

## A survey on serum lipid profile changes in dogs with tail chasing disorder in Iran

a a b a

Bahman Mosallanejad, Reza Avizeh, Mahdi Pourmahdi, Misagh Jalali

<sup>a</sup> Department of Clinical Sciences, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran<sup>b</sup> Department of Food Hygiene, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran

### Keywords

*tail chasing; lipid profiles; behavior disorder; dog*

### Abstract

Canine compulsive disorder such as tail-chasing is a syndrome of abnormal behaviors that affects many breeds. This disorder may be associated with serum lipid elevations in dogs, so the objective of the present survey was to characterize serum lipid profile changes in dogs with tail chasing behavior disorder. Twenty seven companion dogs with tail chasing were selected among the referred cases to the Veterinary Hospital of Shahid Chamran University of Ahvaz. The affected dogs were diagnosed on the basis of the dog's behavioral history (age, frequency and duration of bouts since onset, intensity of the behavior, current or previous medical assessments) and clinical signs. Serum total cholesterol, triglycerides, HDL-C, LDL-C and VLDL-C levels were measured using commercial kits. Twenty seven control dogs were also enrolled on the basis of normal physical examination results, complete blood count and serum biochemistry profiles. Dogs with tail chasing disorder had significantly higher total

cholesterol ( $p < 0.001$ ), HDL-C ( $p < 0.05$ ) and LDL-C ( $p < 0.001$ ) levels compared with control group dogs. Serum triglyceride and VLDL-C levels did not differ significantly between two groups ( $p > 0.05$ ). When all parameters were compared, there was no significant difference between the affected dogs younger and older than one year ( $p > 0.05$ ). In conclusion, tail chasing disorder may be associated with marked elevations of serum cholesterol, HDL-C and LDL-C levels in dogs. These indices may be used as biochemical parameters of tail chasing disorder in clinical settings.

### Abbreviations

COCD: Canine Obsessive-Compulsive Disorder  
HDL-C: High Density Lipoprotein Cholesterol  
LDL-C: Low Density Lipoprotein Cholesterol  
VLDL-C: Very Low Density Lipoprotein Cholesterol

## Introduction

Canine obsessive-compulsive disorder (COCD) is defined as repetitive, exaggerated or sustained behaviors that are observed outside the original context in human beings (Hewson et al., 1999). Examples of COCD in dogs are persistent tail-chasing, acral lick granuloma and self-mutilation. Tail chasing/circling/whirling is a repetitive behavior that is expressed as slow-to rapid circling with the dog's attention directed towards its tail or rapid spinning in tight circles with no apparent focus on its tail (Brown et al., 1987). It may be seen subsequently to physical trauma, surgery, or medical illness (Hewson et al., 1999). Severe tail chasing has been attributed to psychomotor epilepsy and sometimes described as a seizure-related problem (Goto et al., 2012). Genetic predisposition is a major factor in whether a dog might develop COCD (Luescher, 2002). German shepherd and Bull terrier dogs are known to have a predisposition for tail chasing (Moon-Fanelli and Dodman, 1998). Recently, a genome-wide analysis in Doberman pinschers have been documented a relationship between a polymorphism on the cadherin2 gene and flank sucking or blanket sucking (Dodman et al., 2010). Similarities in the clinical signs, development, and response to pharmacological treatment of compulsive behavior patterns have been recognized in companion animals and humans (Fukunaga and Orito, 2012). Many owners who are reluctant to take care of their dogs might be willing to keep them if there is an improvement in their behavior (Bennett and Rohlf, 2007; Blackwell et al., 2008). Epidemiological studies are important to understand the risk factors for behavior problems and thus the best preventive measures. Published studies have been showed an association between changes of serum lipid profiles and psychogenic disorders (Huang et al., 2003). In OCD patients higher low-density lipoprotein cholesterol (LDL-C), very low-density lipoprotein cholesterol (VLDL-C) and triglyceride levels, as well as lower levels of high density lipoprotein cholesterol (HDL-C) were reported (Agargun et al., 2004). Elevated serum cholesterol levels were thought to be related to behavioral signs of tail chasing and complex partial seizures in dogs (Dodman et al., 1996). It is reported that dogs with tail chasing have significantly higher total cholesterol, HDL-C and LDL-C compared with control dogs (Yalcin et al., 2009). Hypocholesterolemia may be associated with dominance aggression in dogs (Senturk and Yalcin, 2003). There are few reports on serum lipid profile changes in dogs with tail chasing disorder. Therefore, the objective of the present survey is to characterize serum lipid profile changes (total cholesterol, triglycerides, HDL-C, LDL-C and VLDL-C levels) in dogs with tail chasing behavior disorder in Ahvaz district, southwest of Iran. To the best of our knowledge, this research is the first survey in dogs in Iran.

## Materials and methods

Twenty seven companion dogs with tail chasing were

selected from referred cases ( in a 4 year period) to the Veterinary Hospital of Shahid Chamran University of Ahvaz, Ahvaz, Iran. The affected dogs were diagnosed on the basis of the dog's behavioral history (age, frequency and duration of bouts since onset, intensity of the behavior, and current or previous medical assessments) and clinical signs. We conducted a questionnaire survey to gather data from pet owners concerning their dogs. Before investigation, a description of tail chasing was brought to make it clear to the owner. The most important questions asked, for this behavioral problem is shown in Table 1. Dogs had tail chasing bouts for a minimum of 30 s/bout to be included. They were advised to exercise their dogs for at least 20 minutes per day. Twenty seven control dogs (in similar circumstances for age and breed) were also enrolled on the basis of normal physical examination results, CBC and serum biochemistry profiles. Normal values were referred to reliable sources (Tilley and Smith, 2005). The studied dogs were 6-36 months and seemed to be clinically healthy. Blood samples were taken from cephalic vein after a fasting period of 12 hour. Serum total cholesterol, triglycerides, LDL-C and VLDL-C levels were determined using respective diagnostic commercial kits (Pars Azmoon and photometric method). HDL-C was measured using Pishtaz-teb kit and direct method in the Jahad-Daneshgahi Research Center, Ahvaz, Iran.

## Statistical analysis

The data were expressed as Mean $\pm$ SD. The significance between the mean values was determined by independent samples t test. The Mann-Whitney U test was also used when distribution of data did not match with normal distribution. Differences were considered significant when  $p < 0.05$ .

## Results

The Mean (SD) serum concentrations of total cholesterol, triglyceride, HDL-C, LDL-C and VLDL-C (mg/dl) were  $230.74 \pm 62.6$ ,  $126.33 \pm 26.48$ ,  $99.48 \pm 15.37$ ,  $88.70 \pm 10.82$  and  $14.83 \pm 6.18$  respectively in dogs with tail chasing as shown in table 2. Mean (SD) of the above parameters for the control group dogs are shown in table 2 also. The affected dogs had significantly higher total cholesterol ( $p < 0.001$ ), HDL-C ( $p < 0.05$ ) and LDL-C ( $p < 0.001$ ) levels compared with the control group. Serum triglyceride and VLDL-C levels did not differ significantly between two groups ( $p > 0.05$ ). When all parameters were compared, there was no significant difference between the affected dogs younger and older than one year ( $p > 0.05$ ). The mean (SD) age was  $17.15 \pm 9.74$  months at onset; fifteen out of twenty seven dogs had begun chasing their tails under or equal 12 months of age. Complete blood counts and serum biochemistry profiles were within normal limits in the control group dogs (Table 2). The affected dogs were mainly pure or mixed German shepherd ( $n=13$ ) and terrier ( $n=8$ ).

**Table 1**

Behaviour questionnaire for tail chasing in the affected dogs (the most important questions)

---

On average, how much time on a day does the dog spend chasing its tail?
On average, how long does one tail chasing bout last?
How does the tail chasing episode end? In what state the dog is? You can specify more than one option.
Have you ever tried to stop the behavior?
Do you give medication for your dog because of this behavior? If yes, please specify the medication:
While behaving, does the dog react to its name, or other commands?
Is there any physical injury to the dog's tail due to tail chasing?
Is the dog spayed/neutered?
At what age was your dog separated from its mother?
When your dog was born, was there any complications etc. with the birth?
Do you give your dog's extra vitamins/ dietary supplements?
How many hours/minutes does your dog get exercise in a typical day?
How much does your dog spend alone in the house/kennel during the average working day?
Can you think of any other important information that might be related to tail chasing behavior?
Does your dog have any of the following diseases such as Diabetes, Epilepsy, Allergies, demodicosis, Hypothyroidism, Pancreatic insufficiency, Liver malfunction, something else?

---

## Discussion

---

Tail-chasing is a neuropsychiatric disorder observed both in humans and animals. This disorder is a repetitive behavior that can become disruptive to the dog's functioning and relationship with its owner (Overall, 2000). Despite the general renown of the behavior and its potential severity in clinical cases, little is known about canine compulsive disorder. The obtained results in the present study (high serum cholesterol, HDL-C and LDL-C levels) may be used as biochemical parameters of compulsive tail chasing in clinical settings in dogs. Serum triglyceride and VLDL-C levels did not differ significantly between the different groups. Our data was similar to research of Yalcin and Batmaz (2009) that reported the affected dogs with tail chasing had significantly higher total cholesterol, HDL-C and LDL-C compared with control group dogs.

The association of identifiable environmental, physiologic, or psychological experiences with onset of tail chasing has been suggested that anxiety resulting from stress, conflict, boredom or environmental changes in dogs (Dodman et al., 1996). The findings of Akiko et al., (2011) showed that distinct risk factors exist for tail chasing behavior and such factors appear to be regulated by both genetics and the environment. Tail chasing has been reported predominantly in terriers and German shepherd dogs (Blackshaw

et al., 1994). Similarly, we found this disorder to develop in pure or mixed breeds of German shepherd and terrier, supporting the role of genetic factors controlling the development of compulsive disorder. Age at onset of tail chasing disorder has been reported from 3 months to 10 years (Moon-Fanelli and Dodman, 1998). Onset of tail chasing under 12 months of age in dogs, suggests that hormonal changes probably associate with puberty (Overall, 2000). In the present study, the mean (SD) age of the affected dogs was 17.15±9.74 months at onset. In our research there was no difference between two groups of dogs younger and older than 12 months. However, this may be related to the small number of the population we studied.

Anxiety, obsessive-compulsive disorder, and depression are common problems for pet animals. Increasing serotonin in the brain means less anxiety and a happier attitude (Overall, 2000). Tiira et al., (2012) stated the dogs which had received dietary supplements, especially vitamins and minerals, expressed less tail chasing compared with dogs that did not receive any supplements. Also, neutered females had less tail chasing, suggesting an influence of ovarian hormones on tail chasing. The socialization period in dogs, which has been called a critical period and lasts from around 3 to 12 weeks, is considered a very important time for puppies to learn how to interact with their mothers and littermates and to cope with stressful events

**Table 2**

Serum lipid levels (mg/dl) in dogs with tail chasing and the control group dogs

	Mean ± SD in dogs with tail chasing (n= 27)	Mean ± SD in the control group dogs (n= 27)	P value
<b>Total cholesterol</b>	230.74 ± 62.6	149.63 ± 21.55	0.001
<b>Triglyceride</b>	126.33 ± 26.48	113.78 ± 18.86	NS
<b>HDL-C</b>	99.48 ± 15.37	67.70 ± 11.48	0.05
<b>LDL-C</b>	88.70 ± 10.82	25.67 ± 4.22	0.001
<b>VLDL-C</b>	14.83 ± 6.18	12.22 ± 3.39	NS

HDL-C: High density lipoprotein cholesterol, LDL-C: Low density lipoprotein cholesterol, VLDL-C: Very low density lipoprotein cholesterol, NS: Not significant.

(Akiko et al., 2011). Pierantoni et al., (2011) indicated compared with the dogs which remained with their social group for 60 days, dogs that had been separated from the litter earlier were more likely to exhibit potentially problematic behaviors.

Most dogs in Iran have not learned appropriate social behavioral programs, therefore, the prevalence of behavioral problems is relatively high in companion animals. Khoshnegah et al., (2011) evaluated prevalence and risk factors of behavior problems in companion dogs in Mashhad. The main behavior problems reported by owners were excessive activity (34%). In another survey by Mashhadi Rafiei et al., (2011) in Tehran, 47.1% had behavioral problems. It is reported that male dogs with OCD significantly outnumbered females (2:1) (Overall and Dunham, 2002). In the recent study, tail chasing was observed much more among male dogs (3.5:1). When a male to female ratio of nearly 70:30 was taken of all the referral dogs to our Hospital in the same period into consideration, it can be suggested that males are overrepresented in this disorder.

Irimajiri et al. (2009) found mild polycythemia associated with compulsive disorder in the affected dogs. In contrast, in our study, complete blood count was determined within normal limits. It seems necessary to study more cases to explore any relationship between polycythemia and compulsive disorders. Dodman et al. (1996) found higher serum cholesterol levels in dogs with tail chasing and complex partial seizures in bull terriers. Similarly, in human beings, Peter et al. (2002) reported elevated cholesterol levels. We obtained normal triglyceride and VLDL-C levels in dogs with tail chasing. Agargun et al. (2004) showed higher LDL-C, VLDL-C and triglyceride levels in OCD patients than normal control subjects. Previous studies report an association between increased cholesterol level and generalized anxiety disorder in human (Peter et al., 2002; Agargun et al., 2004). Pharmacotherapy in combination with behavior therapies has been proven to be effective in treatment of tail chasing. In previous studies, we showed that hypericin was significantly more effective than fluoxetine in the control of tail chasing in dogs (Mosallanejad et al., 2015). Clomipramine and fluoxetine seem to be equally effective in the treatment of tail chasing (Yalcin, 2009). The best prevention is to give the dog adequate attention and exercise, a suitable environment and carefully monitoring. We hope that, in the near future, this and other similar projects will provide the basis of an epidemiologic study for deeper understanding. In conclusion, our results suggest that a high serum cholesterol level might serve as a biochemical parameter for dogs with tail chasing. Further researches will be needed for in depth analysis of the correlation between lipid profiles and compulsive disorders in dogs.

## Acknowledgments

We would like to gratefully thank the Research Council

of Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran, for financial support.

## References

- Agargun, M.Y., Dulger, H., Inci, R., Kara, H., Ozer, O.A., Sekeroglu, M.R. and Besiroglu, L. (2004) Serum lipid concentrations in obsessive-compulsive disorder patients with and without panic attacks. *Canadian Journal of Psychiatry* 49, 776-778.
- Bennett, P.C. and Rohlf, V.I. (2007) Owner-companion dog interactions: relationships between demographic variables and potentially problematic behaviors, training engagement and shared activities. *Applied Animal Behaviour Science* 102, 65-84.
- Blackshaw, J.K., Sutton, R.H. and Boyhan, M.A. (1994) Tail chasing or circling behavior in dogs. *Canine Practice* 19, 7-11.
- Blackwell, E., Twells, C., Seawright, A. and Casey, R.A. (2008) The relationship between training methods and the occurrence of behavior problems, as reported by owners, in a population of domestic dogs. *Journal of Veterinary of Behavior* 3, 207-217.
- Brown, S.A., Crowell-Davis, S., Malcom, T. and Edwards, P. (1987) Naloxene-responsive compulsive tail chasing in a dog. *Journal of the American Veterinary Medical Association* 190, 884-886.
- Dodman, N.H., Karlsson, E.K., Moon-Fanelli, A., Galdzicka, M., Perloski, M., Shuster, L., Lindblad-Toh, K. and Ginns, E.I. (2010) A canine chromosome 7 locus confers compulsive disorder susceptibility. *Molecular Psychiatry* 15, 8-10.
- Dodman, N.H., Knowles, K.E., Shuster, L., Moonfanelli, A.A., Tidwell, A.S. and Keen, C.L. (1996) Behavioural changes associated with suspected complex partial seizures in bull terriers. *Journal of the American Veterinary Medical Association* 208, 688-691.
- Fukunaga, K. and Orito, K. (2012) Time-course effects of St John's wort on the pharmacokinetics of cyclosporine in dogs: interactions between herbal extracts and drugs. *Journal of Veterinary Pharmacology Therapeutics* 35, 446-451.
- Goto, A., Arata, S., Kiyokawa, Y., Takeuchi, Y. and Mori, Y. (2012) Risk factors for canine tail chasing behavior in Japan. *The Veterinary Journal* 192, 445-448.
- Hewson, C.J., Luescher, U.A. and Ball, R.O. (1999) The use of chance-corrected agreement to diagnose canine compulsive disorder: an approach to behavioral diagnosis in the absence of a 'gold standard'. *Canadian Journal of Veterinary Research* 63, 201-206.

- Huang, T.L., Wu, S.C., Chiang, Y.S. and Chen, J.F. (2003) Correlation between serum lipid, lipoprotein concentrations and anxious state, depressive state or major depressive disorder. *Psychiatry Research* 118, 147-153.
- Irimajiri M., Luescher, A.U., Douglass, G., Robertson-Plouch, C., Zimmermann, A. and Hozak, R. (2009) Randomized, controlled clinical trial of the efficacy of fluoxetine for treatment of compulsive disorders in dogs. *Journal of the American Veterinary Medical Association* 235, 705-709.
- Khoshnegah, J., Azizzadeh, M. and Mahmoodi Gharaie, A. (2011) Risk factors for the development of behavior problems in a population of Iranian domestic dogs: Results of a pilot survey. *Applied Animal Behaviour Science* 131, 123-130.
- Luescher, A.U. (2002) Compulsive behavior. In: Horwitz, D.F., Mills, D.S., Heath, S. (Eds.), *BSAVA Manual of Canine and Feline Behavioral Medicine*. Gloucester, BSAVA, UK., pp 233.
- Mashhadi Rafiei, S., Sattari, B. and Naderi, M.M. (2011) Prevalence of behavior problems in domestic dogs in Tehran-Iran. *Global Veterinary* 6, 333-338.
- Moon-Fanelli, A.A. and Dodman, N.H. (1998) Description and development of compulsive tail chasing in terriers and response to clomipramine treatment. *Journal of the American Veterinary Medical Association* 212, 1252-1257.
- Overall, K.L. (2000) Dogs as 'natural' models of human psychiatric disorders: assessing validity and understanding mechanism. *Prog. Neuropsychopharmacol. Biological Psychiatry* 2, 726-776.
- Overall, K.L. and Dunham, A.E. (2002) Clinical features and outcome in dogs and cats with obsessive-compulsive disorder: 126 cases (1989-2000). *Journal of the American Veterinary Medical Association* 221, 1445-1452.
- Peter, H., Hand, I., Hohagen, F., Koenig, A., Kindermann, O., Oeder, F. and Wittich, M. (2002) Serum cholesterol level comparison: control subjects, anxiety disorder patients, and obsessive-compulsive disorder patients. *Canadian Journal of Psychiatry* 47, 557-561.
- Pierantoni, L., Albertini, M. and Pirrone, F. (2011) Prevalence of owner-reported behaviours in dogs separated from the litter at two different ages. *The Veterinary Record* 169, 468.
- Senturk, S. and Yalcin, E. (2003) Hypocholesterolemia in dogs with dominance aggression. *Journal of Veterinary Medicine* 50, 339-342.
- Tilley, L.P. and Smith, F.W.K. (2005) *The 5-minute veterinary consult, 3rd edn*. Lippincott Williams and Wilkins, Maryland, pp 1325-1326.
- Tiira, K., Hakosalo, O., Kareinen, L., Thomas, A., Hielm-Bjorkman, A., Escriou, C., Arnold, P. and Lohi, H. (2012) Environmental effects on compulsive tail chasing in dogs. *PLoS One* 7, e41684.
- Yalcin, E. (2009) Comparison of clomipramine and fluoxetine treatment of dogs with tail chasing. *Tierarztliche Praxis Ausgabe K, Kleintiere/Heimtiere* 38, 295-299.
- Yalcin, E., Icol, Y.O. and Batmaz, H. (2009) Serum lipid concentrations in dogs with tail chasing. *The Journal of Small Animal Practice* 50, 133-135.