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EPIDEMIOLOGICAL MEASURES OF CAUSAL ASSOCIATION BETWEEN PESTE DES PETITS RUMINANTS (PPR) AND ITS DETERMINANTS IN SMALL RUMINANTS

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ABSTRACT

Peste des Petits Ruminants is an acute and highly contagious viral disease of small ruminants causes great economic loss to the small ruminant industries due to the high mortality and morbidity rates in infected sheep and goats. An epidemiological study was undertaken to assess the measures of causal association between Peste des petits ruminants and its determinants in north-west agroclimatic zone of Tamil Nadu, India. Study population of 1014 animals from 18 different Peste des petits ruminants outbreak flocks were taken with respect to the exposed determinants such as overcrowding, endoparastic infestation and nomadism. Relative risk, odds ratio and attributable fraction were 1.96, 2.33 and 0.49 for overcrowding, 4.48, 18.88 and 0.78 for endoparastic infestations and 0.62, 0.56 and -0.61 for nomadism, respectively. Above results indicates that overcrowding and endoparastic infestations under the study were causally associated with the occurrence of Peste des petits ruminants outbreak in this region.

INTRODUCTION

Peste des petits ruminants (PPR) is an acute febrile viral disease of sheep and goats characterized by mucopurulent nasal and ocular discharge, necrotizing and erosive stomatitis, enteritis and pneumonia (Khan *et al*., 2007). PPR is included by the OIE in its list of notifiable animal diseases and is now endemic in the majority of Saharan and sub-Saharan Africa, Turkey, the Middle East and the Indian sub-continent (Banyard *et al*., 2010). In India, the disease was first reported in 1987 in a small sheep flock in the village of Arasur in Tamil Nadu state (Shaila *et al*., 1989), subsequently outbreaks occur as a regular feature in different parts of country since 1994 (Purushothaman *et al.*, 2006) and it has been now endemic in India (Balamurugan *et al*., 2012). PPR causes significant losses due to high morbidity and high mortality rates, with the latter occasionally approaching 90–100% in naive populations, dropping to nearer 20% in endemic areas (Roeder and Obi, 1999) and now it is considered to be the most serious disease threat to the small ruminant industry (Hegde *et al*., 2009).

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Economic losses due to PPRV have been estimated to be 1,800 million Indian Rupees (US$ 39 million) annually (Bandyopadhyay, 2002). The disease is caused by PPR virus (PPRV), a ribonucleic acid virus belonging to the genus Morbillivirus and family Paramyxoviridae (Gibbs *et al.*, 1979). Transmission of PPR is achieved by direct contact from infected to susceptible animals by close contact or through respiratory and oral routes (Chauhan *et al*., 2009). The disease predisposed by several factors including PPRV lineage, animal species, breed, immune status, stocking density, nomadism, intercurrent infection, etc. (Karimuribo *et al*., 2011). Hence, this study was made to ascertain the association between PPR and its determinants in the north-west agroclimatic zone of Tamil Nadu, India.

MATERIALS AND METHODS

A total of 1014 animals from 18 different PPR outbreaks were identified in the above zone based on the history and clinical symptoms and laboratory confirmation. Endoparasitic infestation was assessed by faecal sample examination. Relative risk, odds ratio, and attributable rate were used to determine the causal association between PPR and hypothetical determinants as per the formula described by Martin *et al.* (1994). These measures are independent of

sample size and include the strength of association and the effect of different risk factors in exposed individuals. The association is assessed by 2×2 contingent table (Table-1).

Table 1. 2X2 Contingent table for calculating these measures of association

Risk factor status	Disease status		Total
	Disease present	Disease absent	
Exposed	A	B	a+b
Not exposed	C	D	c+d
Total	a+c	b+d	a+b+c+d

Relative risk (RR)

It is calculated as the ratio between the rate of disease in the exposed group and the rate of disease in the unexposed group. Relative risk = {a/(a+b) / c/(c+d)} If relative risk values are equal to 1, < 1 and >1 indicates that there will be no, sparing and strong associations between hypothetical factor and disease respectively.

Odds ratio (OR)

It is a cross product ratio and used to measure the strength of association. It is interpreted exactly the same as relative risk. Odds ratio = ad / bc

Attributable Fraction (AF)

Attributable Fraction = (Relative risk – 1) / Relative risk

RESULTS AND DISCUSSIONS

Animal's exposure and disease status, values of epidemiological measures and nature of association are shown in table – 2.

Table 2. Animal's exposure and disease status, values of epidemiological measures and nature of association

Factors	Exposure	Disease		RR	OR	AF	Association
		Present	Absent				
Overcrowding	Present (430)	121	309	1.96	2.33	0.49	Present
	Absent (584)	84	500				
Endoparasitic infestation	Present (36)	29	7	4.48	18.88	0.78	Present
	Absent (978)	176	802				
Nomadism	Present (62)	8	54	0.62	0.56	- 0.61	Absent
	Absent (952)	197	755				

RR – Relative risk; **OR** – Odds ratio; **AF**- Attributable fraction

Overcrowding

Relative risk and odds ratio were 1.96 and 2.33 respectively, which were greater than one. Attributable fraction was 0.49, which indicates that 49% of PPR cases in overcrowded animals are due to overcrowding. The present study indicates that overcrowding is causally associated. This corroborates with the reports of Munir *et al*. (2008) who reported that the high concentration of animals in close proximity to each other predisposes for the occurrence of PPR. This might be due to increased stresses in overcrowded animal predisposes the outbreak of PPR.

Endoparastic infestations

Relative risk and odds ratio were 4.48 and 18.88 respectively, which were greater than one. Attributable fraction was 0.78, which indicates that 78% of PPR cases in endoparasitic infested animals are due to parasitism. This indicates that parasitism is causally associated and may be viewed as a putative factor in the occurrence of PPR. This finding corroborates with the report of Kumar *et al*. (2001) who reported that enteroviruses and gastrointestinal parasites (like *Haemonchus*) increase host susceptibility to PPR. Similarly, Couacy-Hymann *et al*. (2007) nutritional status and co-infection with pre-existing parasitic organisms may also contribute to exacerbated disease courses that lead to high morbidity and mortality rates.

Nomadism

Relative risk and odds ratio were 0.62 and 0.56 respectively, which were less than one. Attributable fraction was -0.61. This indicates that nomadism is not causally associated and may be viewed as a sparing causal factor in the occurrence of PPR. But, Khan *et al*. (2007), Raghavendra *et al*. (2008), Zahur *et al*. (2008) and Wang *et al*. (2009) reported that the animal movement and nomadic system in search of pasture and for trade purposes are the risk factors associated with PPR outbreak. Non-causal association might be due nomadic animals were moved through migratory tract with very infection pressure.

Conclusion

Assessment of epidemiological measures indicates that overcrowding, endoparastic infestations and nomadism were causally associated with the occurrence of PPR outbreak in this region and indicates that appropriate steps have to be taken to minimize the effect of these determinants.

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