Original Research

Analysis of Morbidity and Mortality of Important Diseases of Swine in Mizoram State of India

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Abstract

In the present study, a structured sampling design was adopted, which covered the major regions of the Mizoram state, to ascertain the morbidity and mortality rates of important diseases. The overall annual morbidity, mortality and case fatality rates have been estimated from the sample as 33.50%, 20.57% and 61.41%, respectively. Major causes of morbidity were reproductive diseases (aborted fetus), followed by Classical swine fever and major cause of mortality were also reproductive diseases (aborted fetus) followed by Classical swine fever and respiratory diseases. The case fatality rate was highest for poisoning followed by reproductive diseases (aborted fetus), injury & accidents and classical swine fever. Aborted fetuses were the major challenges under village condition in study area, so major emphasis should led to attend the reproductive problems.

Key words: Classical Swine Fever, Morbidity Rate, Mortality Rate, Reproductive Diseases

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Introduction

Pig husbandry is a profitable occupation, especially for small and marginal farmers. It requires minimum capital investment and labour. The pig industry success depends on health of the pigs and any compromise on health ground will shatter the hope of piggery sector. Total livestock population of Mizoram was 0.31 Million (19th Live Stock Census, Department of Animal Husbandry, Dairying and Fisheries, 2012). Among the total livestock, Pigs contributes highest with 78.64% followed by cattle 11.09%, goat 7.12%, buffalo

1.66% besides marginal contribution is attributed by other livestock species such as sheep, camel, mules, donkeys, horses and ponies. The total number of pigs in the state as per census 2012 is 0.24 million numbers. The knowledge of prevalent diseases and causes of morbidity and mortality are very important for managing pig farms efficiently. Keeping the above points in view and for better understanding the disease free production process the present study; efforts have been made for analysis of morbidity and mortality of important diseases of swine in Mizoram state of India using the sample survey data.

Materials and Methods

Selection of Study Area

The present study was conducted in Mizoram. The reason of choosing Mizoram as the research area is that the different diseases like Classical Swine Fever (CSF), Foot and Mouth Disease (FMD), Digestive diseases, Respiratory diseases and Metabolic & nutritional deficiency etc. are causing a great morbidity and mortality that led to high production and economic losses (Deka *et al.*, 2008).

Sampling Design

Mizoram has 8 districts that were divided into two agro-climatic zones. By taking two agro-climatic zones as strata, two districts each from zone 1 & zone 2 were selected randomly. From each selected districts two blocks and from each selected blocks, two villages were selected by simple random sampling without replacement scheme. A total of 15 pig owners have been selected from each selected village & thus a total 240 pig owners constitute the ultimate sample from sixteen villages and eight blocks for the study. The sampling scheme followed in the present study is stratified three-stage random sampling.

Data

The researchers contacted the local Government Veterinary Officer in each of the administrative blocks where the survey was being carried out, to explain the objectives of the survey. Each household selected for the sample was surveyed to collect detailed information using a questionnaire, supported by a disease identification checklist based on clinical symptoms and photographs. Data were collected between September, 2017 and July, 2018.

Statistical Analysis

The data were analyzed by SPSS (version 17) program to compute the results.

Results and Discussion

The overall annual morbidity and mortality rates in Mizoram state have been estimated from the sample as 33.50% and 20.57% respectively (Fig. 1). Out of the total morbidity rates, highest is for reproductive

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diseases (aborted fetus), 8.77% followed by Classical swine fever (8.35%), parasitic diseases (5.36%), respiratory diseases (5.03%), digestive diseases (4.78%), injury & accidents (0.75%) and poisoning (0.46%).

Fig. 1: Overall morbidity & mortality rates in Pigs

Out of the total mortality rates, highest is for reproductive diseases (aborted fetus), 8.69% followed by Classical swine fever (5.07%), respiratory diseases (2.04%), digestive diseases (1.87%), parasitic diseases (1.83%), injury & accidents (0.62%) and poisoning (0.46%). Overall case fatality rate was 61.41%. The case fatality rate was highest for poisoning (100%) followed by reproductive diseases (aborted fetus) 99.05%, injury & accidents 83.33%, classical swine fever (60.70%), respiratory diseases (40.5%), digestive diseases (39.13%) and parasitic diseases (34.11%) (Table 1).

Table 1: Overall morbidity and mortality rates due to different diseases in swine population of Mizoram state

Disease	Population at risk	Cases	Deaths	Morbidity Rates (%)	Mortality Rates (%)	Case Fatality Rates (%)
Specific Disease (Classical Swine fever)	2406	201	122	8.35	5.07	60.7
Reproductive diseases (Aborted Fetus)		211	209	8.77	8.69	99.05
Parasitic diseases		129	44	5.36	1.83	34.11
Respiratory diseases (Coughing & Pneumonia)		121	49	5.03	2.04	40.5
Digestive diseases (Diarrhoea)		115	45	4.78	1.87	39.13
Injury & Accidents		18	15	0.75	0.62	83.33
Poisoning		11	11	0.46	0.46	100
Total	**2406**	**806**	**495**	**33.5**	**20.57**	**61.41**

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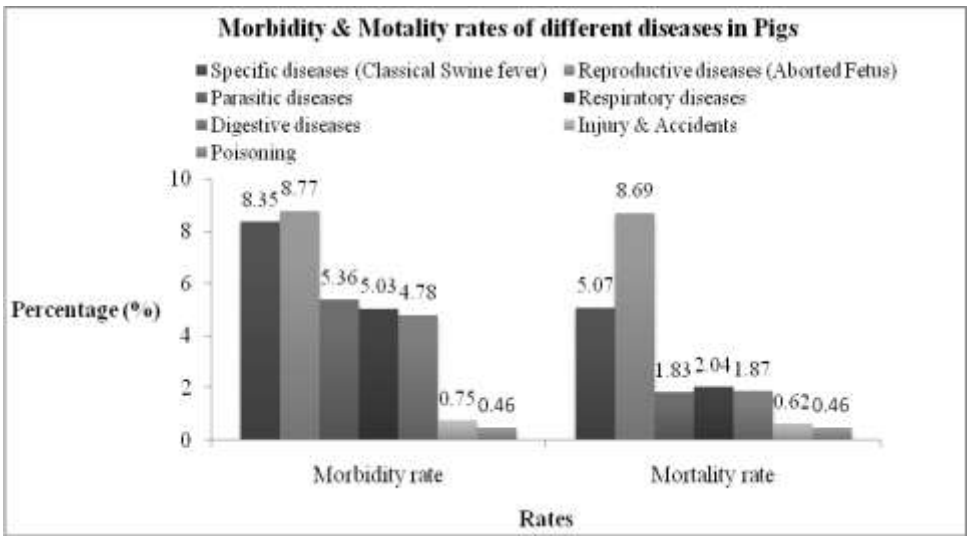

Fig. 2: Mobidity & Mortality rates of different diseases in pigs

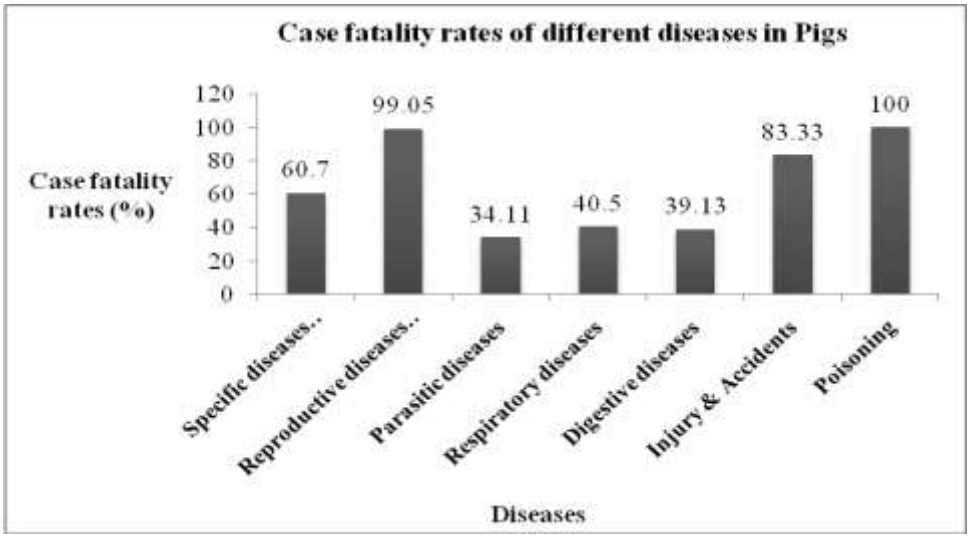

Fig. 3: Case fatality rates of different diseases in pigs

The incidence rate may vary across age group, sex and season. The morbidity rates were highest in piglets (41.87%) followed by young (19.33%) and adults (14.47%). The morbidity rate for classical swine fever was more in young one (14.20%) followed by piglets (7.40%) and adults (3.77%) (Table 2).

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Table 2: Age wise morbidity rate in swine population

Disease	Piglets		Young		Adults		χ^2_{cal}
	Cases	%	Cases	%	Cases	%	
Specific Disease (Classical Swine fever)	117	7.4	72	14.2	12	3.77	χ^2 =33.23**
							χ^2_{12} =21.57**
							χ^2_{13} = 5.5*
							χ^2_{23} = 23.24**
Reproductive diseases (Aborted Fetus)	201	12.71	0	0	10	3.14	χ^2 = 24.54**
							χ^2_{13} = 24.54**
Parasitic diseases	111	7.02	3	0.59	15	4.72	χ^2 =31.57**
							χ^2_{12} =30.74**
							χ^2_{13} = 2.27
							χ^2_{23} = 15.58**
Respiratory diseases (Coughing & Pneumonia)	110	6.96	4	0.79	7	2.2	χ^2 = 36.72**
							χ^2_{12} =28.30**
							χ^2_{13} = 10.36**
							χ^2_{23} = 2.96
Digestive diseases (Diarrhoea)	95	6.01	18	3.55	2	0.63	χ^2 = 18.97**
							χ^2_{12} =4.53*
							χ^2_{13} = 15.81**
							χ^2_{23} = 7.05**
Injury & Accidents	18	1.14	0	0	0	0	-
Poisoning	10	0.63	1	0.2	0	0	-
Total	662	41.87	98	19.33	46	14.47	χ^2 = 147.17**
							χ^2_{12} =84.27*
							χ^2_{13} = 85.05**
							χ^2_{23} = 3.21
Total No. available	**1581**		**507**		**318**		

*The cell containing zero is excluded in χ2 calculation; * Significantly Different (p<0.05), ** Significantly Different (p<0.01)*

The morbidity rates were slightly higher in male (34.96 %) than female (31.86%) (Table 3).

Table 3: Gender wise morbidity rate in swine population

Disease	Male		Female		χ^2_{cal}
	Cases	%	Cases	%	
Specific Disease (Classical Swine fever)	104	8.17	97	8.56	0.12
Reproductive diseases (Aborted Fetus)	115	9.03	96	8.47	0.59
Parasitic diseases	61	4.79	68	6	1.73
Respiratory diseases (Coughing & Pneumonia)	63	4.95	58	5.12	0.036
Digestive diseases (Diarrhoea)	92	7.23	23	2.03	35.57**
Injury & Accidents	6	0.47	12	1.06	2.79
Poisoning	4	0.31	7	0.62	1.21
Total	445	34.96	361	31.86	2.58
Total No. available	**1273**		**1133**		

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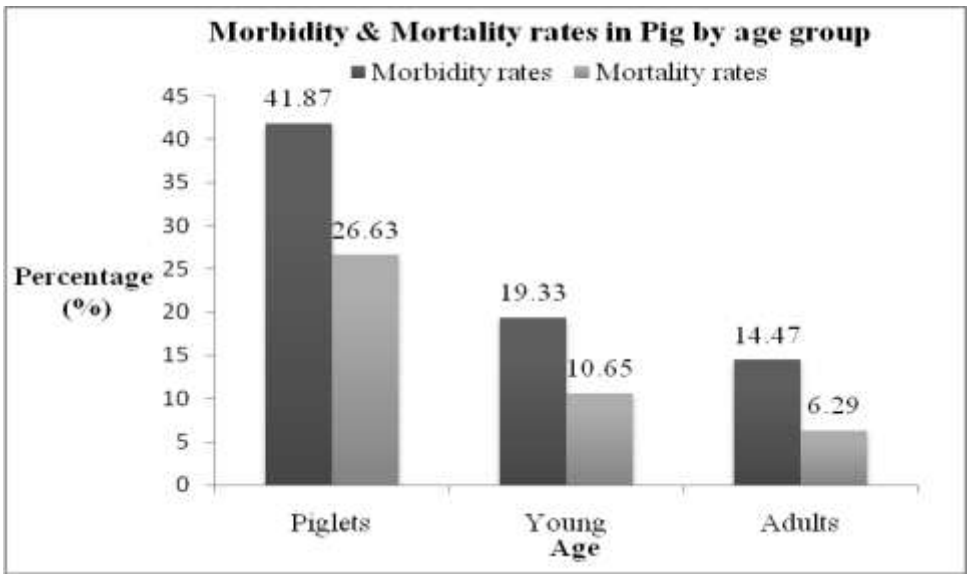

Fig. 4: Mobidity & mortality rates in pig by age group

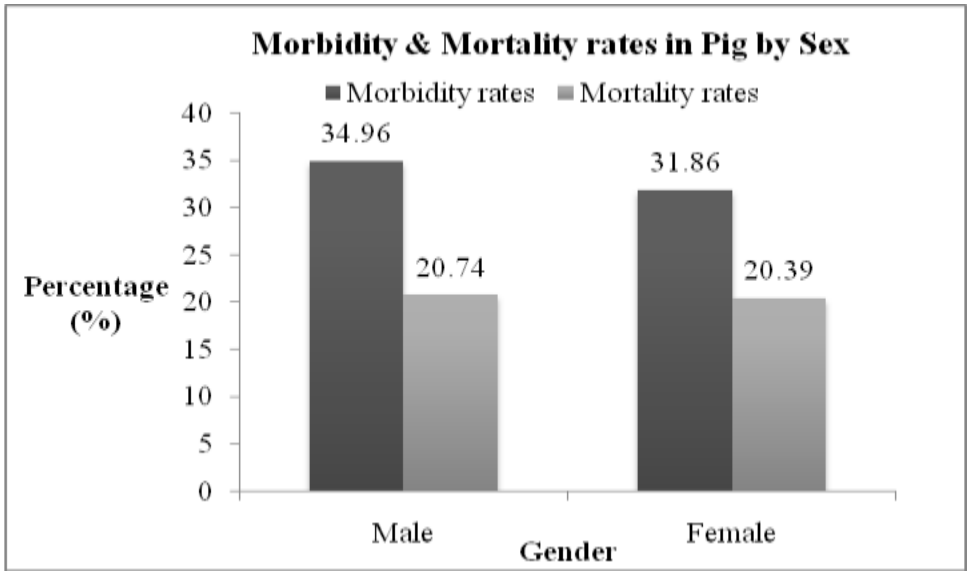

Fig. 5: Mobidity and mortality rates in pig by sex

The morbidity rates were highest in rainy season (14.55%) followed by winter (10.97%) and summer (7.98%) (Table 4).

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Table 4: Season wise morbidity rates in swine population

Disease	Summer		Winter		Rainy		$\chi 2_{cal}$
	Cases	%	Cases	%	Cases	%	
Specific Disease (Classical Swine fever)	79	3.28	25	1.04	97	4.03	62.13**
Reproductive diseases (Aborted Fetus)	72	2.99	73	3.03	66	2.74	22.74**
Parasitic diseases	18	0.75	18	0.75	93	3.87	51.92**
Respiratory diseases (Coughing & Pneumonia)	0	0	89	3.7	32	1.33	57.41**
Digestive diseases (Diarrhoea)	13	0.54	56	2.33	46	1.91	19.59**
Injury & Accidents	5	0.21	3	0.12	10	0.42	2.2
Poisoning	5	0.21	0	0	6	0.25	0.49
Total	192	7.98	264	10.97	350	14.55	
Total number available	**2406**						

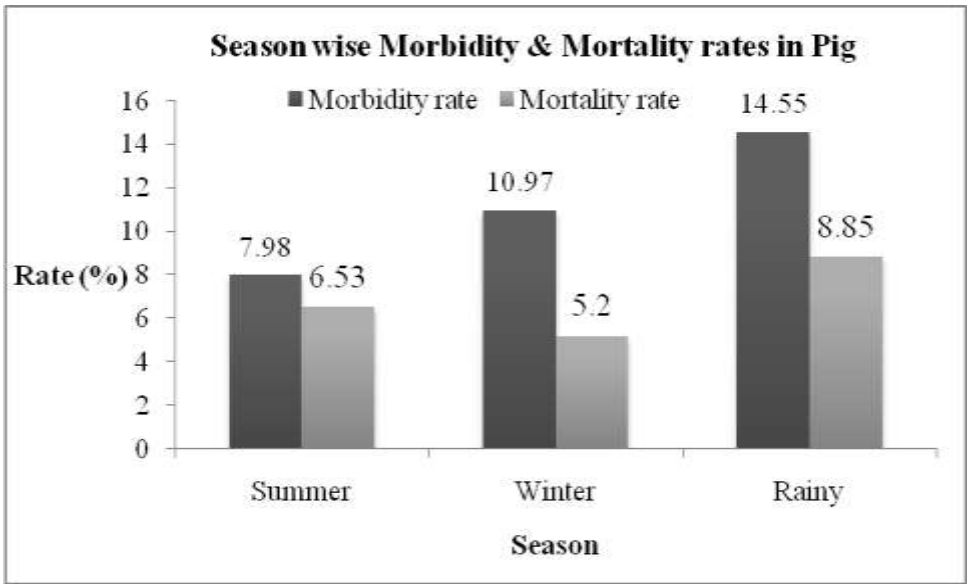

Fig. 6: Season wise Morbidity & Mortality rates in Pig

The logistic regression analysis with respect of classical swine fever revealed significant ($p<0.01$) difference in morbidity rate between age and sex. The logistic regression analysis revealed that young animal (OR=1.885) and male animal (OR=1.672) were at higher risk of morbidity (Table 5).

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Table 5: Disease wise (Classical swine fever) logistic regression analysis of morbidity rates

Factors	B	S.E.	Wald	df	Sig.	OR
Age			359.05	2	0	
Piglets	-3.492	0.249	197.37	1	0	0.03
Young	0.634	0.31	4.18	1	0.041	1.885
Adults	Ref.	-		-	-	1
Male	0.514	0.199	6.679	1	0.01	1.672
Female	Ref.	-		-	-	1
Season			0.248	2	0.883	
Summer	-0.129	0.269	0.232	1	0.63	0.879
Winter	-0.074	0.226	0.106	1	0.744	0.929
Rainy	Ref.	-		-	-	1
Constant	1.178	0.27	19.036	1	0	3.247

Nagelkerke R Square= 0.604; OR= odds ratio: Ref= Reference category

The logistic regression analysis with respect of parasitic diseases revealed significant ($p<0.01$) difference in morbidity rate between age, gender and season. The logistic regression analysis revealed that piglets (OR=1.303) were at higher risk of morbidity than adults and young animal. The analysis showed that male animal (OR=0.675) were at lesser risk of morbidity than female animals. The analysis showed that morbidity is more in rainy season (OR=1.0) than summer (OR=0.357) and winter season (OR=.132) (Table6).

Table 6: Disease wise (parasitic diseases) logistic regression analysis of morbidity rates

Factors	B	S.E.	Wald	df	Sig.	OR
Age			21.134	2	.000	
Piglets	.265	.313	.716	1	.397	1.303
Young	-2.460	.658	13.994	1	.000	.085
Adults	Ref.	-		-	-	1
Male	-.421	.204	4.262	1	.039	.657
Female	Ref.	-		-	-	1
Season			57.256	2	.000	
Summer	-1.029	.284	13.173	1	.000	.357
Winter	-2.021	.279	52.414	1	.000	.132
Rainy	Ref.	-		-	-	1
Constant	-.858	.319	7.211	1	.007	.424

Nagelkerke R Square= 0.235; OR= odds ratio: Ref= Reference category

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Table 7: Age wise mortality rate in swine population

Disease	Piglets		Young		Adults		χ^2_{cal}
	Died	%	Died	%	Died	%	
Specific Disease (Classical Swine fever)	71	4.49	45	8.88	6	1.89	χ^2 =23.05**
							χ^2_{12} =14.07**
							χ^2_{13} = 4.62*
							χ^2_{23} = 16.46**
Reproductive diseases	201	12.71	0	0	8	2.52	χ^2 = 28.11**
(Aborted Fetus)							χ^2_{13} = 28.11**
Parasitic diseases	35	2.21	3	0.59	6	1.89	χ^2 = 5.63
Respiratory diseases (Coughing & Pneumonia)	49	3.1	0	0	0	0	-
Digestive diseases (Diarrhoea)	40	2.53	5	0.99	0	0	χ^2 = 4.34*
							χ^2_{12} = 4.34*
Injury & Accidents	15	0.95	0	0	0	0	-
Poisoning	10	0.63	1	0.2	0	0	-
Total	421	26.63	54	10.65	20	6.29	χ^2 = 105.73**
							χ^2_{12} =55.77**
							χ^2_{13} = 61.43**
							χ^2_{23} = 4.55*
Total No. available	**1581**		**507**		**318**		

The incidence rate may vary across age group, sex, season and region. The mortality rates were highest in piglets (26.63%) followed by young (10.65%) and adults (6.29%) (Table 7). The mortality rates were slightly higher in male (20.74 %) than female (20.39%) (Table 8).

Table 8: Gender wise mortality rate in swine population

Disease	Male		Female		χ^2_{cal}
	Died	%	Died	%	
Specific Disease (Classical Swine fever)	58	4.56	64	5.65	1.49
Reproductive diseases (Aborted Fetus)	115	9.03	94	8.3	0.41
Parasitic diseases	27	2.12	17	1.5	1.29
Respiratory diseases (Coughing & Pneumonia)	21	1.65	28	2.47	2.03
Digestive diseases (Diarrhoea)	34	2.67	11	0.97	9.44**
Injury & Accidents	5	0.39	10	0.88	2.32
Poisoning	4	0.31	7	0.62	1.21
Total	264	20.74	231	20.39	0.045
Total No. Available	**1273**		**1133**		

The mortality rates were highest in rainy season (8.85%) followed by summer (6.53%) and winter (5.20%) (Table 9).

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Table 9: Season wise mortality rates in swine population

Disease	Summer		Winter		Rainy		$\chi 2_{cal}$
	Died	%	Died	%	Died	%	
Specific Disease (Classical Swine fever)	52	2.16	11	0.46	59	2.45	24.04**
Reproductive diseases (Aborted Fetus)	72	2.99	72	2.99	65	2.7	24.93**
Parasitic diseases	17	0.71	5	0.21	22	0.91	4.96
Respiratory diseases (Coughing & Pneumonia)	0	0	23	0.96	26	1.08	2.44
Digestive diseases (Diarrhoea)	8	0.33	11	0.46	26	1.08	5.55
Injury & Accidents	3	0.12	3	0.12	9	0.37	1.9
Poisoning	5	0.21	0	0	6	0.25	0.04
Total	157	6.53	125	5.2	213	8.85	
Total No. Available	2406						

The logistic regression analysis with respect of classical swine fever revealed significant ($p<0.01$) difference in mortality rate between age, sex and season. The logistic regression analysis revealed that young animal (OR=22.509) and female animal (OR=1.0) were at higher risk of mortality. The analysis showed that mortality were more in rainy season (OR=1.0) than summer and winter season (Table 10).

Table 10: Disease wise (Classical swine fever) Logistic regression analysis of mortality rates

Factors	B	S.E.	Wald	df	Sig.	OR
Age			65.624	2	0	
Piglets	-0.548	0.532	1.063	1	0.303	0.578
Young	3.114	0.65	22.93	1	0	22.509
Adults	Ref.	-		-	-	1
Male	-0.721	0.255	7.972	1	0.005	0.486
Female	Ref.	-		-	-	1
Season			16.908	2	0	
Summer	-0.818	0.313	6.822	1	0.009	0.441
Winter	-1.36	0.368	13.646	1	0	0.257
Rainy	Ref.	-		-	-	1
Constant	-0.227	0.53	0.183	1	0.669	0.797

Nagelkerke R Square= 0.331; OR= odds ratio: Ref= Reference category

The logistic regression analysis with respect of digestive diseases revealed significant ($p<0.01$) difference in mortality rate between age and season. The logistic regression analysis revealed that piglets (OR=20.357) were at higher risk of mortality. The analysis showed that mortality were more in summer season (OR=3.491) followed by winter season (OR=1.348) and rainy season (OR=1.0) (Table 11).

Nandi *et al*. (2011) also reported that 63.3% of the samples collected from 12 states in India had CSFV antibodies while 76.7% of the samples collected from 13 states had CSFV antigens. The case fatality rates obtained from this study approximate those published by Kumar *et al.* (2007) but the incidence estimates vary because they measure different but related events. Incidence estimates published by Kumar *et al.*

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(2007) represent the number of animals affected in the CSF outbreaks studied while those obtained from this study represent the rate at which villages are affected by CSF outbreaks over a period of one year. All these findings show that young pigs suffer heavier mortalities compared to older animals. Wright *et al.* (2010) have characterized husbandry systems (feeds, housing, and breeds and breeding) used to raise pigs in north-eastern India. Their observations are very similar to those reported in this study.

Table 11: Disease wise (Reproductive diseases) Logistic regression analysis of mortality rates

Factors	B	S.E.	Wald	df	Sig.	OR
Age			58.397	2	0	
Piglets	3.013	0.394	58.397	1	0	20.357
Young	-18.91	3877.12	0	1	0.996	0
Adults	Ref.	-		-	-	1
Season			18.935	2	0	
Summer	1.25	0.291	18.429	1	0	3.491
Winter	0.299	0.247	1.464	1	0.226	1.348
Rainy	Ref.	-		-	-	1
Constant	-3.1	0.426	53.079	1	0	0.045

Nagelkerke R Square = 0.47; OR= odds ratio: Ref= Reference category

Conclusion

The present study has generated information about the morbidity and mortality rates caused by important diseases in pigs in Mizoram state of India using a survey tools. The overall annual morbidity, mortality and case fatality rates have been estimated from the sample as 33.50%, 20.57% and 61.41% respectively. Major causes of morbidity were reproductive diseases (aborted fetus), followed by Classical swine fever and major cause of mortality were also reproductive diseases (aborted fetus) followed by Classical swine fever and respiratory diseases. Aborted fetuses were the major challenges under village condition in study area, so major emphasis should led to attend the reproductive problems. The probability of getting diseases reduces with increase in age.

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