

## **CORRELATION BETWEEN NEUROTRANSMITTER LEVELS AND ANXIETY-RELATED BEHAVIOURS IN CATS**

**Riva J., Marelli S.P., Funicello B., Polli M., Longeri M.**

Università degli Studi di Milano, Facoltà di medicina Veterinaria, Dipartimento di Scienze Animali  
– Zootecnica Veterinaria: via Celoria 10, 20133 Milano, Italia; e-mail address:

[riva.jacopo@unimi.it](mailto:riva.jacopo@unimi.it)

**Keywords:** neurotransmitters, anxiety, aggressiveness, cat behavioural problem

### **Introduction:**

The present study aims to evaluate the existing correlations between neurotransmitter levels and anxiety-related aggressive behaviour.

### **Materials and methods:**

22 adult cats (age > 6months; no pharmacological therapy for behaviour problems) were grouped according to three different levels of aggressive behaviour: Group 1 (N=11): rare aggressive attacks, anxiety and aggressive-related behaviour problems reported by the owner; Group 2 (N=4): frequent aggressive attacks (n attacks > 12/year); Group 3 (N=7): control, no aggressive attacks reported by the owners. An accurate questionnaire focusing on anxiety and aggressive behaviour was filled in for every subject and evaluated by a DVM certified Specialist in Veterinary Behavioural Medicine. Blood samples were collected in EDTA for all the subjects for neurotransmitters analysis (standard blood processing procedures for HPLC neurotransmitter analysis were applied). HPLC analysis was carried out for the following neurotransmitters: Dopamine precursor LDOPA, dopamine DA, noradrenalin NA, adrenalin A, serotonin SE levels in plasma and platelets; 5-hidrossiindolacetic acid HIAA (serotonin metabolite) and Homovanillic acid (dopamine metabolite) in platelets. SAS ® statistic package was applied to data analysis: FREQ, MEAN and NPAR1WAY procedures were applied; the analysis of variance was carried out using a Kruscal-Wallis one-way ANOVA.

### **Results:**

The results indicate that during the history taking session, the origin of the cat, age at weaning and human family structure are very helpful in aggressive behaviour evaluation, furthermore nervousness, shyness and fearfulness related information are closely linked to anxiety related problems. Higher levels of NA (pg/ml), DA (pg/ml), LDOPA plasma (pg/ml), LDOPA platelet (pg/ml) were found in Control group ( $P \leq 0.05$ ). A correlation between neurotransmitter concentrations and anxiety related behavioural problems has been calculated.

### **Discussion:**

The obtained results suggest, in particular, that the reduction in platelet DA levels could be related to aggressive behaviour towards animals and human beings. Further analysis is needed to improve the knowledge of the complex relations between nervous system and behaviour. In addition the investigation of the genetic basis of behaviour could supply powerful tools in the understanding of anxiety and aggressiveness in companion animals.

### **References:**

Amat M, Ruiz DE LA Torre JL, Fatjo J, Mariotti VM, Van Wijk S, Manteca X, 2009. Potential risk factors associated with feline behaviour problems. *Appl. Anim. Behav. Sc.* 121, 134-139.

- Beaver BV, 2004. Fractious cats and feline aggression. *Journal of Feline Medicine and Surgery* 6, 13-18.
- Bhatt S, Gregg TR, Siegel A, 2003. NK<sub>1</sub> receptors in the medial hypothalamus potentiate defensive rage behavior elicited from the midbrain periaqueductal gray of the cat. *Brain Research* 966, 54-64.
- Bhatt S, Zalcman S, Hassanain M, Siegel A, 2005. Cytokine modulation of defensive rage behavior in the cat: role of GABA<sub>A</sub> and interleukin-2 receptors in the medial hypothalamus. *Neuroscience* 133, 17-28.
- Bhatt S, Bhatt RS, Zalcman SS, Siegel A, 2009. Peripheral and central mediators of lipopolysaccharide induced suppression of defensive rage behavior in the cat. *Neuroscience* 163, 1002-1011.
- Casey RA, Bradshaw JWS, 2008a. The effects of additional socialisation for kittens in a rescue centre on their behaviour and suitability as a pet. *Appl. Anim. Behav. Sci.* 114, 196-205.
- Casey RA, Bradshaw JWS, 2008b. Owner compliance and clinical outcome measures for domestic cats undergoing clinical behaviour therapy. *Journal of Veterinary Behaviour* 3, 114-124.
- Deutch AY, Roth RH, 2009. Pharmacology and Biochemistry of Synaptic Transmission: Classical Transmitters. In: *From Molecules to Networks. An Introduction to Cellular and Molecular Neuroscience*. Second Edition, edited by Byrne JH and Roberts JL, Academic Press, 267-300.
- Heath S, 2009. Aggression in cats. In: *BSAVA Manual of Canine and Feline Behavioural Medicine*. Second edition, Debra F. Horwitz and Daniel S. Mills, 223-235.
- Ohl F, Arndt SS, Van der Staay FJ, 2008. Pathological anxiety in animals. *The Veterinary Journal* 175, 18-26.
- Popova NK, 2006. From gene to aggressive behavior: the role of serotonergic system. *BioEssays* 28, 495-503.
- Seksel K, 2009. Preventive behavioural medicine for cats. In: *BSAVA Manual of Canine and Feline Behavioural Medicine*. Second edition, Debra F. Horwitz and Daniel S. Mills, 75-82.
- Van Erp Amm, Miczek KA, 1996. Prefrontal cortex dopamine and serotonin: microdialysis during aggression and alcohol self-administration in rats. *Soc. Neurosc. Abst.* 22, 161.