Variability of mortality risk factors with age in puppies

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INTRODUCTION

Despite high mortality rate in breeding kennels (10-30%) (1), causes and factors impacting mortality in puppies between birth and 2 months of age are poorly described. Different factors at different ages have been found crucial for survival in porcine species, as i.e. litter size for the first 3 days after birth and early weight gain for older piglets. **The aim of this study was to identify the risk factors for mortality in puppies at different ages.**

MATERIALS AND METHODS

- A total of **2288 puppies** from **390 litters** and from **22 different breeds** born in one breeding kennel were included in the study. Following factors were recorded: age of dam, season at birth, number of puppies present in the kennel at their time of birth (animal density), litter size, breed, sex and weight since birth until 3 weeks.
- Depending on adult body weight of the breed, puppies were classified into small (<10kg, n=722), medium (10-25kg, n=535), large (25-45kg, n=644) and giant (>45kg, n=387) sized breeds.
- The birth weight was encoded in quartiles defined separately for each breed size (Table 1).
- The impact of registered factors on mortality during four different periods were tested with multivariable logistic models with dam as a random effect (Proc GLIMMIX; SAS, Cary, N.C., USA).

Birth weight classification (g)				
Breed size	**Q1**	**Q2**	**Q3**	**Q4**
Small	< 160	160-184	185-220	> 220
Medium	< 215	215-254	255-310	> 310
Large	< 380	380-424	425-470	> 470
Giant	< 370	370-419	420-470	> 470

Table 1. Birth weight classification depending on breed size.

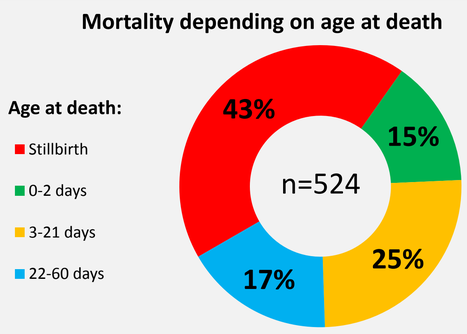


Fig. 1. Percentage of total mortality depending on age at death.

RESULTS

- A total mortality rate in puppies between birth and 60 days of age was **22.9%** (524/2288).
- Among dying puppies (n=524), 43.1% (226) died at birth, 14.5% (76) between 0-2 days, 25.2% (132) between 3-21 days and 17.2% (90) between 22-60 days (Fig. 1).
- Factors influencing mortality differed according to puppies age (Fig. 2-7).
- Dam as a random term had a significant influence on mortality at all considered periods (p<0.001 in all four models).

STILLBIRTH

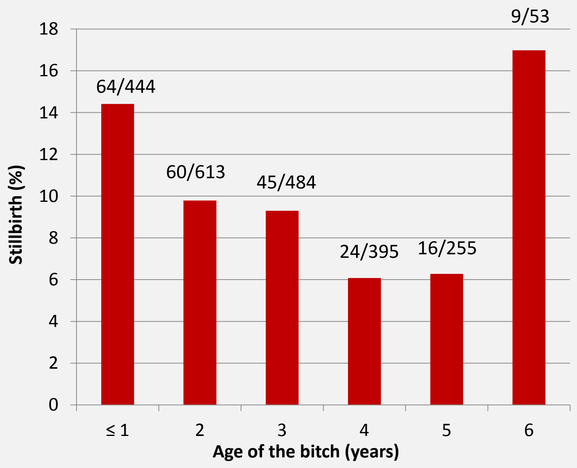


Fig. 2. Proportion of stillborn puppies depending on age of dam.

Mortality due to stillbirth was influenced by age of the dam (p=0.02; Fig. 2). Stillbirth rate tended to be higher in giant breeds compared with small, medium and large breeds (16.0% vs. 8.0%; 8.0%; 9.8%, respectively; p=0.06).

MORTALITY 0-2 days

Mortality between 0-2 days was influenced by birth weight (p<0.001; Fig. 3). Birth weight in puppies was negatively correlated with age of the dam (r=-0.13, p<0.001).

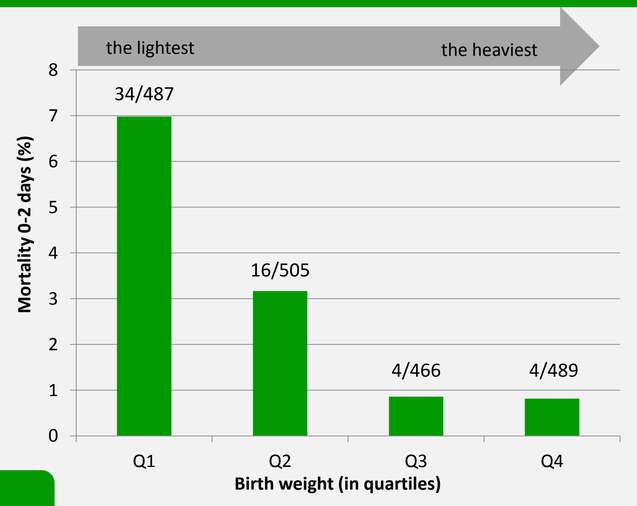
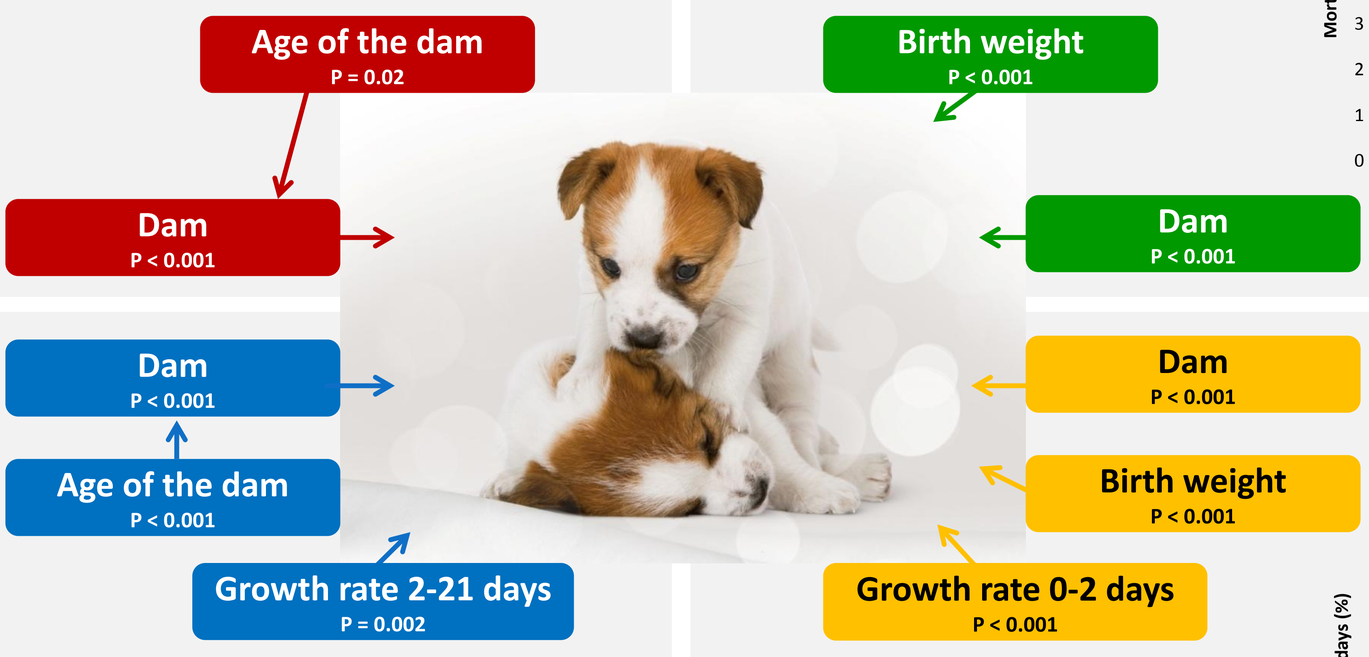


Fig. 3. Proportion of puppies dying between birth and 2 days of age depending on birth weight.



MORTALITY 22-60 days

Mortality between 22-60 days was influenced by age of the dam (p<0.001; Fig. 6) and growth rate between 2 and 21 days of age (p=0.002; Fig. 7).

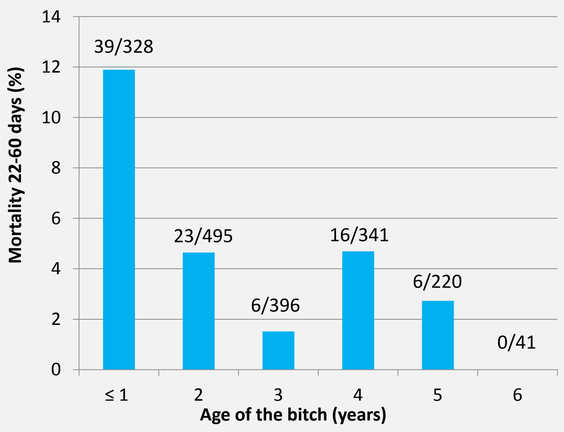


Fig. 6. Proportion of puppies dying between 22 and 60 days of age depending on age of dam.

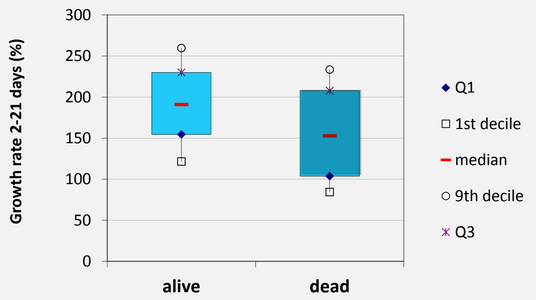


Fig. 7. Box and whisker plot of growth rate between 2 and 21 days of age in alive puppies and puppies dying between 22 and 60 days of age.

MORTALITY 3-21 days

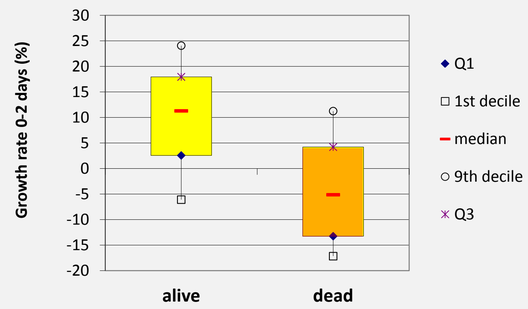


Fig. 4. Box and whisker plot of growth rate between birth and 2 days of age in alive puppies and puppies dying between 3 and 21 days of age.

Mortality between 3-21 days was influenced by growth rate over the first 48 hours (p<0.001; Fig. 4) and birth weight (p<0.001; Fig.5).

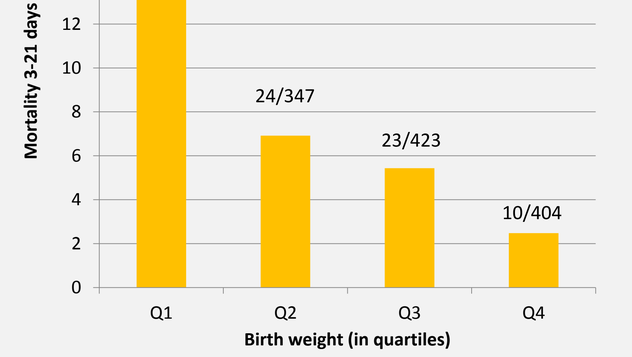


Fig. 5. Proportion of puppies dying between 3 and 21 days of age depending on birth weight.

DISCUSSION & CONCLUSIONS

- The highest part of mortality in this kennel was due to stillbirth. This result is in accordance with other published data (2).
- The risk of death in puppies was increased in young dams and dams over 5 years old; however, the effect of parity remains to be tested.
- Risk factors appeared to differ according to the age of puppies, but the effect of the dam seems of major importance.
- Systematic weighing to detect low-birth-weight puppies and puppies with retarded growth could be advised from this study to detect puppies at risk of death.
- Specific nursing of puppies at risk, i.e. by additional feeding with milk replacer could help to decrease mortality rate in breeding kennels.

1) Lawler DF, *Current Veterinary Therapy,* Kirk,(Ed).W.B. Saunders Co. Philadelphia 1989, 1325 - 1333. 2) Tonnessen R et al., Theriogenology 2012; 77(9):1788-1801.