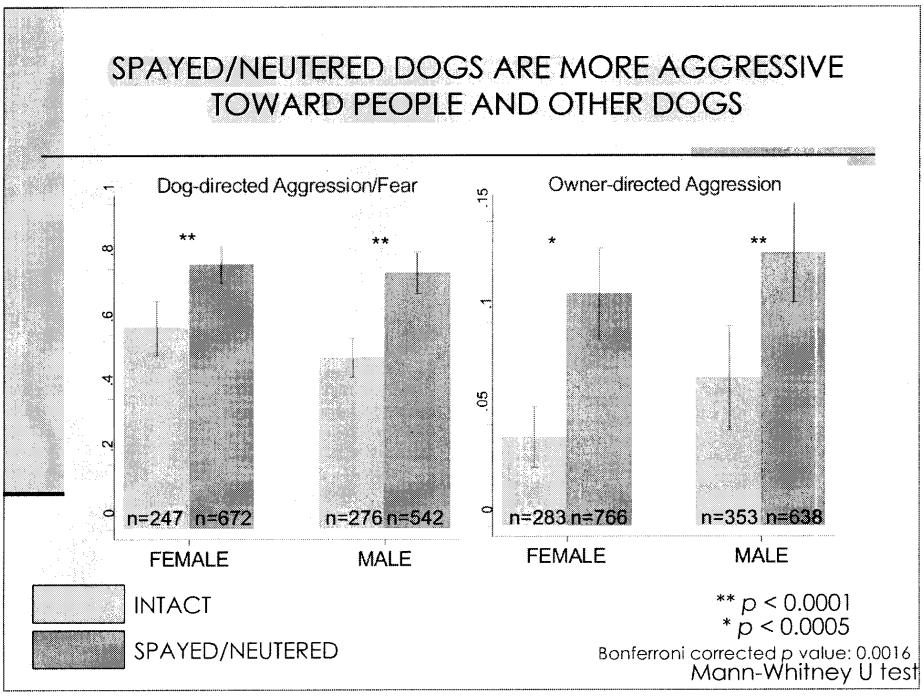
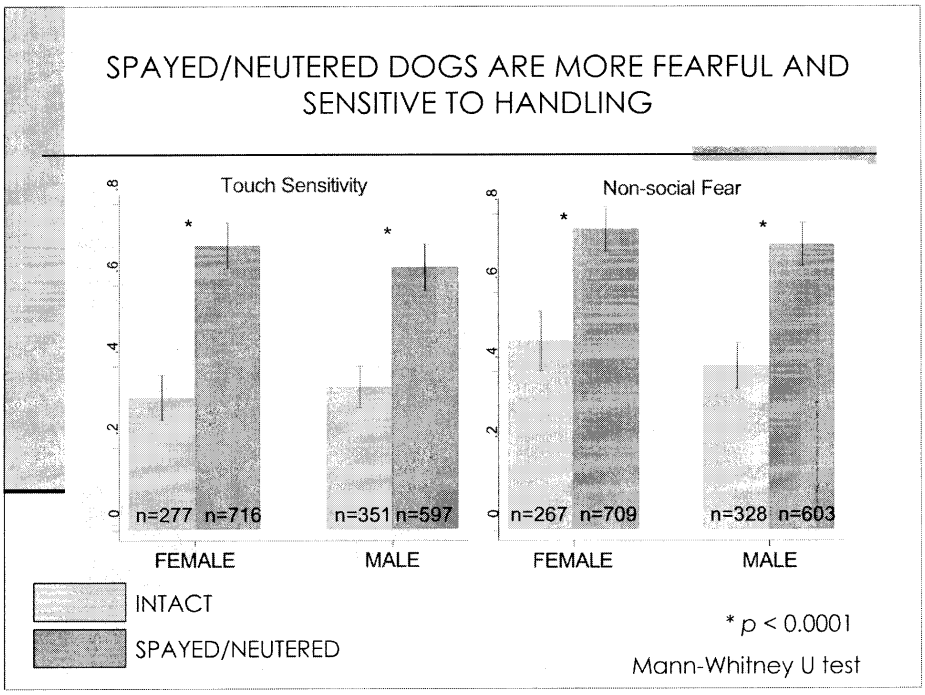
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy





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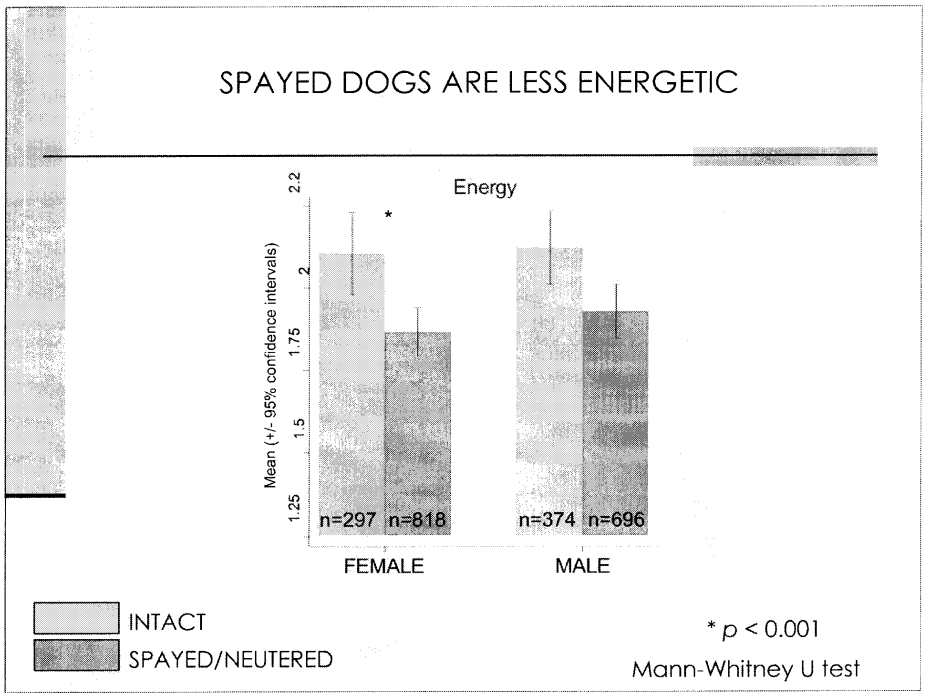

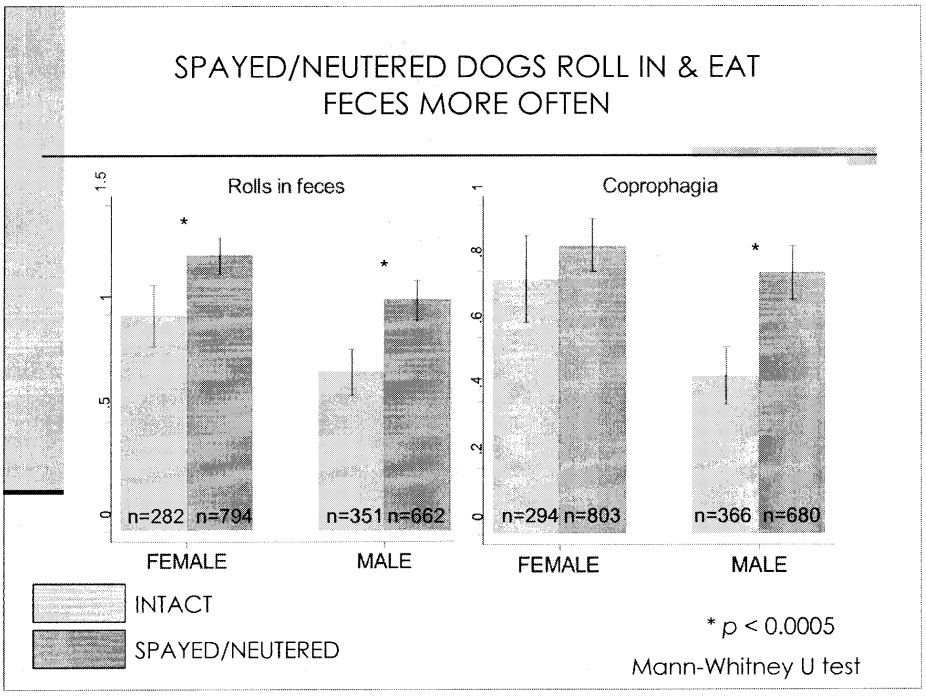

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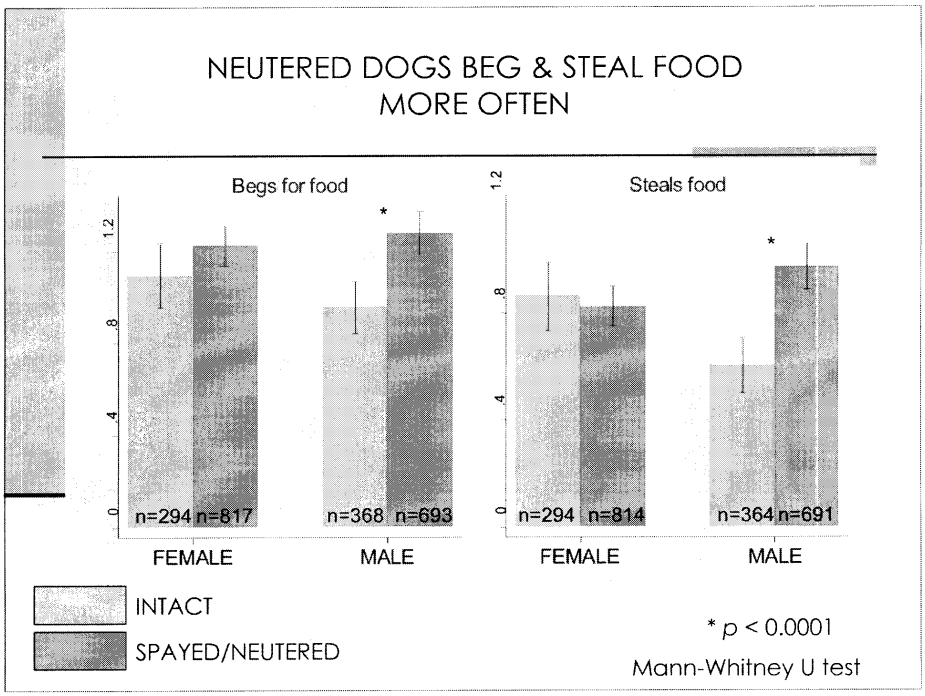

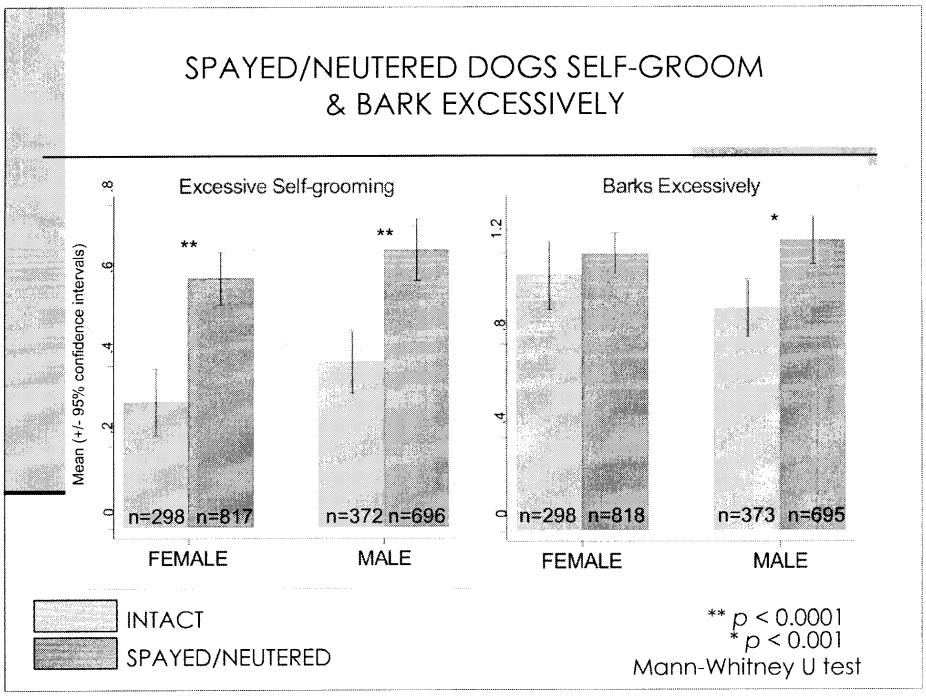

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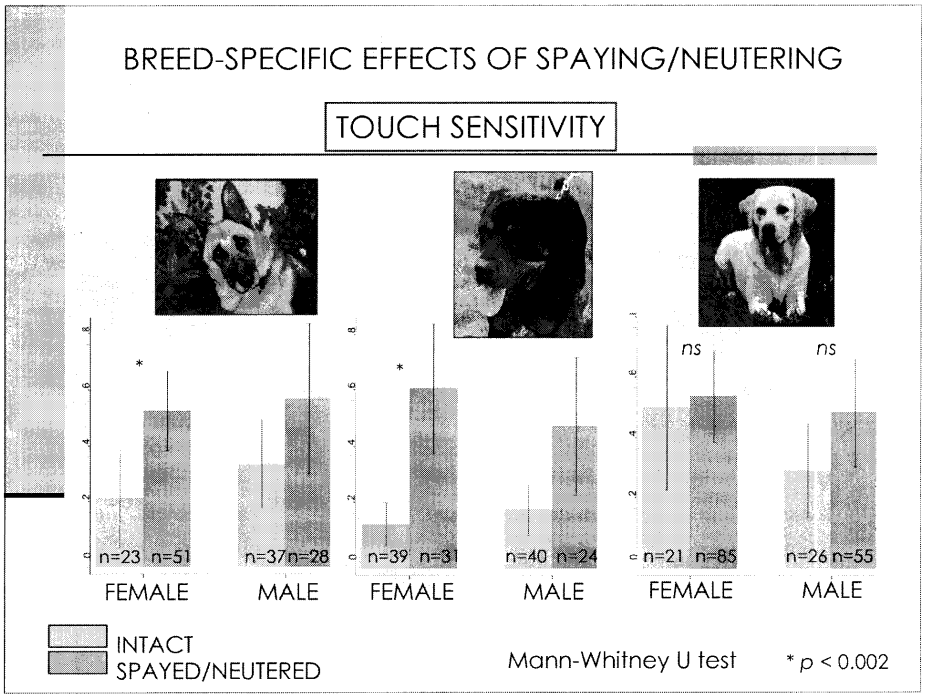

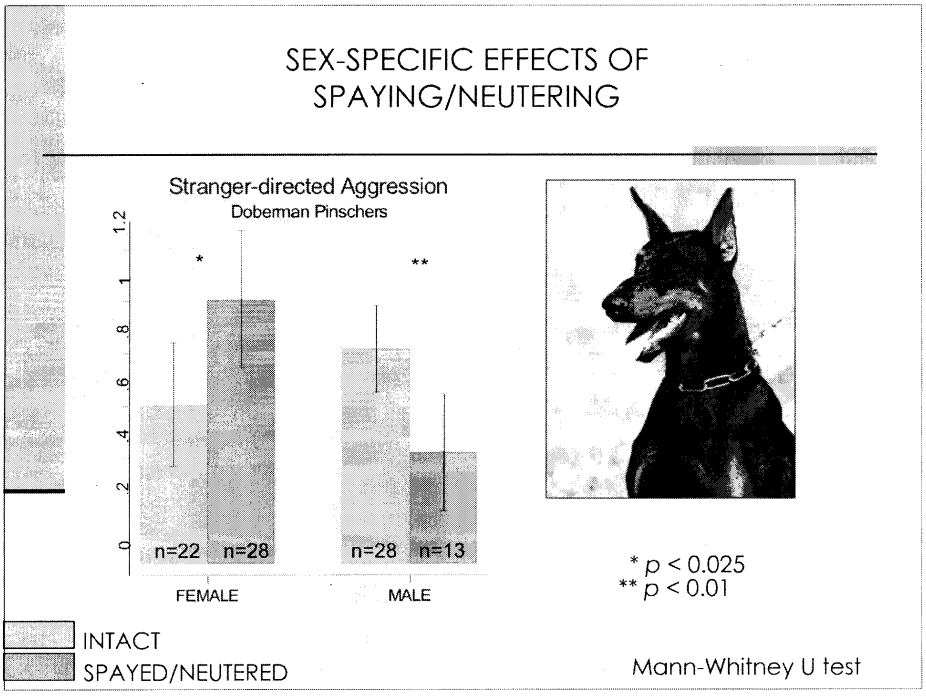

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SUMMARY

- For most behaviors, spaying/neutering was associated with worse behavior, contrary to conventional wisdom.
- A few behaviors (e.g., energy level, urine marking) were reduced in spayed/neutered dogs.
- The effects of spaying/neutering are often specific to certain breeds and are not always equivalent between sexes.

CONCLUSIONS

- Significant differences in scores do not necessarily indicate severe behavioral problems.
- Neutering male dogs does not render them useless for protection or guarding.
- We need to investigate mechanisms for behavioral effects of spaying and develop alternatives.
- Dog owners need to receive accurate information to help them form realistic expectations.

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- All participants.

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APPLIED ANIMAL BEHAVIOUR SCIENCE

The English Cocker Spaniel: preliminary findings on aggressive behaviour

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Abstract

Two thousand questionnaires were distributed randomly via the Kennel Club (UK) to owners of purebred English Cocker Spaniels (ECSs). Owners were asked to give details about the ECSs they owned: age, sex, neuter status, coat colour. They were also asked to indicate whether their dog showed aggression (on a 1–5 scale; 1, never or almost never; 5, always or almost always) in any of 13 situations. These were: aggression towards strange dogs (A1), towards strangers approaching the dog (A2), towards persons approaching/visiting the home (A3), towards persons approaching the owner away from home (A4), towards children in the household (A5), towards other dogs in the household (A6), when the owner gives attention to other person or animal (A7), toward owner or member of owner's family (A8), when disciplined (A9), when reached for or handled (A10), when in restricted spaces (A11), at meal times/ defending food (A12) and, suddenly and without apparent reason (A13).

A total of 1008 (50.4%) replies was received, of which 932 (owning 1109 dogs) were suitable for analysis. Solid colour ECSs were significantly more likely to show aggression than parti-colours in 12 out of the 13 situations (A2–A13) and red/goldens were more likely to show aggression than blacks in situations A1, A4, A5 and A7–A13 inclusive. Males were significantly more likely to show aggression than females in situations A1, A8, A9 and A10 while females were significantly more likely to show aggression towards other dogs in the household (A6). When comparing ECSs which had been neutered before signs of aggression were apparent, with entires, neutered females were found more likely to show aggression towards children in the household (A5). Cluster analysis revealed six groups of associated variables; these were labelled, 'protective (of itself and owner)', 'protective (of territory)', 'intraspecific (unfamiliar dogs)', 'competitive', 'possessive', and 'dominance-type' aggression. Most dogs showed 'protective (of territory)' aggression (45.7%) while 'dominance-type' aggression was the least common (11.7%).

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The results suggest a genetic and neuroendocrine basis for the within-breed differences in aggression. Neutering was not found to be useful as a preventative measure for aggression. From the cluster analysis, there was some evidence that so-called 'rage' syndrome, a condition often reported in the breed and one which is characterised by sudden and unpredictable aggression, is an expression of social dominance, rather than being a separate or pathological phenomenon. Follow-up projects are now underway and it is hoped they will lead to a better understanding of all types of canine aggression, and provide an answer as to whether or not 'rage' truly exists as a distinct phenomenon.

1. Introduction

Although the English Cocker Spaniel (ECS) is a popular breed in the United Kingdom, it has attracted some negative publicity, especially during the early 1980s because of problems with aggressive behaviour. Mugford (1984) reported that the ECS was the third most common breed seen at his behavioural referral practice in Britain and that most (74%) cases of aggression involved those of the red/golden coat colour type. In particular, the breed has become synonymous with a condition called 'rage' syndrome, where a dog suddenly and inexplicably is aggressive towards its owners or other household members. This type of aggression has also been reported in other breeds such as American Cocker Spaniels (Dodman et al., 1992), Bernese Mountain Dogs (Van der Velden et al., 1976), Chesapeake Bay Retrievers (Dodman et al., 1992), Dobermanns (Hart and Hart, 1985), English Bull Terriers (Neville, 1991), English Springer Spaniels (Dodman et al., 1992), German Shepherds (Hart and Hart, 1985), Golden Retrievers (Fisher, 1993), Pyrenean Mountain Dogs (Neville, 1991) and St. Bernards (Hart and Hart, 1985). However, it is a rare condition (Hart and Hart, 1985; Blackshaw, 1987; Blackshaw, 1991; Reisner, 1991) and there are no published data on its prevalence in ECSs.

There are two main theories as to what this syndrome could be. First, that it is an exaggerated or unusual form of dominance aggression (Mugford, 1984; Neville, 1991; Reisner, 1991; O'Farrell, 1992). Secondly, that it is a type of epilepsy, part of a group known as complex partial seizures (Colter, 1989). It closely resembles a form of subthreshold limbic epilepsy known as episodic dyscontrol syndrome (Dodman et al., 1992) a condition for which there is some electroencephalographic evidence. Beaver (1980) reported on a condition she labelled 'mental lapse' syndrome which is similar to 'rage' syndrome and episodic dyscontrol syndrome. However, there have been no further reports of it in the literature. To date, macroscopic and microscopic investigations of the brains of dogs euthanised because of unexplained, severe aggression have revealed only a mild degree of encephalitis in some cases (Hart, 1977). Mugford (1984) argued that there may be a genetic basis for 'rage' syndrome in ECSs and Van der Velden et al. (1976) has shown evidence for this in Bernese Mountain Dogs.

To learn more about aggression in the ECS and to determine whether 'rage ' exists and if so, where it fits in the classification of canine aggression, a multi-layered study has been initiated at the University of Cambridge Veterinary School. This paper reports on the first stage of the programme which involved a large scale survey of owners of purebred ECSs.

2. Animals, materials and methods

Two thousand one-page (double-sided) questionnaires were distributed randomly through the postal system in November 1992 via the Kennel Club (UK) to UK owners of purebred ECSs. Professional breeders, however, were excluded from the study as it was thought unlikely that they would report truthfully on aggressive behaviour in their dogs. The replies were sent to the principal author using a FREEPOST address. Owners were asked to provide their name, address and phone number and to indicate how many adults and children (under 16 years of age) lived in the household. They were also asked about the number of ECSs they owned and for a description of each: name of dog, coat colour, age, sex, and whether or not it had been neutered. Finally, they were asked to consider whether their dog (a separate sheet was available for each dog) showed aggression in any of 13 situations (see Table 1). The owners indicated the relative frequency of such behaviour on a 1–5 scale for each of the 13 situations: 1, never or almost never; 2, rarely; 3, occasionally; 4, usually; 5, always or almost always.

All data were analysed using the statistical package SPSS for the Macintosh: Version 4.0. The Mann–Whitney U test (see Siegel and Castellan, 1988) was used to compare solids with particolours, red/goldens with blacks, males with females, neutered males with entire males, and neutered females with entire females in each of the 13 (A1–A13) situations in which aggression could occur (see Table 2 for N values). Agglomerative hierarchical cluster analysis, using Ward's method and squared Euclidean distances (see Hair et al., 1987), was performed on these 13 variables to determine clusters or groups of related situations. From these it was possible to label the clusters into 'types' of aggression.

In order to calculate the percentage of dogs aggressive in each of the 13 situations, the rating scale was reduced to a 'present' or 'absent' scoring system (1–2, 'absent'; 3–5, 'present'). The mean of the percentages related to each aggression group or cluster was then calculated to show the incidence of these in the ECS population.

Table 1
The 13 different situations about which the owners were asked to rate the relative frequency of their dog's likelihood to show aggression

Aggressive situation	Code
Towards strange dogs	A1
Towards strangers approaching the dog	A2
Towards persons approaching/visiting the home	A3
Towards persons approaching owner away from home	A4
Towards children in the household	A5
Towards other dogs in the household	A6
When owner gives attention to other person or animal	A7
Toward owner or member of owner's family	A8
When disciplined	A9
When reached for or handled	A10
When in restricted spaces	A11
At meal times/defending food	A12
Sudden and without apparent reason	A13

3. Results

A total of 1008 (50.4%) replies was received, of which 932 (owning 1109 dogs) were suitable for analysis. A good representation of registered ECSs was achieved as the distribution of coat colours of the survey dogs compared well with the coat colours of ECSs registered in 1992 in the UK.

Registration figures for the breed, including coat colour of the dogs, were obtained from the Kennel Club (UK) for the period 1982–1992. This was done to see if the negative publicity of the early 1980s had had an effect on preferences for the breed and for coat colour. Although the percentage of ECSs registered fell from 1982 to 1987, they then rose and continued to do so through to 1992 (Fig. 1). However, coat colour preferences showed a more sustained change. The popularity of solid colours decreased from a time when they were the most popular colour type, 1982; particolours have been more popular ever since (Fig. 2). This change in solid colour preference is due to a decrease in the number of red/goldens being registered (Fig. 3).

3.1. Demographics

The mean number of adults in the households was 2.3 (range 1–10, mode 2) and the mean number of children was 0.7 (range 0–5); only 40% of owners had children.

The mean number of ECSs owned was 1.2: 86% owned one, 11% owned two and 3% owned three or more. The mean age of these dogs was 2.7 years (range 0.25–17 years, mode 2.5 years). Solid colour dogs made up 38.6% of the sample and particolours 61.4%. Of the solid colours, 47.9% were blacks while 52.1% were red/goldens. There were similar numbers of males (545, 49.1%) and females (564, 50.9%) in the sample and most were entires (66.8% females, 82.7% males).

Table 2
N values for the various Mann–Whitney *U* tests which were performed

Variable	Aggressive situation												
	A1	A2	A3	A4	A5 [a]	A6 [a]	A7	A8	A9	A10	A11	A12	A13
Solid colour	426	428	428	426	142	373	425	428	427	428	423	426	428
Particolour	679	679	680	679	272	622	678	677	680	680	677	678	680
Red/golden	221	223	223	222	78	192	222	223	222	223	220	222	223
Black	205	205	205	204	64	181	203	205	205	205	203	204	205
Male	544	544	545	543	199	478	543	545	545	545	541	542	545
Female	562	564	564	563	215	518	561	561	563	564	560	563	564
Neutered male	94	93	94	94	33	76	93	94	94	94	94	94	94
Entire male	447	448	448	446	165	399	447	448	448	448	444	445	448
Neutered female	183	184	184	183	53	160	182	184	183	184	182	183	184
Entire female	370	371	371	371	158	349	370	368	371	371	369	371	371

[a] *N* values are smaller than for the other aggressive situations because not every owner could respond to these, i.e. because not every owner had other dogs in the house and because most (60%) did not have children.

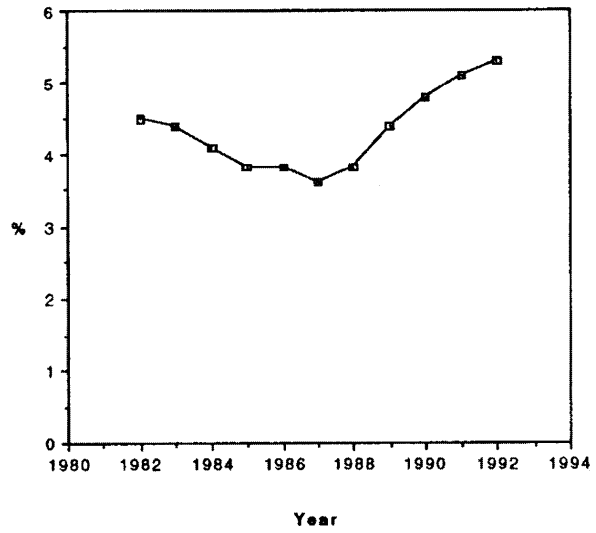

Fig. 1. The percentage of the total number of dog registrations with the Kennel Club (UK) which were English Cocker Spaniels (1982–1992).

3.2. Solid vs. particolour English Cocker Spaniels

Solid colours were significantly more likely to show signs of aggression than particolours in 12 out of the 13 situations. These included A2 (towards strangers

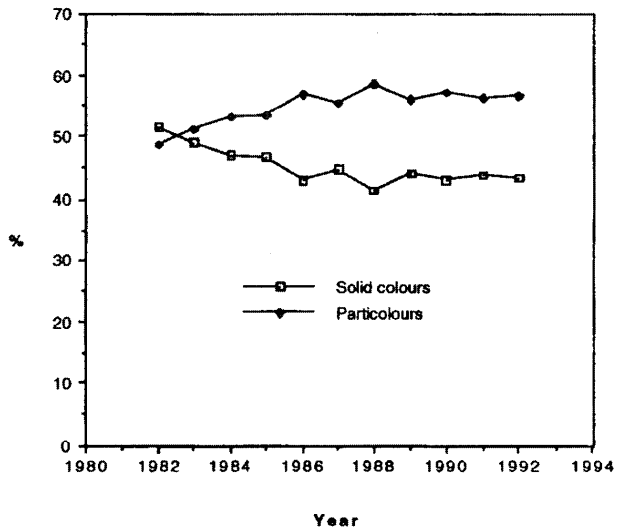

Fig. 2. The percentage of English Cocker Spaniels registered with the Kennel Club (UK) which were either solid colour or particolour (1982–1992).

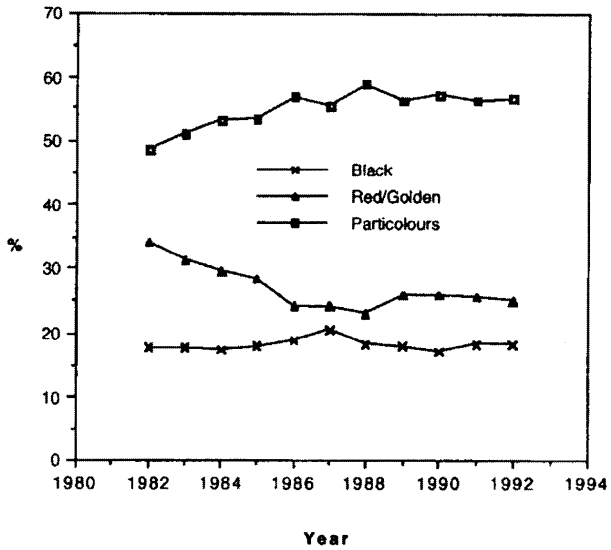

Fig. 3. The percentage of English Cocker Spaniels registered with the Kennel Club (UK) which were either red/golden, black or particolour (1982–1992).

approaching the dog; Mann–Whitney U test, $Z = 3.723$, $P < 0.001$), A3 (towards persons approaching/visiting the home; $Z = 4.213$, $P < 0.001$), A4 (towards persons approaching owner away from the home; $Z = 4.514$, $P < 0.001$), A5 (towards children in the household; $Z = 6.462$, $P < 0.001$), A6 (towards other dogs in the household; $Z = 2.163$, $P < 0.05$), A7 (when owner gives attention to other person or animal; $Z = 4.452$, $P < 0.001$), A8 (toward owner or member of owner's family; $Z = 9.766$, $P < 0.001$), A9 (when disciplined; $Z = 8.623$, $P < 0.001$), A10 (when reached for or handled; $Z = 7.255$, $P < 0.001$), A11 (when in restricted spaces; $Z = 7.631$, $P < 0.001$), A12 (at meal times/defending food; $Z = 9.547$, $P < 0.001$), and A13 (sudden and without apparent reason; $Z = 8.057$, $P < 0.001$).

3.3. Red / goldens vs. black English Cocker Spaniels

Within the solid colour group, red/goldens were compared with blacks. Here it was found that red/goldens were significantly more likely to be aggressive in a number of situations. These included, A1 (towards strange dogs; Mann–Whitney U test, $Z = 2.582$, $P < 0.01$), A4 (towards persons approaching owner away from home; $Z = 2.774$, $P < 0.01$), A5 (towards children in the household; $Z = 3.365$, $P < 0.001$), A7 (when owner gives attention to other person or animal; $Z = 3.336$, $P < 0.001$), A8 (toward owner or member of owner's family; $Z = 4.988$, $P < 0.001$), A9 (when disciplined; $Z = 4.524$, $P < 0.001$), A10 (when reached for or handled; $Z = 3.161$, $P < 0.01$), A11 (when in restricted spaces; $Z = 2.4$, $P < 0.05$), A12 (at meal times/ defending food; $Z = 3.492$, $P < 0.001$), A13 (sudden and without apparent reason; $Z = 3.643$, $P < 0.001$).

3.4. Males vs. females

Males were more likely to be aggressive than females in situations A1 (towards strange dogs; Mann–Whitney U test, $Z = 2.02$, $P < 0.05$), A8 (toward owner or member of owner's family; $Z = 2.089$, $P < 0.05$), A9 (when disciplined; $Z = 4.459$, $P < 0.001$) and A10 (when reached for or handled; $Z = 2.235$, $P < 0.05$). Females were more likely to be aggressive than males in situation A6 (aggression towards other dogs in the household; $Z = 2.763$, $P < 0.01$) only.

3.5. Neutered males vs. entire males

Neutered males were found to be significantly more aggressive than entire males in situations A5 (towards children in the household; Mann–Whitney U test, $Z = 3.967$, $P < 0.001$), A8 (toward owner or member of owner's family; $Z = 4.066$, $P < 0.001$), A9 (when disciplined; $Z = 4.032$, $P < 0.001$), A10 (when reached for or handled; $Z = 4.28$, $P < 0.001$), A11 (when in restricted spaces; $Z = 2.917$, $P < 0.01$), A12 (at meal times/defending food; $Z = 2.724$, $P < 0.01$), and A13 (sudden and without apparent reason; $Z = 4.736$, $P < 0.001$).

3.6. Neutered females vs. entire females

Neutered females were found to be significantly more likely to be aggressive than entire females in situations A2 (towards strangers approaching the dog; Mann–Whitney U test, $Z = 1.963$, $P < 0.05$), A3 (towards persons approaching/visiting the home; $Z = 2.494$, $P < 0.05$), A4 (towards persons approaching owner away from home; $Z = 2.74$, $P < 0.01$), A5 (towards children in the household; $Z = 3.246$, $P < 0.01$), A8 (toward owner or member of owner's family; $Z = 3.289$, $P < 0.01$), A9 (when disciplined; $Z = 4.127$, $P < 0.001$), A10 (when reached for or handled; $Z = 2.805$, $P < 0.01$), A11 (when in restricted spaces; $Z = 2.211$, $P < 0.05$), A12 (at meal times/defending food; $Z = 2.465$, $P < 0.05$), and A13 (sudden and without apparent reason; $Z = 2.458$, $P < 0.05$).

3.7. Follow-up study

As the neutering results were surprising it was decided to further investigate the effects of neutering by contacting the owners of all neutered ECSs and asking for details on (1) age at which aggression started (if dog was aggressive at all), (2) age at which the dog was neutered and (3) why the dog was neutered. Data were collected on 149 (81%) neutered females and 73 (78%) neutered males. The mean age at which aggression started was 0.9 years (11 months) for males and females, while the mode was 0.5 years (6 months) and 0.2 years (2 months), respectively. Neutered dogs were once again compared with entires using the Mann–Whitney U test for each of the 13 situations in which aggression could occur. However, this time dogs which were neutered because they were aggressive and those which were neutered after aggressive behaviour had first started, were excluded (neutered males $N = 55$, neutered females $N = 139$). This would

Table 3
The components of each cluster and the labels assigned

Cluster label	Components
Protective (of itself and owner)	Aggression towards: strangers approaching the dog (A2) persons approaching owner away from home (A4)
Protective (of territory)	Aggression towards persons approaching/visiting the home (A3)
Intraspecific (unfamiliar dogs)	Aggression towards strange dogs (A1)
Competitive	Aggression: towards other dogs in the household (A6) when owner gives attention to other person or animal (A7)
Possessive	Aggression at meal times/defending food (A12)
Dominance-type	Aggression: toward owner or member of owner's family (A8) when disciplined (A9) when reached for or handled (A10) when in restricted spaces (A11) sudden and without apparent reason (A13)

then tell us if neutering was in some way a precursor to aggression. The results of this analysis revealed that neutering was probably the consequence of aggressiveness rather than the cause. All statistically significant differences between neutered and entire males disappeared when dogs which had been neutered either after or because they became aggressive were removed from the sample. The same was largely true for females,

Table 4
Mean percentage of English Cocker Spaniels showing a particular category of aggression

Aggression category	Components	*N* (aggression present)	Total *N*	%	Mean % for category
Protective (of itself and owner)	A2	198	1108	17.9	15.2
	A4	138	1106	12.5	
Protective (territory)	A3	507	1109	45.7	45.7
Intraspecific (unfamiliar dogs)	A1	317	1106	28.7	28.7
Competitive	A6	184	996	18.5	17.8
	A7	190	1104	17.2	
Possessive	A12	266	1105	24.1	24.1
Dominance-type	A5	44	414	10.6	11.7
	A8	124	1106	11.2	
	A9	184	1108	16.6	
	A10	124	1109	11.2	
	A11	126	1101	11.4	
	A13	91	1109	8.2	

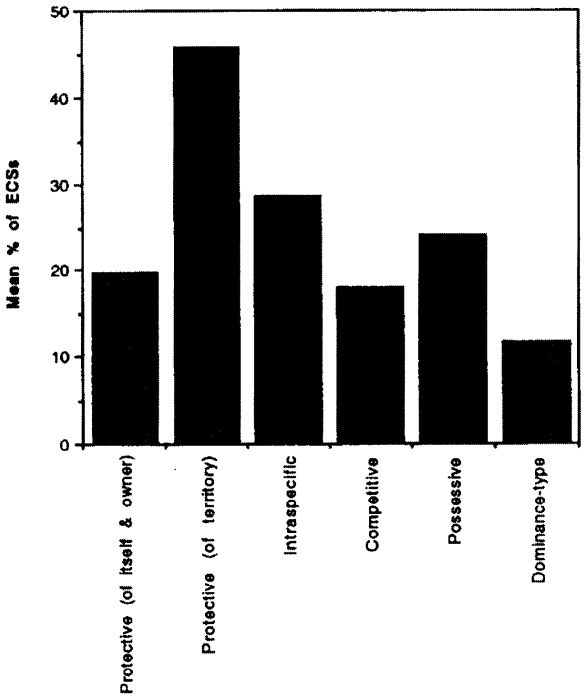

Fig. 4. The mean percentage of English Cocker Spaniels showing any of the six types of aggression determined by the cluster analysis.

except that neutered females were now found to be significantly more likely to display aggression towards children in the household (Mann–Whitney U test, $Z = 2.015$, $P < 0.05$).

3.8. Cluster analysis

Changes in agglomeration coefficients between cluster stages were used to determine the number of significant clusters; a six cluster solution was achieved. This solution was cross-validated using the technique of split sample replication (see Hair et al., 1987 for details). The six groups or clusters were labelled ' protective (of itself and owner)', 'protective (of territory)', 'intraspecific (unfamiliar dogs)', 'competitive', ' possessive', and ' dominance-type' aggression (see Table 3).

The percentage of dogs which were aggressive (scored 3, 4 or 5 on the rating scale) in any of the 13 situation variables and the mean percentage which displayed a particular type or category of aggression are provided in Table 4. Most ECSs (45.7%) showed protective (of territory) aggression while dominance-type aggression was least common (11.7%; Fig. 4).

4. Discussion

The interpretation of the results of this study rests heavily on the reliability and validity of the methods used to measure aggressive behaviour. When completed by persons familiar with the animals being assessed, subjective rating scales of the type employed here have been found to provide reliable measures of individual differences in behaviour in laboratory rhesus monkeys (Stevenson-Hinde et al., 1980; Stevenson-Hinde, 1983) and domestic cats (Feaver et al., 1986). However, although comparable techniques have also been used to elicit owner assessments of both dog (Serpell, 1983; Serpell and Jagoe, 1995) and cat (Turner and Stammbach-Geering, 1990) behaviour, their accuracy and reliability have not been tested. This raises the possibility that any observed differences between different subgroups within the same population of ECSs are simply artefacts of biases in owners' perceptions. For example, it is possible (though unlikely) that the owners of solid colour ECSs tend to perceive them as being more aggressive than do the owners of particolour dogs, regardless of any actual differences in behaviour. The use of quantitative rather than qualitative rating scales would be expected to reduce the likelihood of these kinds of subjective biases.

It should also be emphasised that, while the present findings are statistically highly significant in many cases, the overall effect sizes are relatively small. In other words, a finding that is probably true for the sampled population as a whole, for example, solid colour ECSs are more aggressive than particolours, is unlikely to be reliable at the level of the individual dog.

Coinciding with the negative publicity about the breed during the early 1980s, the percentage registered with the Kennel Club (UK) dropped but then rose again in the latter part of that decade. However, a more decided change occurred with coat colour preference. The decrease in popularity of the solid colours, especially the red/goldens, suggests that the negative publicity had a sustained effect. The ability of the print media to affect human attitudes and preferences to particular breeds of dog has been discussed previously by Podberscek (1994).

The existence of significant behavioural differences between the different colour morphs of the breed is interesting in the light of the view of Hemmer (1990) that coat colour in domestic animals is often closely associated with temperament (the hypothesis is based on the fact that the pigment melanin shares a common biochemical synthesis pathway with the catecholamine group of neurotransmitters). The fact that solid colour animals were more aggressive than particolours in 12 out of the 13 different contexts certainly suggests a genetic basis for this difference. It does not, however, provide support for Hemmer's theory since the bloodlines of these two colour variants are known to be quite distinct (Lloyd Carey, 1992). In addition, within the solid colour group, the red/golden variety was more aggressive, on average, than the black, and this agrees with the findings of Mugford (1984) who also noted that the red/golden variant appeared to be more inbred. Current follow-up research on the pedigrees of a subset of aggressive and non-aggressive dogs should help to clarify this issue.

A further interesting theoretical issue raised by the present findings concerns the apparent evidence for 'global' genetic effects on aggressiveness. According to the conventional view, different forms of aggressive behaviour, such as territorial or

dominance-related aggression, are differently motivated and therefore likely to be under the influence of separate genetic and physiological controls (see Serpell and Jagoe, 1995). Indeed, the ways in which the different behaviour patterns grouped in the cluster analysis is broadly consistent with this idea. The differences in aggressiveness between solid and particolour ECSs were, however, virtually consistent across all the different aggressive contexts, and this would suggest some underlying causal link. It is possible that solid colour forms (especially red/goldens) are simply more 'reactive' to stimuli (sensu Hart and Hart, 1985) than particolours in a general way. Unfortunately, the reactivity of the dogs in other, non-aggressive contexts was not measured in the present study. In any case, the possible genetic and neuroendocrine basis for these apparent within-breed differences in overall aggressiveness would probably repay more detailed investigation.

Although there are many examples in the literature suggesting that male dogs are more likely to be aggressive than females (see Borchelt, 1983; Mugford, 1984; Wright and Nesselrote, 1987; Podberscek and Blackshaw, 1990; Blackshaw, 1991; Landsberg, 1991; Wright, 1991; Beaver, 1993; Podberscek and Blackshaw, 1993) this was only supported in four out of the 13 situations recorded, and females were more aggressive than males in one situation (aggression towards other dogs in the household). One of the reasons for this difference could be that some researchers have not looked for sex differences in the different types of aggression, rather they have lumped all types together. Also, and more importantly, most studies do not have a control group of randomly selected dogs and therefore it is not possible to say whether either sex is actually overrepresented. To support the present findings, Scott and Fuller (1965, p. 419) found reduced sex differences in aggressiveness in relatively non-aggressive breeds, such as the (American) Cocker Spaniel, compared with aggressive breeds such as Fox Terriers and Basenjis, particularly with respect to social dominance. Males in the present study were more likely to be aggressive towards strange dogs and this also was the only component of the 'intraspecific (unfamiliar dogs)' cluster. Most cases of this sort of aggression have been attributed to males and usually involve male to male fighting and may be affected by circulating androgens (Borchelt, 1983; Hart and Hart, 1985; O'Farrell, 1992).

Females were more likely to be aggressive towards other dogs in the household and this may be because these households owned other female dogs; females rarely fight with males (see Borchelt, 1983). Unfortunately, the composition of the households in terms of the number and sex of other dogs was unknown.

Male dogs neutered before signs of aggression had appeared were not different from entire males in their likelihood of showing aggression in any of the 13 situations. This implies that neutering was not effective in preventing aggression and agrees with the findings of Le Boeuf (1970) and Salmeri et al. (1991). Other research, however, has indicated that neutered dogs are less aggressive than entires (Beaver, 1983; Borchelt, 1983; Wright and Nesselrote, 1987; Blackshaw, 1991). These previous studies, however, are based on cases presented to behavioural clinics without data on the age at which neutering took place being collected or at least this was not taken into account in the analyses. Hopkins et al. (1976) found that intermale fighting decreased when adult dogs were castrated but that territorial and fear-induced aggression were not.

Compared to entire bitches, female ECSs which were neutered before they showed any signs of aggression were only more likely to show aggression towards children in the household. There are a number of studies which have indicated that neutered females are more likely to be aggressive than entires (Borchelt, 1983; Wright and Nesselrote, 1987; O'Farrell and Peachey, 1990). However, Blackshaw (1991) in her study of 87 cases of canine aggression, found that neutered females were the smallest group. Only O'Farrell and Peachey (1990) have conducted a systematic and scientific study on the effects of neutering in bitches. Their study of 150 bitches whose behaviour was assessed before and after neutering and compared with a control group of 150 entires showed that dominance aggression increased significantly after neutering compared with controls. This increase was most likely to be shown in puppies under one year of age which were already showing signs of aggression. A difference in the present study is that dogs aggressive before neutering are not included in the analyses thus indicating that neutering is not a preventative measure for aggression in bitches and should be avoided especially if there are children in the household.

The mean age at which aggression started for both the neutered males and females in the follow-up study was 11 months while Mugford (1984) reported a mean age of onset of 7.4 months from his sample of ECSs. Females in the present study most commonly started to show signs of aggression at 2 months of age while males started most commonly at 6 months. This difference is most probably related to the onset of puberty in males with its associated large rise in testosterone secretion (Hart and Hart, 1985).

The types of aggression determined by cluster analysis generally fitted the classification schemes detailed by Borchelt (1983) and Beaver (1993). However, the present study did not cover all possible types of aggression; for example, pain-induced or maternal aggression were not explored. The most common type of aggression shown by the ECSs was protective (territorial) and the least common, dominance-type. This does not agree with most of the available literature on canine aggression. Dominance aggression is usually reported as the most common type of aggression treated at behavioural clinics (Beaver, 1983; Borchelt, 1983; Line and Voith, 1986; Blackshaw, 1991; Beaver, 1993) while the percentage of dogs showing territorial aggression has ranged from 5.5% of aggression cases (Beaver, 1993) to 29% (Blackshaw, 1991). However, Scott and Fuller (1965) found exceptionally low levels of social dominance in (American) Cocker Spaniels compared with some of their other breeds. In the present study, intraspecific aggression was high (28.7%) but this is not commonly treated at behavioural clinics (Borchelt, 1983; Blackshaw, 1991; Landsberg, 1991). Possessive aggression was a common form of aggression seen in the ECS and this has also been reported by Mugford (1984); however, it is not a commonly treated problem at behaviour clinics (Borchelt, 1983; Beaver, 1993) The reasons for the differences between the present data and those reported from behavioural clinics are most probably related to the owners wants or needs; that is, they want their dog to be aggressive towards strangers, to protect them, but they don't want their dog to bite them. Therefore not many protective dogs will be taken to a behaviourist. That being said, reports based on behavioural clinic cases offer a biased view on the behaviour of dogs in general; the dogs are usually showing extreme expressions of an 'abnormal' or distressing behaviour. Also, the samples are biased because only a select number of people actually take their dog to a specialist behavioural

clinic; others either tolerate the behaviour or the dog is abandoned or euthanised. Therefore, clinical data sets provide information on the types of aggression that are unacceptable to owners but do not necessarily provide any data on the prevalence of behaviour problems. Also, many of the previous studies have not taken breed differences into account. The present study overcomes these biases and puts the various types of aggression of a particular breed, into a societal context.

The results of the cluster analysis revealed that the tendency of ECSs to display aggression 'suddenly and without apparent reason' was clearly associated with other typical symptoms of dominance-type aggression. This finding offers some evidence that so-called 'rage' syndrome, which is usually characterised by its sudden and unpredictable onset, is an expression of social dominance conflicts, rather than being a separate or pathological phenomenon. Although we cannot be certain at this stage that dogs exhibiting aggression 'suddenly and without apparent reason' are actually suffering from 'rage' as it is generally defined clinically, we will be investigating this possibility further in the second stage of this project.

Breed-specific studies of canine aggression are rare. They are, however, extremely useful as a means of eliminating the potentially confounding effects of breed differences in temperament. This study provides important information on the prevalence of different types of aggression in the English Cocker Spaniel. It is also the first published study to validate scientifically the popular reports of aggressive problems with the solid, and in particular the red/golden, colour dogs. Follow-up studies will consider other factors which may be relevant to the development of aggression in this breed and to provide an answer as to whether or not 'rage' truly exists as a distinct phenomenon.

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Behavioral assessment of child-directed canine aggression

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BRIEF REPORT

Behavioral assessment of child-directed canine aggression

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Objective: To characterize behavioral circumstances of bites to children by dogs presented to a veterinary behavior clinic.
Methods: Retrospective case series examining medical records of dogs presenting by referral to a university veterinary hospital for aggression and which had bitten a child <18 years old. Behavioral data included age of victim, familiarity with dog, and circumstances of bites.
Results: Records of bites to 111 children were examined. Children <6 years old were most commonly bitten in association with resource guarding (44%), whereas older children were most commonly bitten in association with territory guarding (23%). Similarly, food guarding was the most common circumstance for bites to familiar children (42%) and territory guarding for bites to unfamiliar children (53%). Behavioral screening of the 103 dogs examined revealed resource guarding (61%) and discipline measures (59%) as the most common stimuli for aggression. Anxiety screens revealed abnormalities in 77% of dogs. Potential contributory medical conditions were identified/suspected in 50% of dogs. When history before presentation was known, 66% of dogs had never previously bitten a child, and 19% had never bitten any human. Most dogs (93%) were neutered, and 66% of owners had taken their dogs to obedience training classes.
Conclusions: Most children were bitten by dogs with no history of biting children. There is a high rate of behavioral abnormalities (aggression and anxiety) in this canine population. Common calming measures (neutering, training) were not routinely effective deterrents.

Most dog bites reported to public health authorities are inflicted on children.[1] Whereas there are a number of studies reporting the epidemiologic characteristics of dog bite injury, information about the behavior of the dog or bite victim is limited.[2–4]

Veterinary behavioral medicine is a recently recognized specialty in veterinary medicine.[5 6] Data obtained in a veterinary behavior clinic can help pediatricians, parents, and other care givers to better understand the behavioral aspects of child-directed canine aggression, which, in turn, should lead to more effective prevention measures.

METHODS

The records of dogs presenting to the Behavior Clinic of the Matthew J Ryan Veterinary Hospital of the University of Pennsylvania (MJR-VHUP) for human-directed aggression from January 2002 to December 2005 were reviewed retrospectively. All cases in which the dog had bitten a child under the age of 18 years were included. However, bitten children for whom age or the circumstances of the bite were unknown were excluded.

A questionnaire, which included information about the dog, the owners' family, description of aggressive incidents as well as screening questions for aggressive and anxious behaviors exhibited by the dog, was completed by each dog owner at the time of the initial appointment. In addition to completed questionnaires and aggression and anxiety screens, each medical record included referring veterinary examination and laboratory results as well as physical examination and laboratory findings conducted at the time of the veterinary behavior consultation.

Bite occurrences were categorized by familiarity of the victim with the dog and by circumstances surrounding the event. Familiar children included members of the family and/or household, or frequent visitors who were not household members. Unfamiliar children did not live in the household and were either unknown to the dog or were infrequent visitors to the home. Circumstances of bites to familiar children included resource guarding or food guarding, benign (non-aversive) interaction, aversive but non-painful interaction, aversive and painful interaction, or interaction while the dog was resting or sleeping. Circumstances of bites to unfamiliar children were categorized relative to the dog's perceived territory (house, yard, and surrounding area), and as either interactive or non-interactive.

Statistical analysis

Data are presented using frequencies and percentages. To compare children in different age groups by biting circumstances, the Fisher exact test was used. Where applicable, data are presented as differences with 95% CI. Statistical significance was defined as $p<0.05$. All analyses were performed using SAS V.9.1 (SAS Institute, Cary, North Carolina, USA).

RESULTS

Children

A total of 145 children under the age of 18 years were bitten. Of these, 111 met inclusion criteria. Thirty four children (31%) were younger than 6 years old, and 77 (69%) were 6–17 years old. Half were boys and half were girls.

Familiar children were most commonly bitten in relation to food or resource guarding (n = 29; 26%) and "benign" interactions (n = 20; 18%) such as petting, hugging, bending over, or speaking to the dog. Presence in or entering the dog's territory was the most common situation in which unfamiliar children were bitten, regardless of whether the child was (n = 10; 9%) or was not (n = 21; 19%) actively interacting with the dog. Unfamiliar children were also bitten away from the dog's home or yard, regardless of interaction (n = 4; 4%) or lack of interaction (n = 5; 5%).

Table 1 summarizes the circumstances of the biting episode relative to both age of the child and familiarity with the dog. Children <6 years old were significantly more likely than older children to be bitten in relation to food guarding or other resource-associated aggression (44% vs 18%, difference = 26%, 95% CI 4 to 45%, p = 0.009) or in aversive, potentially pain-eliciting interactions such as stepping or falling on the dog (18% vs 0%; difference = 18%, 95% CI 7 to 35%, p = 0.0006). No differences were noted between girls and boys in any of these stimulus categories.

Table 1 Circumstances of aggression to 111 children by dogs presented to a veterinary behavior service

Category	Stimulus description	<6 years (n=34)	6–17 years (n=77)	p Value
Aggression to familiar children				
Resource guarding	Approaching, reaching for or touching dog while dog is near or eating/chewing food, bone or toy	15 (44)	14 (18)	0.009
Benign (non-aversive)	Petting, hugging, kissing, bending over, reaching, speaking	5 (15)	15 (19)	NS
Resting	Waking dog; interacting while dog is resting; approaching while dog is resting/lying down; lying beside recumbent dog; pushing/pulling dog off furniture	1 (3)	8 (10)	NS
Aversive, painful	Stepping on dog; pulling on hair or body; falling on to dog; trimming nails; punishment by hitting or use of leash correction	6 (18)	0 (0)	0.0006
Aversive, non-painful	Restraint/pulling by collar; grooming, toweling feet; bathing; lifting; verbally scolding	0 (0)	5 (6)	NS
Aggression to unfamiliar children				
Territorial, non-interactive	In/on dog's territory, including house, yard, area surrounding home, car; child does not interact	3 (9)*	18 (23)	NS
Territorial, interactive	In/on dog's territory, including house, yard, area surrounding home, car; child interacts, eg, by speaking to dog, petting, reaching, attempting to feed, removing objects, restraining	2 (6)*	8 (10)	NS
Not territorial, interactive	Not on dog's territory; child interacts, eg, by speaking to dog, petting, reaching, attempting to feed, removing objects, restraining	0 (0)	4 (5)	NS
Not territorial, non-interactive	Not on dog's territory; child does not interact	1 (3)	4 (5)	NS
Aggression - other		2 (6)	7 (9)	†

Values are number (%). Columns may add up to more than total because children could have been bitten in more than one context (one child in <6-year-old group; six children in 6–17-year-old group).
*Total N=33; cirumstances of territorial bite were unknown for one child.
†Comparison was not performed because bite circumstances varied.

Dogs

A total of 103 dogs had bitten a child under the age of 18 years. Three quarters of the dogs were male (n = 77; 75%), and all but four males and three females had been neutered. Forty one breeds were represented. English Springer Spaniels and German Shepherd Dogs each comprised 9% of pure-bred dogs (7% of all dogs), followed by 5% each of Labrador Retrievers, Golden Retrievers, and American Cocker Spaniels (4% of all dogs). The total number of times a dog had bitten (historically) was known for 98 dogs. Nineteen (19%) presented for the single bite incident involving a child, and had never previously bitten a person of any age. The remaining 79 (81%) dogs had bitten at least one person (the same child, or a different child or adult) more than once (two bites, 15%; three bites, 18%; four bites, 13%; five bites, 9%; more than five bites, 24%). When the historical details of bites before the current bite were known, 66% (n = 48) of dogs had never previously bitten a child. Forty four dogs (45%) had bitten a child who was a member of the family or household, and 65% had bitten either child or adult members of the family or household. Thirty five (35%) dogs had bitten only unfamiliar children. In some cases, histories were largely unknown because of age at acquisition.

Aggression screens completed by the owner of each dog revealed that the most common circumstance associated with aggression historically, to either adults or children, was resource guarding (61%) (table 2). Similarly, dog anxiety screening demonstrated common abnormal or reactive behavioral tendencies (table 2).

Table 2 Responses to canine aggression and anxiety screens by owners of 103 dogs presented to a veterinary behavior clinic with a history of biting children

Stimulus category	Positive (aggressive or anxious)	Negative (not aggressive or anxious)	Situation does not apply
Aggression screen			
Remove dog food, special food, toys (resource guarding)	48 (61)	31 (39)	24
Punish (verbally scold, correct with leash, hit)	24 (59)	17 (41)	62
Disturb while sleeping or resting; push or pull off furniture	38 (49)	40 (51)	25
Reach over or toward dog	34 (38)	56 (62)	13
Bathe, groom, or towel	21 (26)	59 (74)	23
Anxiety screen			
Anxiety related to separation from owner(s) while owner is absent	34 (35)	62 (65)	
Anxiety related to separation from owner(s) while owner is present but inaccessible	49 (51)	47 (49)	
Anxiety or fear related to thunderstorms/fireworks	47 (50)	47 (50)	
Any anxiety (either separation or storm/noise-related anxiety, or both)	78 (77)	23 (23)	

Values are number (%) or number. Aggression was directed to children, adults, or both. "Situation does not apply" refers to situations or provocations that do not occur for the particular dog. For example, resource guarding cannot be assessed if owners have not attempted to remove food or toys. In the aggression screen, positive responses refer to growling, baring teeth, lunging, snapping, or biting a person in response to the listed stimulus. In the anxiety screen, positive responses refer to trembling, panting, pacing, vocalization, destructiveness, urination, or defecation. Anxiety screen rows may not add up to 103 because of missing values.

On the basis of clinical assessment, fear-related aggression was the most common primary behavioral diagnosis in the dogs (n = 90; 87%), followed by resource guarding (n = 53; 51%), territorial defense (n = 52; 51%), social conflict (n = 40; 39%), and pain (n = 14; 14%). Additional diagnoses included generalized anxiety (n = 64; 62%), inappropriate or excessive attention-seeking behavior (n = 36; 35%), and clinically significant noise or thunderstorm fear (n = 30; 29%) and separation anxiety (n = 18; 17%).

On the basis of physical examination, laboratory findings, and observation, a medical problem was identified or suspected in 51 (50%) dogs. Orthopedic (n = 18; 20% of all dogs examined) and dermatologic (n = 18; 20%) conditions were most commonly identified. Other medical problems included dermal or epidermal masses and ophthalmologic, metabolic (eg, renal and hepatic), endocrinologic, and infectious (eg, *Borrelia burgdorferi*) disease.

Most owners (66%) had taken their dogs through formal obedience training classes. Twenty one families had no prior experience, as adults, with dog ownership; however, prior experience or its lack had no significant association with biting.

DISCUSSION

In this study, we describe the circumstances surrounding bites to children by dogs evaluated for aggressive behavior at a university-based veterinary behavior service. Although the epidemiology of bitten children has been reported in a number of studies, there have been few studies on the circumstances of aggression, or behavioral or medical information about the biting dogs themselves. This is the first study to examine the behavioral aspects of child-directed canine aggression from the point of view of a veterinary behavioral assessment.

Although 66% of the evaluated dogs had no prior history of biting children, behavioral abnormalities were universally present in this canine population. Historically, although 19% of dogs had never bitten before presentation, a history of aggressive behavior other than biting (eg, baring teeth) was common. Furthermore, although some types of human-directed aggression tend to be observed only in behaviorally mature dogs (starting at 1–3 years of age),[7] aggression related to food or pain may be seen in juvenile dogs.[8] Thus, aggression even in a puppy, and even in the absence of biting, should raise concern and consideration should be given to referral for behavioral evaluation of the dog.

Anxiety screening identified abnormalities in 77% of animals. Historical evidence of fearful or anxious behavior in response to loud noises and thunderstorms or separation from the owner may signal a predisposition to biting in threatening situations related to anxiety or fear.[7] Dogs that react with anxiety to threatening stimuli may be more likely to react aggressively to children, who, particularly when very young, are at risk because of their high-pitched voices, sudden movements, and inappropriate interactions.

Key points

- Children are at risk of dog bite in association with resource guarding by the dog or pain-causing interactions. Unfamiliar children are at risk of dog bite while in the dog's home, yard, or perceived territory, regardless of whether or not they are interacting with the dog.
- All dogs evaluated for human-directed aggression in our study had a behavior and/or medical abnormality.
- Episodes of aggression were not limited to specific dog breeds, gender, neuter status, or history of training.
- The risk of biting may be increased in the presence of pain or disease in the pet.

Medical conditions were identified or suspected in 50% of the dogs evaluated. There were a number of dogs with orthopedic, dermatologic, and other disease both at the time of consultation and historically. These associated medical or painful conditions may have increased the risk of aggression. However, because of the lack of a well-animal clinic for comparison of presented dogs, it was not possible to determine whether this was higher, lower, or as expected in the patient population. Because disease and pain can increase irritability in dogs,[9–11] even if a causal relationship is not confirmed, their presence should be an indication to separate the dog from young children until the disease has been treated or the pain reduced.

Previous reports of dog bites to children have made safety recommendations, such as neutering male dogs,[2] canine obedience training,[12] and avoiding specific breeds.[13] The prevalence of males (75%) in our study is similar to other studies.[2] Almost all dogs, both male and female, were neutered. Although our data did not include age at neutering or whether the surgery occurred before or after the appearance of aggressive behavior, it is apparent that neutering does not guarantee a reduction of aggression in dogs. It is interesting to note that the predominant canine behavioral diagnosis, fear-related aggression, lacks sexual dimorphism,[7] and therefore neither sex should be over-represented. However, even male-associated aggression such as territorial defense is unlikely to be eliminated by neutering.[14] Regardless of neuter status, parents seeking a pet dog might be advised to seek a female. Two-thirds of the dogs in this study had been taken to training classes by their owners. It is not known whether owners had made specific efforts to train or socialize dogs to be comfortable with children. Although the success of obedience training for individual dogs was not measured, the results of this study suggest that obedience training, like neutering, will not ensure prevention of future bites to children. However, the efficacy of obedience training in reducing aggression was not specifically measured. Cohort studies would be needed to evaluate whether training (or neutering) reduces biting behavior. With the exception of the English Springer Spaniel, the breeds included in our study ranked high in American Kennel Club breed registrations and appear to reflect breed popularity. Because the total number of English Springer Spaniels in our study was small, and the study was performed at a referral hospital with a highly selected group of patients, it is safest to conclude that any breed of dog is capable of biting a child.

The findings for younger children were not unexpected. Food or resource guarding is a common behavior problem in dogs and was noted in almost two thirds of the dogs in this study.[15] To be safe, children of any age should not be permitted near the dog whenever food (including human food) is present.

The meaning of "provocation" has been inconsistent in the literature and should be interpreted with caution.[16–19] The mere presence of a parent, who may underestimate the risk of bites to young children,[20] may not be sufficient to prevent bites.[21] Although it is natural to assume that hitting and other pain-inducing interactions can elicit aggression, parents and dog owners may be less vigilant when a child simply approaches or pets a dog. Similarly, for unfamiliar children, walking or cycling near a dog's home may be provocative enough when dogs are tethered outdoors or are not securely fenced.[22]

Our study focuses on children bitten by pet dogs evaluated in a secondary and tertiary care veterinary behavior clinic with a history of aggression to children. We recognize the limitations of a retrospective case series study at a referral center. Our patients are a highly selected group of dogs, and the ability to

draw generalizable inferences from them is limited. We also acknowledge the limitations of a retrospective study of self-report and self-assessment (of their pets) by dog owners seeking help for problem behavior. However, we do attempt to better characterize this common clinical problem from the unique perspective of the canine behavioral analysis.

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