

A unique dietary approach to managing stress levels in dogs

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Background

The worldwide Covid 19 pandemic has focussed our minds on the problems of stress and anxiety in our communities, yet veterinary professionals are all too familiar with canine patients presenting with signs of stress and anxiety which can be initiated or exacerbated by a wide variety of environmental factors.

[E Tod, D Brander, N Waran; CA Dixon, RD Mistry].

Stress in dogs is often demonstrated in unwanted behaviours which can lead to a cycle of interrelated stress in the owners, surrender of the dog to the rescue sector or, in extremis, euthanasia. Veterinary practice can offer drug and/or pheromone treatment as well as referral to qualified animal behaviourists, in an attempt to break this cycle but the overall aim is to manage rather than cure the condition.

The development of drug therapy has recognised that, by enhancing the transport of individual amino acids into the brain, it is possible to alter both animal and human behaviour. This change in behaviour is preceded by altered synthesis rates of neurotransmitters, including serotonin and its precursor tryptophan.

Serotonin is known to reduce behaviours such as aggression, anxieties, over-excitability and reactivity by raising overall mood state and promoting more positive emotional responses. Serotonin is also known to improve learning and decision making, thus aiding the success of behaviour therapy and rehabilitation.

As part of their management strategy, behaviourists have long been familiar with 'Val's Diet', a nutritional approach that was designed to help a dog reach and maintain optimal emotional balance and mood state. The diet features a unique

ingredient balance that allows the vital amino acids and vitamins needed to synthesise key neurotransmitters such as serotonin to reach the brain for when they are required.

First published in 1998, the Val Strong diet uses insulin, secreted in response to carbohydrate ingestion, to regulate plasma glucose levels and divert large neutral amino acids to peripheral skeletal tissues where they are involved in energetic and immune system pathways, enabling tryptophan to gain a competitive edge across the blood brain barrier. Behaviourists had been constrained in their ability to use the diet by the need for dog owners/carers to assemble the ingredients on a daily basis, with both convenience and compliance being cited as being limiting factors.

In 2017, a commercially available, complete, dry dog food version of 'Val's Diet' was produced by the manufacturers of Oscar pet foods and has been distributed primarily among behaviourists. Initially this 'Breakthrough' diet was trialled by several qualified behaviourists with their clients' and veterinary surgeons' approval. 22 dogs were included in this trial, with 21 dogs showing significant improvement in both their emotional assessments and mood state. At the end of the trial, all owners requested to continue feeding the diet. One owner, who had subsequently relocated to Spain, was so impressed with the improvement in her dog's behaviour, arranged to have the diet shipped at her own cost.

Since then, the 'Breakthrough' diet has been tested in a kennel environment at Wood Green Animal Centre, where the study looked at anxiety/agitation/inability to settle vs calm/relaxed behaviour in one group and at reactivity/low impulse control vs composed/responsive behaviour in a second group. Results were impressive in both groups and were published in 2017 [Veterinary Practice Today]. Anecdotally, staff at the centre were particularly impressed with two cases where, in

a managed outreach situation, sufficient improvement in the dogs' behaviour allowed the owners to avoid any need to surrender their dogs to rescue at all.

Further work looking at urine cortisol levels was carried out at the University of Glasgow, as part of a Masters' degree submission, and it was felt that a double blind study looking at efficacy in a controlled situation, where the maintenance of effect could also be measured, would be advantageous.

As a result, a double blind trial was conducted in a rescue kennel situation.

Summary of findings

Methodology

Three groups of dogs, each of between 10 and 13 dogs of differing stress levels, were subject to three diets. Treatment C was the standard treatment (control) and A and B were trial diets. For the purpose of identification in the charts below, diet A was a commercially available complete dog food from the same manufacturer as diet B - which was the 'Breakthrough' diet*.

Stress was measured over a 9-week period using a number of metrics each providing a score of between 0 and 10 with all scores averaged to provide the mean stress score. The assessment was made separately for the kennelled and exercise/walk periods.

After the sixth week the trial diets were replaced with the standard diet to explore whether the effect (positive or negative) was maintained.

Effect on reducing stress levels

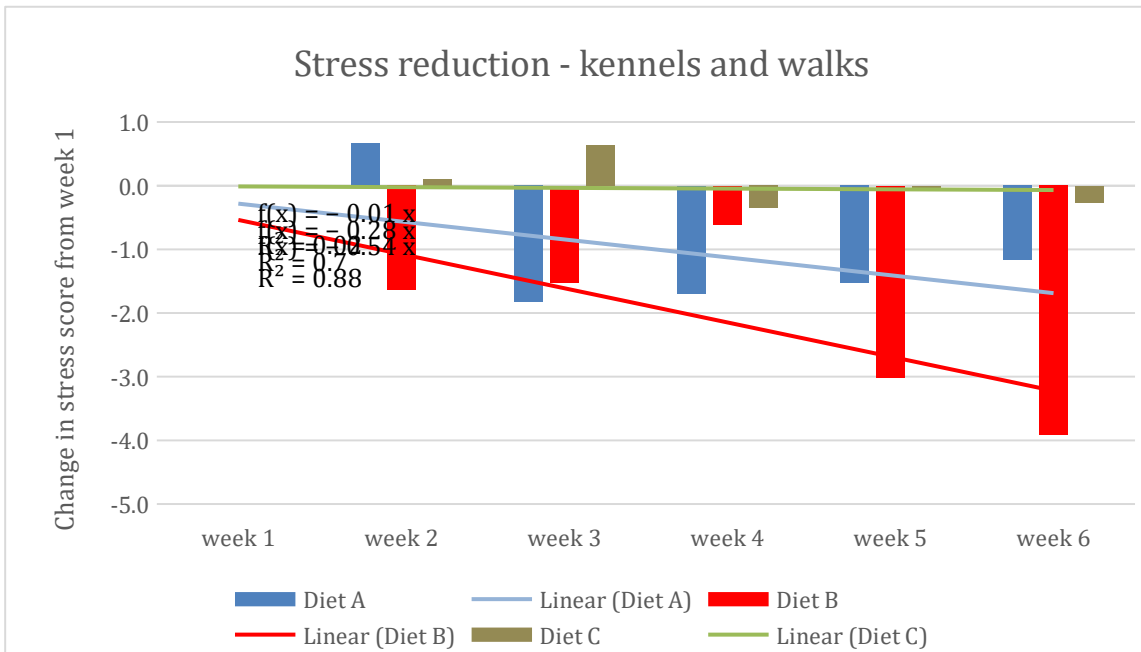
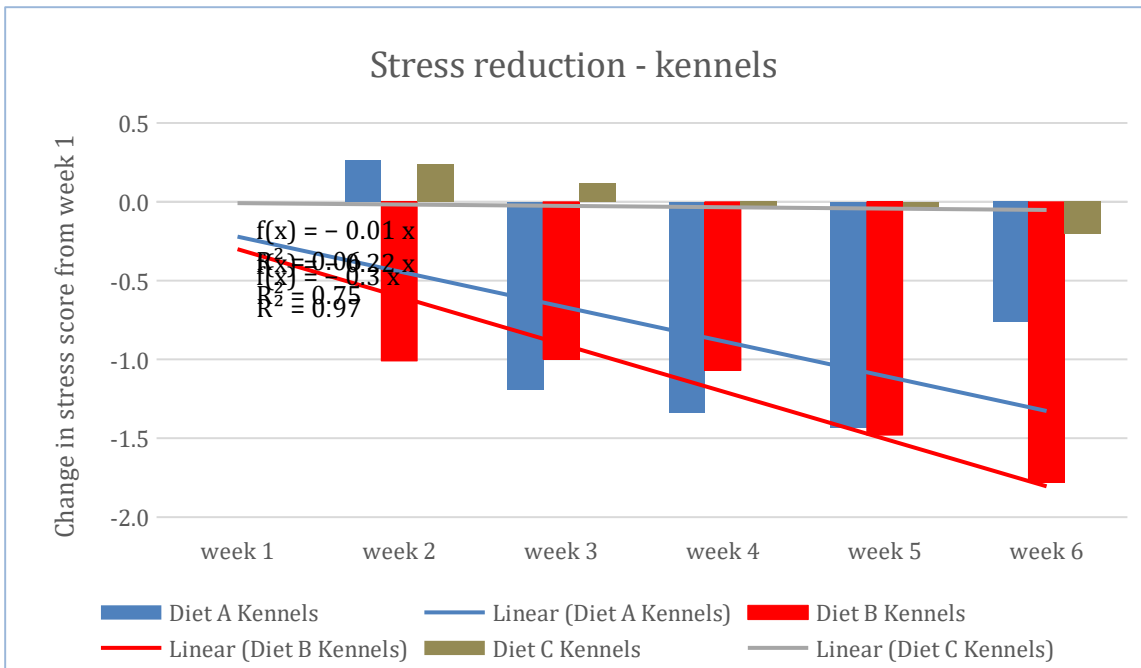
The mean stress scores for each group of dogs were compared each week with their baseline mean scores at the beginning of the trial (week 1), showing the change in average stress levels over the period.

When analysed relative to the control group on Diet C, the groups on Diet A and Diet B both exhibited decreased stress levels over the period they were on the new diets. There was a reduction in measured stress levels both when kennelled and during exercise periods and this reduction tended to increase over the 6 weeks. However, the reduction was more consistent when kennelled, perhaps as a result of differences in exposure to stressful situations.

As would be expected, the same pattern was demonstrated when the kennel and walk data were combined.

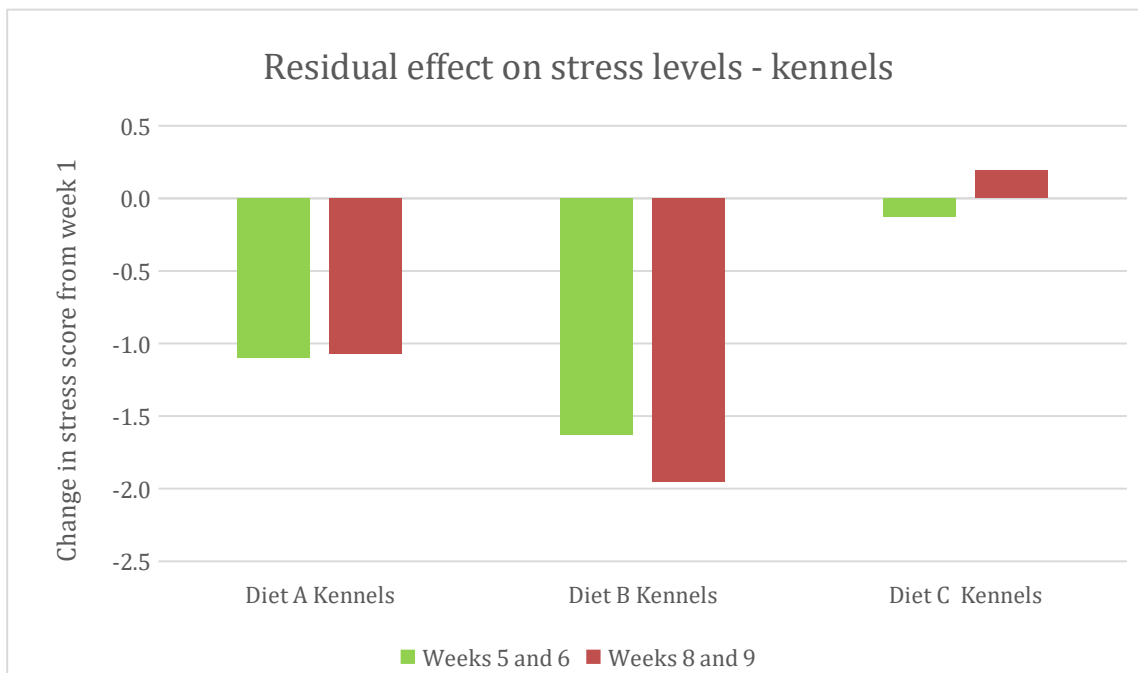
Dogs on Diet B showed a more consistent trend in stress reduction than those on Diet A. Those on Diet C showed no noteworthy change in stress scores over the period.

See below for stress reduction monitored in kennels over the 6 weeks when dogs were fed the three different diets (before they were taken off Diets A and B in week 7.) The trendlines indicate that the reduction in stress levels in dogs on Diet B continued at the rate of approx. 30% per week and the reduction in stress in those on Diet A grew by approx. 20% per week. Response to Diet A appeared to be less consistent (evidenced by the lower R² figure which is a measure of correlation).



The stress reduction observed in kennels was more apparent and consistent than on walks. The combined effect on mean stress levels in kennels and at exercise over the 6 weeks is shown below. The combined reduction in stress levels of dogs on Diet B grew by 50% per week on average. The stress scores of dogs on Diet A were also reduced compared with week 1 but the response grew at a slower and less consistent pace.

Difference in stress reduction when taken off the new diets



When the diet reverted to the standard diet (diet C) for the final two weeks of the trial the reduction achieved to that point was maintained. This was most obvious for diet B. It would be interesting to find out whether this was sustained over a longer period.

While the work to date is not conclusive, the early indications are impressive and show that diet can potentially make a contribution to stress reduction.

Mode of Action

The amino acids tryptophan and tyrosine are converted to neurotransmitters in the mammalian brain. Tyrosine is converted to the catecholamine stimulants dopamine and noradrenaline, while tryptophan is converted to serotonin.

Serotonin plays a role in the regulation of mood, the control of sleep and arousal, the management of pain and in the control of eating. A lack of serotonin causes a reduction of the reward cascade [K. Blum, J. G. Cull, E. R. Braverman, D. E. Comings] which means new or alternative behaviours cannot be learnt and depresses the release of enkephalins (the body's natural analgesics), causing an increase in touch sensitivity.

Nutritional Application

Tryptophan is an essential amino acid and therefore its concentration in the body depends ultimately on the presence of adequate dietary intake, whereas tyrosine is a non-essential amino acid, therefore not dependent on dietary intake as it can be synthesised from the essential amino acid phenylalanine. [M. Eastwood] [M. H. Fernstrom & J.D.Fernstrom]

The synthesis of serotonin depends upon certain co-factors being present. The enzymes involved in serotonin synthesis are B6 and riboflavin dependent, as these act as co-factors. As the B-Group vitamins are water soluble, an adequate concentration needs to be provided in the daily diet.

The concentration of an amino acid in the brain does not reflect its level in the blood. A complex group of blood-brain barrier mechanisms control both the kinds of substances that enter the extra cellular fluid of the brain and the rate at which they

enter. Amino acids, amongst other important substrates, use an active transport mechanism, combining with transport proteins, to cross the blood-brain barrier.

The large neutral amino acids tryptophan, tyrosine, leucine, isoleucine, valine use the same transport system to cross the blood brain barrier and compete for uptake. Hence, a treatment such as meal ingestion can influence the level in the brain of a given amino acid by modifying its concentration in the blood and/or the blood concentration of other amino acids that compete with it for uptake. [C. R. Markus et al.] Therefore, the ratio of tyrosine or tryptophan to the sum of the other large neutral amino acids in the circulation will effectively control the amount of that amino acid taken across the blood-brain barrier. Competition between tryptophan and other large neutral amino acids is a dominant determinate of tryptophan uptake into the brain.

Insulin is secreted in response to carbohydrate ingestion, to regulate plasma glucose levels, but also diverts valine, leucine and isoleucine to peripheral skeletal tissues where they are involved in energetic and immune system pathways. Consequently, by stimulating insulin secretion, tryptophan will gain a competitive edge over tyrosine for transport across the blood brain barrier. However, tryptophan levels can only be significantly raised by carbohydrate intake if the carbohydrate load occurs after protein has been broken down into its component amino acids.

Conclusion

This diet has been shown to be useful in reducing anxiety and in facilitating learning in a number of kennel environments. It can be used in conjunction with pharmaceuticals such as SSRI's as it enables increased levels of brain serotonin to be available for these drugs to exert an enhanced effect.

In addition, the diet can complement other treatments, such as pheromone therapy and should be considered as an additional, adjunct treatment option.

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After qualifying as a medical scientist, Val went on to pursue a career in animal behaviour and training, gaining an MSc in Companion Animal Behaviour Counselling from the University of Southampton. She specialises in the effects of diet on canine behaviour and training.

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