



## Factors Influencing Mortality of Pigs Under Hot and Humid Conditions of Tamil Nadu, India\*\*

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### Abstract

*Influence of various factors on piglet mortality was studied in an organized pig farm of Tamil Nadu. Data over 31 years were taken and analyzed under three age groups using Chi-square test of independence. Genetic group, sex, period, birth weight, parity of dam and litter size at birth found to have its effect on pre-weaning mortality. Genetic group, sex, period, birth weight, season of birth, season of death, weaning weight and weaning age were found to have its effect on post-weaning mortality. Genetic group, sex, period, birth weight, season of death, weaning weight and weaning age were found to have its effect on adult mortality. The results revealed the inclusion of genetic group and birth weight as selection criteria for the improvement of survivability. Special care should be taken during winter season for male piglets and sows in early and late parity. Late weaning could improve survivability.*

**Keywords:** Factors, Mortality, Survivability, Pig, Weaning

## Introduction

India with its rapidly growing population needs to focus on creating the source of nutrients that meet the future food demand of the country which might be the prime problem in our near future. Considering the fact, meat as a major source of protein that could meet the purpose in future, more focus is to be laid on improvement of pork production. But the recent census report available shows that the total pigs in the country have decreased by 7.54 per cent over the previous census and the total pigs in the country are 10.29 million numbers in 2012 (19<sup>th</sup> Livestock census). Exotic breeds of pig such as Large White Yorkshire, Landrace, Duroc etc., have been used for crossbreeding with Desi pigs to augment production in terms of body weight as well as litter size and lean meat content. Adaptability of these breeds to the varied environment will determine the success of such cross-breeding programs. Mortality is one of the important adaptability traits and excess mortality results in huge economic loss and is found to have high impact on sustainability of a farm. Mortality can be controlled not only by identifying and treating the cause but also by checking the predisposing factors and enhancing the protecting factors. The present study was undertaken to evaluate mortality and identify factors affecting the mortality in various swine genetic groups including varying blood levels of exotic inheritance.

## Materials and Methods

A retrospective study was conducted based on the data available at Pig Unit of Post Graduate Research Institute in Animal Sciences (PGRAS), Kattupakkam, Tamil Nadu. Data pertaining to 17390 animals belonging to Large White Yorkshire (LWY), LWY crosses (four inheritance levels), Desi, Landrace, Duroc, Landrace-LWY cross and Three Way Synthetic cross (Landrace X LWY X Duroc) genetic groups, over a period of 31 years (from 1987 April to 2018 March) was collected for the present study. Various factors influencing pig mortality were analysed in three age groups; pre-weaning, post-weaning and adult. For the study on pre-weaning mortality, weaning age fixed was 56 days and post weaning period was from 57 to 240 days, after which adult mortality was studied.

From the available information factors influencing mortality were identified as genetic group, sex, time period, birth weight, litter size at birth, parity of dam, weaning age, weaning weight, season of birth and season of death. Study considered 10 different genetic groups as shown in Table 1. The F<sub>1</sub> and F<sub>2</sub> generations were considered as separated groups. The study period was sub divided into five time periods (Table 3). Birth weight was divided in to four classes based on quartiles (Table 4). Parity of dam of piglet was categorized as seven groups (Table 5). Litter size at birth ranged from 1 to 17 and was grouped into 7 classes as shown in Table 6. Similar to birth weight, weaning weight was also divided in four classes; Below 7.01 kg, 7.01 kg to 8.00 kg, 8.01 kg to 9.60 kg and above 9.60 kg were the range of respective classes Season was classified as four; summer (March to May), South-West monsoon (June to August), North-East monsoon (September to November) and winter (December to February) for season of birth as well as season of death.

## Statistical Analysis

Mortality percentage was estimated for each age group. To test the significance of factors considered, Chi-square test of independence at 95 per cent confidence interval was employed. The test of our interest is focused on independence between classified item according to the two different criteria by rows and columns (mortality and factors in this study). Data were analysed using IBM SPSS version 25.

## Results and Discussion

The pre-weaning, post weaning and adult mortality observed in the study were 7.19 per cent, 11.27 per cent and 4.28 per cent, respectively.

### Genetic Group

Genetic group was found to have highly significant effect on mortality in all the three categories (Table 1). Out of the 10 genetic groups Desi breed was found to have the highest mortality of 39.09 per cent and LWY had the lowest mortality of 5.75 per cent with overall mortality of 7.19 per cent in pre weaning category. In post-weaning category, Duroc had the highest mortality (20.16 per cent) and Desi lowest mortality with 2.99 per cent. In adult category overall mortality observed was 4.28 per cent among which Landrace-LWY cross was observed to have highest

mortality (8.54 per cent).

**Table 1:** Genetic group-wise mortality of pigs over different stages

Breed	Pre weaning mortality			Post weaning mortality			Adult mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)	Total	Death	Mortality (%)
TWS	1143	72	6.30	537	35	6.52	502	8	1.59
L x Y	349	25	7.16	190	26	13.68	164	14	8.54
75% LWY-F2	3570	274	7.68	1065	90	8.45	975	18	1.85
50% LWY-F2	265	44	16.60	149	14	9.40	135	5	3.70
75% LWY	168	15	8.93	137	8	5.84	129	2	1.55
50% LWY	185	33	17.84	150	18	12.00	132	4	3.03
Duroc	210	36	17.14	129	26	20.16	103	6	5.83
Landrace	790	47	5.95	215	27	12.56	188	6	3.19
Desi	110	43	39.09	67	2	2.99	65	3	4.62
LWY	7055	406	5.75	1682	241	14.33	1441	98	6.80
<b>Total</b>	13845	995	7.19	4321	487	11.27	3834	164	4.28
<b>Chi-square</b>	<b>292.655**</b>			<b>57.212**</b>			<b>56.697**</b>		
<b>p - value</b>	<b>&lt; 0.001</b>			<b>&lt; 0.001</b>			<b>&lt; 0.001</b>		

TWS Three way synthetic; LWY – Large White Yorkshire; LXY – Landrace x LWY

LWY is known for its better adaptability. Though Desi pigs are best suitable for the native environment, when they moved from free range system to farm condition mortality was high during its pre-weaning stage. Lack of space to wander around and aggressive nature of dam preventing from giving external care, low quantity of milk *etc.* might be the reasons for higher mortality. Genetic variation was reported for perinatal survival and pre-weaning survival earlier (Lund *et al.*, 2002). Similarly, genetic factors influences the mortality pattern in pigs (Basumatary *et al.*, 2009). Present results concur with the previous studies (Fahmy and Bernard, 1971, Lund *et al.*, 2002 and Basumatary *et al.*, 2009) that genetic factors influences the pre weaning mortality pattern in pigs.

## Sex

Sex was found to have its influence on mortality at 0.05 level of significance for pre-weaning and 0.01 level of significance among post-weaning and adult stage (Table 2). Overall pre-weaning mortality was 7.19 per cent among which mortality in male was 7.67 per cent and in female 6.68 per cent. For post-weaning stage also, male found to have more mortality rate compared to female. But in adult stage female found to have higher rate compared to male. Since males were disposed off earlier, survivability might be higher among selected adult males compared to adult females. Further, adult sows were at high risk compared to the boar, especially during period of gestation and farrowing. The result of the study concurs with the studies of Becker (1995) and Lay *et al.* (2001).

**Table 2:** Mortality of pigs of different sex in different stages

Sex	Pre weaning mortality			Post weaning mortality			Adult mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)	Total	Death	Mortality (%)
Male	7107	545	7.67	2085	287	13.76	1798	45	2.5
Female	6738	450	6.68	2236	200	8.94	2036	119	5.84
<b>Total</b>	13845	995	7.19	4321	487	11.27	3834	164	4.28
<b>Chi-square</b>	<b>5.082*</b>			<b>25.070**</b>			<b>26.045**</b>		
<b>p - value</b>	<b>0.024</b>			<b>&lt; 0.001</b>			<b>&lt; 0.001</b>		

## Period

Chi-square analysis indicated that period had highly significant influence on mortality in all the three stages

(Table 3). Highest mortality occurred during 1993-1997 in pre-weaning (17.77 per cent) and adult (27.75 per cent) category. In post-weaning category highest mortality (15.98 per cent) occurred during 2003-2007 period, when Desi pig was introduced to farm and the breeding programme began. Lowest adult mortality in the last period indicated that management practices improved over the period. The results of present study harmonize with the early studies of Fahmy and Bernard (1971).

**Table 3:** Mortality of pigs over different period in each stage

Period	Pre-Weaning Mortality			Post Weaning Mortality			Adult Mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)	Total	Death	Mortality (%)
1987-1992	423	12	2.84	127	7	5.51	120	16	13.33
1993-1997	349	62	17.77	195	22	11.28	173	48	27.75
1998-2002	1631	87	5.33	645	91	14.11	554	23	4.15
2003-2007	3028	243	8.03	1120	179	15.98	941	35	3.72
2008-2012	3554	283	7.96	1032	98	9.50	934	23	2.46
2013-2018	4860	308	6.34	1202	90	7.49	1112	19	1.71
<b>Total</b>	13845	995	7.19	4321	487	11.27	3834	164	4.28
<b>Chi-square</b>	<b>90.596**</b>			<b>54.720**</b>			<b>282.909**</b>		
<b>p - value</b>	<b>&lt; 0.001</b>			<b>&lt; 0.001</b>			<b>&lt; 0.001</b>		

### Birth Weight

Based on chi-square analysis, it is evident that birth weight had significant effect on mortality in all the stages (Table 4). Piglets born with birth weight below 1.11 kg was more susceptible in all three stages with mortality of 10.39, 14.11 and 5.65 per cent for pre-weaning, post-weaning and adult age groups respectively. The low-birth-weight piglet is physiologically compromised in terms of energy stores and susceptibility to cold and is at a disadvantage in competing with larger littermates at the udder and this is one of the reasons that they are at high risk for pre-weaning morbidity and mortality (Lay *et al.*, 2001). This might be the reason for above results in the present study.

**Table 4:** Mortality of pigs in different birth weight category (kg) in each stages

Birth weight (kg)	Pre weaning mortality			Post weaning mortality			Adult mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)	Total	Death	Mortality (%)
≤1.10	3733	388	10.39	1318	186	14.11	1132	64	5.65
1.11 to 1.22	3628	253	6.97	930	90	9.68	840	39	4.64
1.23 to 1.41	3248	191	5.88	960	105	10.94	855	21	2.46
≥ 1.42	3094	147	4.75	1000	103	10.30	897	34	3.79
<b>Total</b>	13703	979	7.14	4208	484	11.50	3724	158	4.24
<b>Chi-square</b>	<b>94.107**</b>			<b>13.584**</b>			<b>13.047**</b>		
<b>p – value</b>	<b>&lt; 0.001</b>			<b>0.004</b>			<b>0.005</b>		

### Parity

Parity of dam had significant effect on pre-weaning mortality. However, it is not significant for post-weaning and adult age group (Table 5). High mortality rate was observed in piglet born to dam at its early (1 and 2) and late parity (6 and above). Sows in their mid-parity (3, 4 and 5) are in their prime age breeding. As parity increases milk production of sows increases but later when sows get older milk production reduces. Older sows tend to have a larger variation in birth weight and this could lead to mortality of weaker piglets as described above. (Vaillancourt and Tubbs, 1992).

**Table 5:** Mortality of pigs born under different parity of the dam in each stage

Parity of dam	Pre weaning mortality			Post weaning mortality			Adult mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)	Total	Death	Mortality (%)
1	6362	491	7.72	2233	262	11.73	1971	85	4.31
2	3267	265	8.11	924	98	10.61	826	39	4.72
3	1802	94	5.22	443	56	12.64	387	15	3.88
4	981	56	5.71	263	31	11.79	232	12	5.17
5	658	35	5.32	145	14	9.66	131	0	
6	320	25	7.81	100	8	8.00	92	2	2.17
≥ 7	255	21	8.24	66	9	13.64	57	2	3.51
<b>Total</b>	13645	987	7.23	4174	478	11.45	3696	155	4.19
<b>Chi-square</b>	24.436**			3.42			8.027		
<b>p – value</b>	< 0.001			0.755			0.236		

### Litter Size at Birth

The results portrayed in Table 6 evinced that among pre-weaning piglet, mortality percentage was 10.28, 8.64 and 7.35 per cent for litter size ≤ 5, 6 and ≥11. There was about 7 per cent mortality for litter size 7 and 8 and about 5 per cent for litter size 9 and 10. The study contradicts with the study of Dyck and Swierstra (1987) that mortality increases with increase in litter size.

**Table 6:** Mortality of pigs in different litter size at birth in each stage

Litter size at birth	Pre weaning mortality			Post weaning mortality			Adult mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)	Total	Death	Mortality (%)
≤ 5	1498	154	10.28	500	62	12.4	438	25	5.71
6	1215	105	8.64	414	46	11.11	368	14	3.8
7	1828	134	7.33	552	59	10.69	493	31	6.29
8	2550	186	7.29	821	82	9.99	739	26	3.52
9	2694	159	5.9	708	84	11.86	624	23	3.69
10	2161	121	5.6	641	72	11.23	569	20	3.51
≥ 11	1823	134	7.35	627	79	12.6	548	21	3.83
<b>Total</b>	13769	993	7.21	4263	484	11.35	3779	160	4.23
<b>Chi-square</b>	40.213**			3.493			9.984		
<b>p – value</b>	< 0.001			0.745			0.125		

### Season

Season of birth and death (Table 7 and Table 8) was found to affect mortality in post weaning stage with highest occurrence of death during winter season; 14.42 per cent and 14.17 per cent respectively. For adult mortality season of death was found to be significant with highest mortality in winter season (6.09 per cent). This result concurs with study of Becker (1995).

**Table 7:** Mortality of pigs over different season of birth in each stage

Season of birth	Pre weaning mortality			Post weaning mortality			Adult mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)	Total	Death	Mortality (%)
Summer	3472	274	7.89	1037	113	10.90	924	45	4.87
S-W monsoon	3305	223	6.75	1146	117	10.21	1029	45	4.37
N-E monsoon	4158	276	6.64	1417	153	10.80	1264	45	3.56
Winter	2910	222	7.63	721	104	14.42	617	29	4.70
<b>Total</b>	13845	995	7.19	4321	487	11.27	3834	164	4.28
<b>Chi-square</b>	6.275			<b>8.924*</b>			2.673		
<b>p - value</b>	0.099			<b>0.030</b>			0.444		

**Table 8:** Mortality of pigs in different season among each age group of pigs

Season of death	Pre weaning mortality			Post weaning mortality			Adult mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)	Total	Death	Mortality (%)
Summer	3395	277	8.16	1197	134	11.19	1063	39	3.67
South-West monsoon	3116	213	6.84	987	97	9.83	890	33	3.71
North-East monsoon	3214	257	8.00	874	115	13.16	759	40	5.27
Winter	3446	248	7.2	995	141	14.17	854	52	6.09
<b>Total</b>	13171	995	7.55	4053	487	12.02	3566	164	4.60
<b>Chi-square</b>	5.612			<b>10.682*</b>			<b>8.807*</b>		
<b>p - value</b>	0.132			<b>0.014</b>			<b>0.032</b>		

### Weaning Weight

Weaning weight was found to be a significant factor that can influence mortality (Table 9) in post-weaning stage and adult stage. Animals with low weaning weight (< 7 kg) had higher mortality (13.53 per cent) in post-weaning stage which concurs with the previous study result of Larriestra *et al.* (2006) that improvement of weight at nursery exit reduces the mortality but in adult age group pigs with highest weaning weight was found to have high mortality (6.54 per cent) which contradicts the previous case.

**Table 9:** Mortality of pigs in different weaning weight (kg) category in each stages

Weaning weight (kg)	Post weaning mortality			Adult mortality		
	Total	Death	Mortality (%)	Total	Death	Mortality (%)
≤ 7.00	1146	155	13.53	991	28	2.83
7.01 to 8.00	652	46	7.06	606	21	3.47
8.00 to 9.6	875	93	10.63	782	30	3.84
≥ 9.61	1052	89	8.46	963	63	6.54
<b>Total</b>	3725	383	10.28	3342	142	4.25
<b>Chi-square</b>	<b>24.327**</b>			<b>18.624**</b>		
<b>p - value</b>	<b>&lt; 0.001</b>			<b>&lt; 0.001</b>		

### Conclusion

It could be concluded that genetic group, sex, period and birth weight are important factors influencing mortality of pigs at different ages. Better survivability of LWY and its crosses indicated adaptability of the breed to the region.

Male piglets should be given more care especially during pre-weaning mortality. Birth weight should be included as a criterion for selection. Litter size and parity had got its effect on pre-weaning mortality. Sows in their early and late parity should be provided special attention. Improvement in weaning weights and later weaning age would help in improving survivability. Enough protection and care should be given to the animals during winter season.

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## Conflict of Interests

There is no conflict of interest.

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