rs.39552.00**

Where, **C2 = C21 +C22**

C21 = [(12/ KI)- {12/ (KI+W)}] (I –D) PL (1-A) Z M

C21 = [(12/ 95) - {12/ (9.5+3)}] (553-331) × 0.33 × (1-0.21)×120.2× 26 = Rs. 39733.94

C22 = [(12/ KI)-{12/ (KI +W)}] (I –D) PL (1-A) NK PC

C22 = [(12/ 9.5)-{12/ (9.5 +2)}] (553 –331) × 0.33 × (1-0.21) × 1.48 × 26 = Rs. 11290.07

Therefore, C2 = 36213.21 + 10289.69 = **Rs. 51024.01**

Therefore, C = C1 + C2 = 39552 + 51024.01 = Rs.90576.01

For estimating the losses due to reproduction failure in cases of PPR, various information on abortion rate and price of new born kid were collected and are presented in Table 3. Other necessary and required information were taken into consideration from available literature. During the present study, abortion rate in PPR affected does was 21.00%. The loss due to reproductive failure as a result of abortion was 4.24% (Rs.90576) of overall losses due to PPR in goats of south Gujarat.

Earlier, Thombare and Sinha (2009) reported 20.42% reduction in price due to abortion in goats of Pune district. Singh *et al.* (2014) reported 28.00% abortion rate with estimated 9.37% share of overall losses due to PPR with gross loss of Rs.11.77 lakhs due to reproductive failure in goats of India.

Table 3 : Important variable for estimating losses due to reproductive failure in PPR affected goats

Sr. No.	Parameters	Value	Source of information
1	Av. number of live kids born per doe ($N_{K)}$	1.48	Annonymous (2014)
2	Increased abortion rate (%) (A)	21	—
3	Increase kidding interval (months) ($K_{I)}$	9.5	Singh *et al.* (2014)
4	Price of new born kid ($P_{C)}$	600	—
5	Delay in conception (months) (W)	2	Singh *et al.* (2014)

D. Losses due to loss in body weight:

The losses due to loss in body weight of affected goats were calculated as follow:

D = (I-D) (1-P_L) W_L W_A P_W = (553-331) (1-0.33) ×0.20 **×** 25× 300**= Rs.223110**

PPRV infection in goats causes diarrhoea and debility which directly results in loss of body weight in affected animals. Considering 20% loss in body weight of affected goats, loss due to reduced body weight was 10.45% (Rs.223110) of overall losses due to PPR in goats of south Gujarat. Earlier, Awase *et al.* (2013) assessed the economic losses due to PPR in goats of Indore division of Madhya Pradesh. They reported loss of Rs.278 per goat due to reduced body weight which shared 53.20% of overall losses due to PPR in goats. Later, Singh *et al.* (2014) also estimated the economic losses due to PPR in small ruminants of India. They estimated loss of Rs.41.53 lakhs due to loss in body weight in affected goats with 33.05% share of overall losses due to PPR in goats of India. In both above reports, the losses due to reduced body weight had maximum proportion in total economic losses due to PPR in goats, whereas it stood second after mortality losses (70.52%) in the present study. The information of variables considered for calculating losses due to weight loss is given in Table 4.

Table 4 : Important parameters having significant effect in losses due to body weight in PPR of goats

Sr. No.	Parameters	Value	Source of information
1	Average body weight (kg) (W_A)	25	Anonymous (2014)
2	Proportion of body weight lost (%) ($W_{L)}$	20	—
3	Price of live weight per kg (Rs.) ($P_{W)}$	300	—

E. Cost of treatment (E):

The cost of treatment in affected animals was calculated as follow:

E = I T_C= 553 × 330= **Rs. 182490**

The cost of treatment in affected animals with necessary antibiotic (Inj. Enrofloxacin LA, 200 mg/

ml), NSAID (Inj. Meloxocam, 5 mg/ml) and required supportive regime including fluid therapy along with visit charges of veterinarian/para-veterinarian was estimated on the basis of actual usages per affected goat and is tabulated in Table 5. The average cost of treatment per affected goat was Rs.330. Earlier, Thombare and Sinha (2009) reported Rs.155 as treatment cost in PPR infected goat of Pune district of Maharashtra. Awase *et al.* (2013) estimated treatment cost to the tune of Rs.108 as per affected goat, which contributed 20.60% of overall losses due to PPR. In a recent report of Singh *et al.* (2014), the estimated treatment cost was to the tune of Rs.345 per affected goat and Rs.18.72 lakhs as total treatment cost in goats of India with 14.90% share of overall loss due to PPR in goats of India. In affected goats, treatment with Inj. Enrofloxacin LA along with supportive therapy reduced further complication and mortality. Similarly, Jindal *et al*. (2005) and Soni *et al.* (2013) also reported that the treatment of PPR affected goats with broad spectrum antibiotics along with necessary supportive therapy was found effective to reduce secondary bacterial infections and thus reduced mortality.

Table 5 : Treatment cost of PPR affected goat

Sr. No.	Treatment Protocol	Dose	Duration of course	Total cost (Rs.)
1	Inj. Enrofloxacin long action (120mg/ml)	7.5mg/kg	2 time at 72 hrs interval	30.00
2	Inj. Meloxicam with paracetamol	0.5mg/kg OD I/M	3 days	20.00
3	Inj. Hivit	1.5 ml OD I/V	5 days	40.00
4	Inj. DNS / RL	500ml OD I/V	3 days	90.00
5	Pul. Neblon	20 gOrally/day	5 days	25.00
6	Visit charge of para-veterinarian @25.00/day/goat		5 days	125.00
Total Expenditure				330

F. Opportunity cost (F)

These costs are difficult to quantify where records and estimates on cost of feeding, rearing and transportation and extra human labour for sick animals and disinfection of the shed are lacking. In absence of such information, the opportunity cost was assumed to be approximately 5% of overall value of animals survived in a flock and the details are given in Table 6. During the study, the estimated opportunity cost was Rs.98370, which shared only 4.61% of total economic losses due to PPR in goats of south Gujarat. The only single report of Singh *et al. (2014)* estimated opportunity cost to the tune of Rs.7.97 lakhs which shared 6.34% of total economic losses due to PPR in goats of India.

$$F = (S_{AG}P_{AG} + S_{YG}P_{YG} + S_{KG}P_{KG})\ 0.05$$

= (261 × 5400 + 126 × 3600+ 58 × 1800) 0.05 **= Rs. 98370**

Table 6 : Number of survival animals during the PPR outbreaks in south Gujarat

Sr. No.	Parameters	Value
1	Number of survival animals above 12th month of age (S_{AG})	261
2	Number of survival animals between 6th to 12th month of age (S_{YG})	126
3	Number of survival animals below 6th month of age (S_{KG})	58

The overall monetary losses due to PPR in goats of south Gujarat was Rs. 2133688 (Rs.21.34 lakhs; Table 7). Earlier Bandyopadhyay (2002) estimated Rs.1800 million (US $ 39 million) annual economic losses due to PPR alone in India. In a report from our neighbouring country (Bangladesh), Sayeed *et al*. (2005) stated that PPR caused annual loss of 870 million Taka (Rs.678 million) with an overall 11.00 % mortality in goats. Further, they stated that the mortality due to PPR alone contributes 86.00 % of overall mortality in goats. Abubakar and Munir (2014) from Pakistan also reported annual loss of Rs.834100 due to PPR in small ruminants. Saliu *et al*. (2008) also reported annual loss of 40 billion Naira (Rs.15.20 billion) due to PPR in small ruminants of Nigeria. Recently, Singh *et al.* (2014) estimated total economic losses due to PPR in goats and Sheep of India as Rs. 5477 crores for goats and Rs.3417 for sheep, with total of Rs. 8895 crores.

Table 7 : Monetary losses due to PPR in goats of south Gujarat

Sr. No.	Items	Economic losses (Rs.)
1	Mortality loss (A)	1504800(70.52)
2	Milk loss (B)	34342(1.60)
3	Reproductive loss (C)	90576(4.24)
4	Body weight loss (D)	223110(10.45)
5	Treatment cost (E)	182490(8.61)
6	Opportunity loss (F)	98370(4.61)
	Total losses (T)	2133688(100.00)

*Figures in parenthesis indicates percentage

CONCLUSIONS

The results indicated that PPR causes heavy economic losses to the farmers due to higher morbidity and mortality. Therefore, disease surveillance at regular intervals and mass vaccination programs are urgently needed to implement for control of PPR in goats of study areas.

REFERENCES :

Abubakar, M. and Munir, M. (2014). *Transbound. Emerg. Dis*., **61(1)**: 710.

Anonymous (2014). Annual Report (2013-14), All India Co-ordinated Research Project on Goat Improvement–Surti field unit, Livestock Research Station, NAU, Navsari, Gujarat,pp: 36.

Awase, M., Gangwar, L., Patil, A., Goyal, G. and Omprakash. (2013). *Livestock Res. International*, **1(2)**: 61-63.

Aytekin, I., Mamak, N., Ulucan, A. and Kalinbacak A. (2011). *Kafkas Universitesi. Vetriner. Fakiiltesi. Dergisi.*, **17(3)**: 49-55.

Balamurugan,V.,Sen, A., Venkatesan, G., Yadav, V., Bhanot, V., Riyesh, T., Bhanuprakash, V. and Singh, R.K. (2010). *Trop. Anim. Helth Prod.,* **42**:1043-1046.

Bandyopadhyay, S.K. (2002). The economic appraisal of PPR control in India. In: proccedings of 14th annual conference and national seminar on management of viral diseases with emphasis on global trade and WTO regime*,* Hissar, India,18-20 January, pp:21-23.

Gibbs, E.P., Taylor, W.P., Lawman, M.J.P. and Bryant, J. (1979). *Intervirology,* **11(5)**: 268-274.

Jindal, N., Mahajan, N., Sharma, P., Batra. M., Mittal, D. and Khokhar, R. (2005) . *Haryana Vet.,* 44: 65-69.

Kataria, A.K., Kataria, N. and Gahlot, A.K. (2007). *Slow. Vet. Res.,* **44**: 123-132.

Radostits, O.M., Blood, D.C. and Gray, C.C. (2007). Veterinary Medicine: A text book of the diseases of cattle, horse, sheep, pigs and goats.10th ed. London: Elsevier, Pp:1242-1243.

Saliu, O.J., Auda, S.I., Sanda, M.E., Aribido, S.O. and Olaolu, M. (2008). *Agril. J.,* **3(5)**: 404-405.

Santhosh, A., Raveendra, H., Isloor, S., Gomes, R., Rathnamma, D., Byregowda, S., Prabhudas, K. and Renikprasad, C. (2009). *Indian Vet. J.*, **86**: 659-660.

Sayeed, M. A., Ataur, R.,Alam, J. and Taimur, M. J. (2005). *SAARC J. Agric.*, **3**: 17-28.

Sharma, K., Kshirsagar, D., Kalyani, I., Patel, D., Vihol, P. and Patel, J. (2015). *Vet. World,* **8(4)**: 443-448.

Singh R.P., Saravanan P., Sreenivasa B.P., Singh R.K. and Bandyopandhya S.K. (2004). *Rev. Sci. Tech.,* **23**: 807-819.

Singh, R., Balamurugan, V., Bhanuprakash, V., Sen, A., Saravanan, P. and Yadav, M. (2009). *Veterinaria Italiana,* **45(3)**: 449-462.

Singh, B., Bardhan, D., Verma, M.R., Prasad, S. and Sinha, D.K. (2014). *Vet. World,* **7(4)**: 194-199.

Soni, A.K., Chandra, N. and Shukla, P.C. (2013). *Vet. Practioner.,* **14(1)**: 157- 158.

Tariq, A., Aqil, K., Akabaar, Z., Mahboob, K., Sarfraz, A., Rafique, R., Nasir, F. and Parveen, S. (2014). *Int. J. Vet. Sci.*, **3(4)**: 206-209.

Thombare, N.N. and Sinha, M.K. (2009).*Agril. Econ. Res. Rev.,* **22**: 319-322.

❑