Epidemiol. Infect. (1993), **110**, 267–272

The seasonality of canine births and human campylobacteriosis: a hypothesis

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(*Accepted 20 October 1992*)

SUMMARY

The seasonality of canine births was investigated using records from the Kennel Club and the breeding centre for the Guide Dogs for the Blind Association. In these populations a distinct seasonal pattern was found with a greater number of puppies being born in the summer months than the winter. The hypothesis that the greater number of puppies acquired as pets during the summer months may contribute to the seasonal rise in human campylobacter cases, seen at this time, is discussed.

INTRODUCTION

The present study was prompted by an interest in the epidemiology of campylobacter infections in man and animals. An interesting feature of the epidemiology of campylobacter enteritis in man is the systematic seasonal pattern evident in the number of recorded cases, with many more cases being seen in the summer months than in the winter [1, 2]. As a prelude to further investigations to (a) assess the contribution potentially presented by pet dogs to the number of human cases of campylobacter enteritis and (b) examine the hypothesis that puppies contribute to the summer rise in incidence, the seasonal distribution of births was examined in two separate populations of dogs in Great Britain.

MATERIALS AND METHODS

Birth data were collected from Kennel Club (KC) registrations of pedigree puppies of all breeds born during 1988 and registrations of all terrier litters born during a 5-year period (1984–8). In addition, the Guide Dogs for the Blind Association (GDBA) breeding centre records were also examined for available years (1986, 1987, 1989 and 1990).

The month of birth of each puppy or litter of puppies from each data source was recorded. Analysis of covariance was used to test for a quadratic trend within years, while adjusting for any yearly differences.

RESULTS

Registered puppies born in 1988

More than 175000 pedigree puppies were born and registered with the KC during 1988. The seasonal pattern of births for each group of dogs is shown in

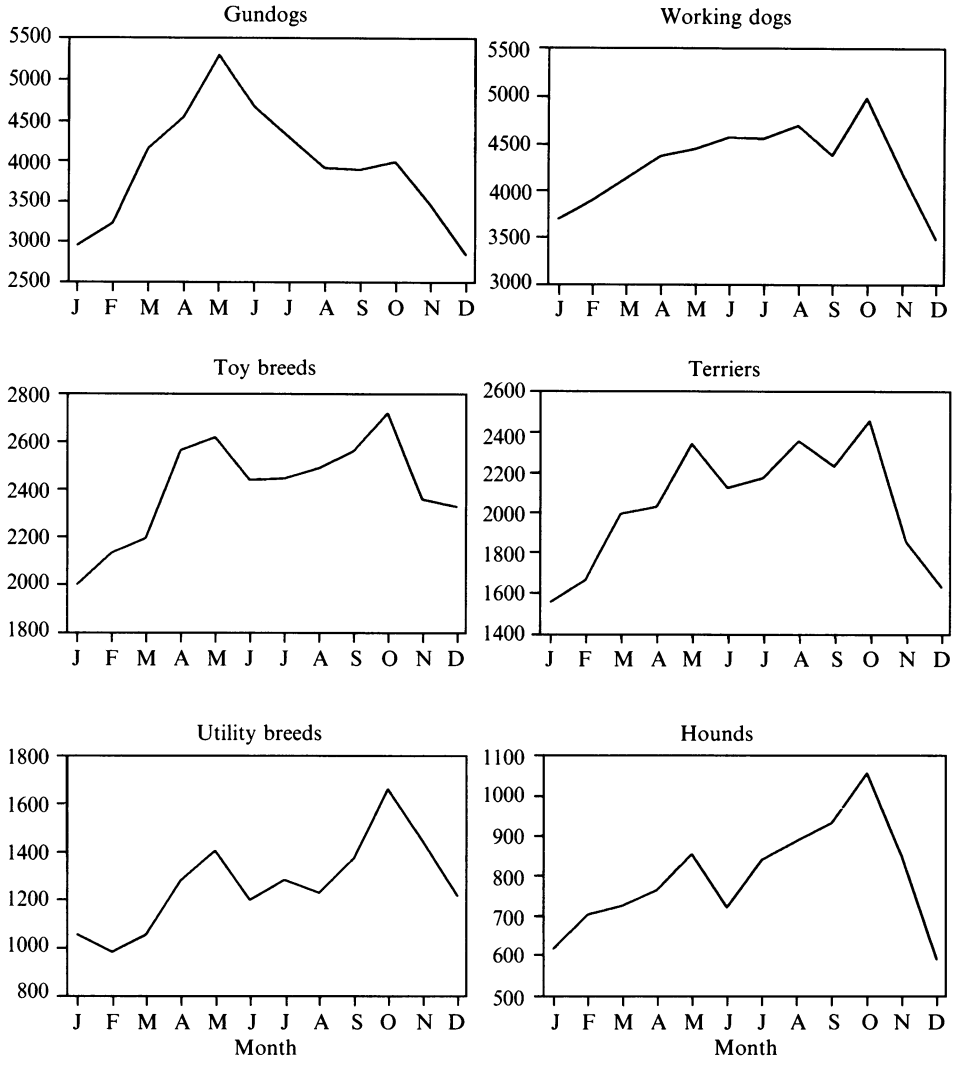

Fig. 1. Seasonal pattern of births of Kennel Club registered dogs in 1988 (vertical axes refer to number of puppies born).

Figure 1. The pattern varied with group, with a peak in May, October or both, but the lowest number of puppies were born during the winter months (November to February) in all groups.

Terrier litters born 1984–8

Figure 2 shows the number of terrier litters born monthly during 5 successive years (1984–8). Analyses of covariance revealed a highly significant ($P < 0{\cdot}001$) trend within years with the number of litters peaking during the middle of the year (Table 1).

GDBA breeding records

Table 1 also shows the trend in number of litters born each month at the GDBA breeding centre over the examined years. The quadratic trend shown by analysis

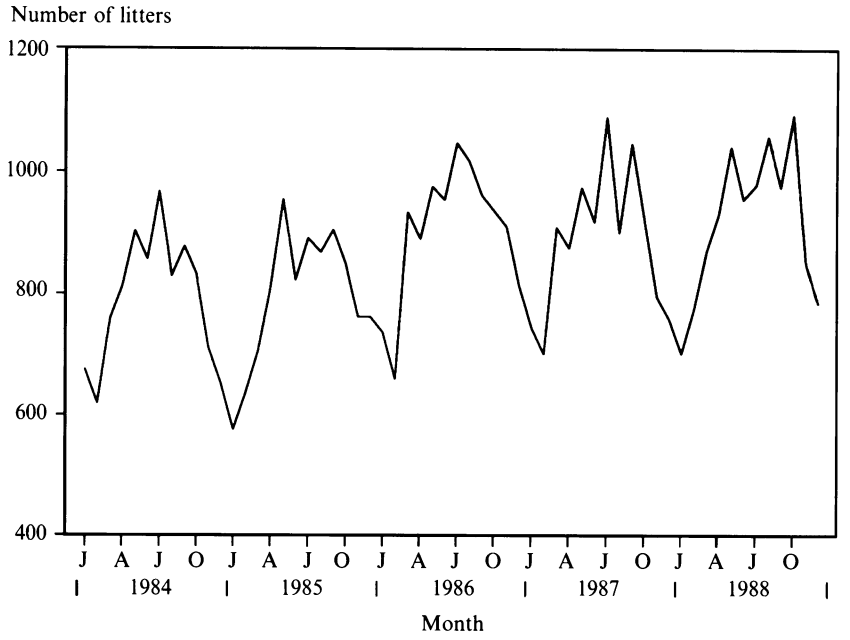

Fig. 2. Seasonal pattern of births of Kennel Club registered terrier litters (1984–8).

Table 1. *Monthly means of the number of Kennel Club registered terrier litters born or litters recorded by the Guide Dogs for the Blind Association breeding centre.*

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.
KC	686	677	834	864	970	901	995
GDBA	9·0	7·8	10·0	11·8	10·5	11·8	11·5

	Aug.	Sep.	Oct.	Nov.	Dec.	Standard error
KC	934	953	926	806	753	25
GDBA	12·5	10·8	10·3	9·8	6·0	0·42

of variance of the monthly number of litters born over the 4 years was statistically significant ($P < 0{\cdot}006$) with a negative coefficient indicating a maximum number of puppy births in the middle of the year.

DISCUSSION

Reproductive activity in the bitch differs from the polycyclic pattern of other species in that bitches have a prolonged period of anoestrus between successive oestrus periods, irrespective of pregnancy. The average interoestrus interval is 6–7 months but varies between breeds and, to a lesser extent, between bitches of the same breed [3]. Bitches can breed at any time during the year but whether any seasonal breeding characteristics exist, under the controlled environmental conditions in which most dogs are kept, was examined by the present study.

In countries in which there are four distinct seasons, the photoperiod and temperature will vary with season and this is known to influence breeding patterns in many domestic animals. Some studies of oestrus activity in domestic dogs have indicated that they exhibit little or no seasonal breeding cycle [3, 4]. However, a

recent study in Sweden found that although oestrus periods were evenly distributed in 56 Labrador Retrievers and German Shepherd Dogs kept as family pets, a marked seasonal pattern was seen in a colony of Beagles housed outdoors with almost half of their oestrus periods occurring during May, June or July [5].

The present study has shown that in Great Britain a greater proportion of KC registered puppies and GDBA litters were born during the summer months compared with the winter months. This agrees with a similar study of the seasonal distribution of canine births registered with the American Kennel Club during 1971–3 [6]. This seasonal pattern probably reflects a combination of seasonal variations in oestrus activity and human intervention (planned breeding) and it is expected that similar influences may be exerted on non-pedigree owned dogs. Thus the findings of the present study may be generalized to the whole owned population.

The seasonal pattern of canine births shown in the present study may have implications when considering the epidemiology of campylobacteriosis in humans.

Campylobacters (mainly *C. jejuni/coli*) are the most frequently identified infectious cause of acute human enteritis in Great Britain and other developed countries [2]. There are many potential sources of this infection for man but it is thought that the majority of infections are food borne. However, direct contact with infected pets is also a source of some of these infections [1]. A number of independent studies have reported that the prevalence of canine infection with thermophilic campylobacters is greatest in diarrhoeic puppies with isolation rates of 20–40% reported in individually owned puppies [7–10]. In contrast only 5–10% of diarrhoeic adult dogs have been found to be infected [7, 8, 11, 12] and this is similar to the prevalence of asymptomatic infection in all ages [7–11, 13]. When dogs are housed communally, up to 50% of animals may be infected [14]. Newly acquired puppies, especially those reared in a kennelled environment, are therefore likely to present the greatest pet-associated risk of human infection due to high campylobacter carriage rates and the high risk of human contact with canine faeces in households containing a young, poorly house-trained puppy. Skirrow estimated that about 5% of all cases of campylobacter enteritis could be attributed to contact with infected pets, mainly dogs [15]. However, this proportion is likely to be greater in high risk groups, such as children in contact with puppies or persons occupationally exposed to dogs [16] and it is not known whether the proportion of cases attributed to pet contact varies seasonally.

There is a remarkably constant seasonal pattern of laboratory reports of human cases which is illustrated in Figure 3. The numbers rise sharply in May each year and reach a peak in June or July. There is then a steady decline through the rest of the summer followed by a relatively low number of reports in the winter months (November–March). The pattern of dates of clinical onset of disease is likely to be shifted towards the beginning of the year by a month or more due to a lag period caused by laboratory investigation and reporting. Reporting biases may be important as reported cases are likely to reflect only cases which are severe or occur in young, old or immunocompromised patients. Other factors may also affect consulting and submission rates. The reason for this seasonal pattern is unknown. Contributing factors may include summer activities such as barbecues and camping [17–18], which are known risk factors, and higher summer

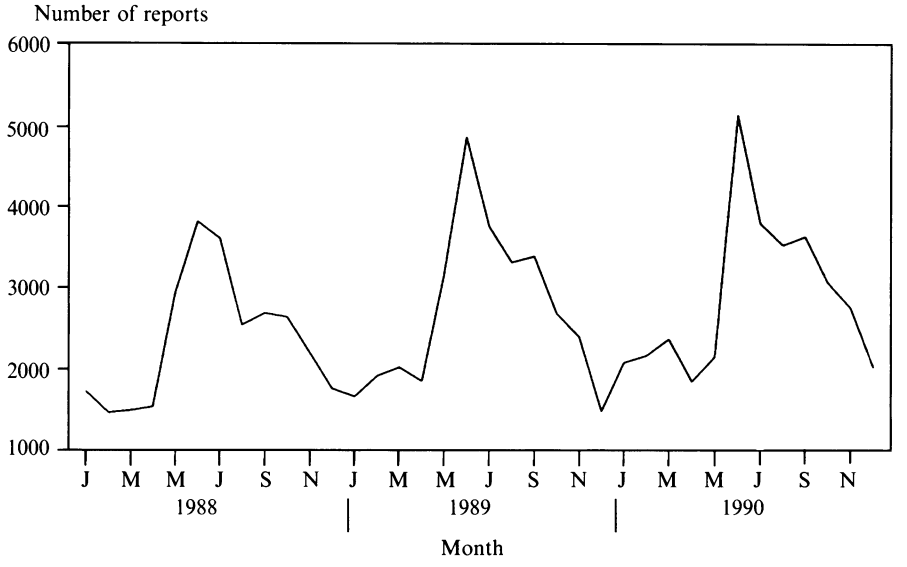

Fig. 3. Seasonal pattern of human campylobacter isolations in England and Wales (1988–90). Laboratory reports to the Public Health Laboratory Service Communicable Disease Surveillance Centre.

campylobacter carriage rates in poultry [19] which are a major food borne source of infection. Recent evidence indicates that part of the spring rise may be due to bird-pecking of doorstep delivered bottle milk in Great Britain [20]. However, this cannot be the reason for the similar spring rise seen in other countries which do not have this delivery service.

The present study has shown that the seasonal rise in puppy births during the summer coincides with the seasonal rise in reports of human campylobacteriosis. Although this association is purely ecological in nature it can be hypothesized that the rise in proportion of puppies in the canine population during the summer months may contribute to the seasonal rise in human cases of this disease. However, if one considers transmission within households, the peak month for families acquiring a new puppy (aged 6–8 weeks) may occur after the peak month of onset of clinical cases due to the biases discussed. Therefore infection from puppies may be more closely associated with the high summer incidence than the early spring peak. A study has been initiated to investigate this association further by conducting a cohort study to assess the risk of human infection from puppies and to establish the contribution of this source to the summer rise in reported human cases and therefore investigate this hypothesis. A simultaneous case-control study will investigate the ways in which puppies become infected.

ACKNOWLEDGEMENTS

The author is extremely grateful for the provision of the data by the Kennel Club, the Guide Dogs for the Blind Association breeding centre and the Public Health Laboratory Service Communicable Disease Surveillance Centre and for the statistical assistance of Mr A. R. Sayers.

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