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RISK FACTORS FOR PUP MORTALITY IN A BOXER COHORT

Nielen A.L.J.[1], VD Beek S.[2], Knol B.W.[1], Van Oost B.A.[1], Schukken Y.H.[3]

Dans une cohorte de portées de chiots boxer nés entre 1994-1995 aux Pays-Bas, les facteurs de risque de mortalité des chiots ont été étudiés. Sur les 2629 chiots, 571 étaient morts-nés ou sont morts avant sevrage (à l'âge d'environ 50 jours). Sachant que l'impact le plus important sur la mortalité avant sevrage est du à des facteurs entre portées, des connaissances supplémentaires au niveau du chiot pourraient permettre de faire diminuer la mortalité des chiots. Les données sur les chiots ont inclus la mort du chiot, son sexe, sa couleur, le poids à la naissance, le temps écoulé entre la naissance de deux chiots, temps entre la naissance et la première tétée, et l'intervention à la mise-bas de l'éleveur ou du vétérinaire. Les résultats mettent en évidence que la couleur blanche du chiot, des poids faibles ou élevés sont significativement liés à une mortalité plus élevée. Du fait que l'euthanasie des chiots blancs a été considérée comme un cas de mortalité et que ces chiots sont euthanasiés de façon spécifique, la relation mise en évidence n'était pas inattendue. Le lien observé entre le risque de mortalité et les poids de naissance élevés et faibles peut s'expliquer du fait que les poids de naissance élevés sont souvent associés à des dystocies et que les chiots nés avec un poids faible sont souvent plus fragiles Dans une sous-population de chiots, l'heure de naissance pour chaque chiot a été enregistrée : une diminution linéaire du risque de mortalité a été associée avec l'augmentation du temps entre les naissances.

INTRODUCTION

Pup mortality is of great concern of dog breeders. Death of one or more pups in a litter affects the breeder financial and emotional. Studies on this subject reported mortality of pups before weaning (about 7 weeks of age) between 6 and 34% (Bowden R.S.T 1963; Farstad W. 1983; Von Radinger I. 1989: Widmann-Acanal B. 1992). In a birth cohort of boxer pups in the Netherlands a mortality of 22 % was found (Nielen A.L.J. 1997). With improved knowledge of causes of pup mortality a prevention program to lower pup mortality can be set up. Data on risk factors for neonatal death have been collected in commercial breeding colonies (McKelvie and Andersen 1963). These data are not necessarily applicable to individual breeders.

Risk factors of pup mortality can be divided in three categories: genetic factors, environmental factors that are similar for all pups in one litter (i.e. whelping facilities) and factors that varies for pups in the same litter (i.e. sex, birthweight). In a recent study (S. Van der Beek et al., 1997) the most impact on preweaning mortality was due to between litter factors. For breeders it can be useful to know which specific risk factors on pup level are related with pup mortality. Pups with a higher risk for death can be extra monitored or management can be changed.

MATERIAL AND METHODS

POPULATION

Data were collected from litters of the boxer population born in the Netherlands between January 1994 and March 1995. All dams had an official pedigree from the Dutch Kennel Club; all sires were registered in FCI enlisted Kennel Club registration. The data included 414 litters with 2629 pups.

DATA COLLECTION

Breeders of boxer litters were asked to contact the study center when a bitch was pregnant. They were sent a questionnaire before the pups were born. Breeders who did not notify the center before the birth of a litter were contacted by telephone as soon as the litter was reported to the Dutch Kennel Club and a questionnaire was sent the week after the pups were born. Data for this specific study were collected at pup level. Data on the pups included death of the pup; sex; color; weight on birth; time between the birth of the pup and that of the previous pup; time between birth and first suckling; position of the pup during birth and help of breeder or veterinarian at birth.

DATA ANALYSIS

Pup mortality was defined as a binary trait with 0 if the pup was alive at weaning and 1 if the pup died and. Sex (on nominal scale), color (categorical: yellow, brindled and white), weight at day 0 (ratio scale), position of the pup (categorical: head in front and another position, time between the pups (ratio), first suckling and help at birth (categorical: no help, help of breeder, Section Caesarian) were the independent variables. They were checked on missing data. The Data were analyzed using a backward approach (< 0.10) of logistic regression. Two null-models were used. The first one included all pups, and the second model only included litters where information on time of birth was available per pup. All analyses were performed using Statistix (NH analytical software, St Paul, MN, USA).

1 Department of Clinical Sciences of Companion Animals, P.O. Box 80154, 3508 TD Utrecht, The Netherlands

2 Department of Animal Breeding, P.O. Box 338, 6700 AH Wageningen, The Netherlands

3 Department of Herd Health, Yalelaan 7, 3584 CL Utrecht, The Netherlnands

RESULTS

Of the 2629 pups in total 571 died or were euthanased before the age of weaning (50 days of age). Information for the risk factors that was available differed: sex: 2551, color: 2629, weight at day 0: 1705, position of the pup: 1379, time between the pups: 1322, first suckling: 1301 and help at birth: 2629. There was considerable variation in mortality for pups of different weight categories as shown in figure 1. Also for the risk factor color there was variation in percentage of death pups, Epecially white colored pups had a high death risk. The variation between yellow colored and brindled pups was not large.

Of the 1699 pups information of all three variables were present the results of the logistic regression analysis are presented in Table I. The results of the final-model of the subpopulation of 680 pups with data on time of birth were presented in table II.

Figure 1
Pup mortality of the different categories of birthweight of 1705 pups

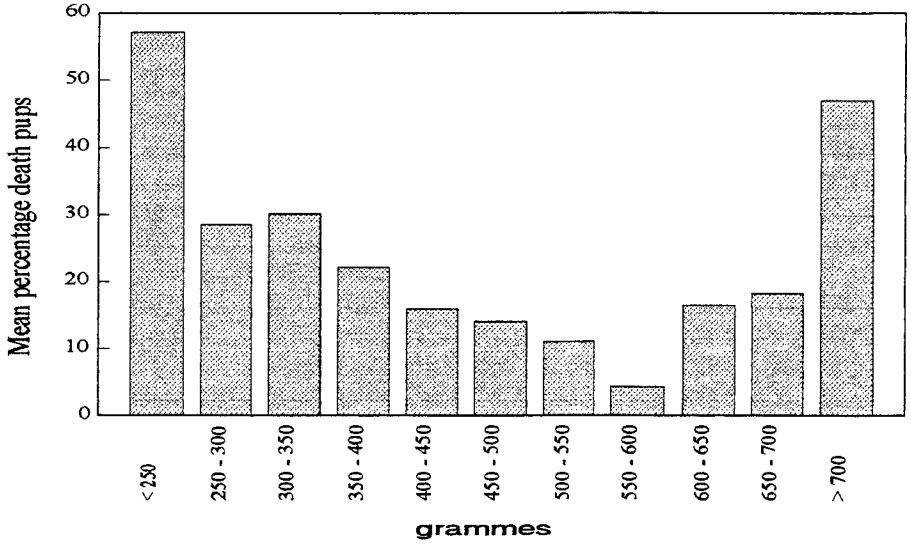

Table I
Results of logistic regression analysis of pup variables on pup mortality on 1699 pups.

Parameter	Coefficient	Std. Error	Significance
Constant	7.03463	1.28111	0.0000
Sex	-0.19470	0.14485	0.1789
Color Yellow	-2.13708	0.22210	0.0000
Brindled	-1.97859	0.21594	0.0000
Weight	-0.02576	0.00529	0.0000
Weight square	$2.364*10^5$	$5.589*10^6$	0.0000

Table II
Results of logistic regression analysis of pup variables on pup mortality in a subpopulatin of 680 pups with time of birth information.

Parameter	Coefficient	Std. Error	Significance
Constant	5.35332	2.42971	0.0276
Sex	-0.32410	0.27576	0.2399
Color Yellow	-1.85893	0.43330	0.0000
Brindled	-2.08503	0.43683	0.0000
Weight	-0.01694	0.01093	0.1210
Weight square	$1.265*10^5$	$1.245*10^5$	0.3097
Time between birth of pup and previous born pup	-0.00476	0.00302	0.1156

DISCUSSION

Risk factors for pup mortality in a birth cohort of boxer pups were analyzed. The color white was the most important risk factor in this cohort. This is not unexpected, because boxer breeders in the Netherlands euthanase

white pups. In the birth cohort study of Nielen et al. 102 white pups were euthanased for their color (17.9 percent of al died pups before weaning age was due to this fact). Because this cause of death differs widely from the other causes of death further analyses where these pups will be excluded will be necessary.
The weight of the pups in this study appears to have a relationship with pup mortality. McKelvie (1963) did not find a relationship between weight and mortality. However, Fox (1965) suggested that a low birth weight is accompanied by immaturity of a variety of physiological processes and that there is a relation to mortality of individual pups. In this study only data about the boxer, which is a brachycephalic dog, were involved. In the literature a relationship between brachycephaly and a high frequency of stillbirths, because of dystocia and problems with removing the amnion, is suggested (Ebel 1984). Pups with a high birthweight will be at more risk on dystocia and a higher death rate in those pups is explicable.
It is a pity that information about the risk factors was not available for all pups. Models with all risk factors included only 680 pups of the 2629. The subgroup of 680 pups is probably not a good reference for the total group because breeders of the subgroup of 680 who were present at birth at were accurate with filling in the questionnaires differs likely also in management from the breeders less accurate at birth.

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