



Clinical Evidence Report

Technical Information Services

ANTIOXIDANT BENEFITS FOR ADULT DOGS STUDY SYNOPSIS

Jewell DE, Toll PW, Wedekind KJ, et al. Effect of increasing dietary antioxidants on concentrations of vitamin E and total alkenals in serum of dogs and cats. *Vet Therapeutics* 2000; 1:264-272.

BACKGROUND

Oxidative damage to DNA, proteins and lipids has been implicated as a contributor to aging and various chronic diseases. The presence of total alkenals in blood and tissues is an indicator of lipid peroxidation, which may increase when defense mechanisms for oxidative damage are reduced and/or oxidative stress is increased.

As a result of normal energy production, highly reactive intermediates known as reactive oxygen species (ROS) are produced within mitochondria. When present in a complex biologic system, ROS may result in damage to DNA, lipids and proteins. When defense mechanisms of oxidative damage are reduced and/or oxidative stress is increased, ROS concentrations within cells are increased, resulting in increased damage to biomolecules with subsequent production of lipid peroxidation byproducts, which are the measured alkenals. In this study, alkenals were used as biomarkers of oxidative stress because they are significant products of peroxidation and cause further cellular damage.

A large and growing body of studies suggests ROS may eventually result in mutation, neoplastic transformation loss of cellular function, cellular aging and, ultimately, cellular death. In light of this body of knowledge, much interest has been focused on antioxidants such as vitamin A, vitamin C, and vitamin E, to synergistically scavenge oxygen-derived species, repair damage to target tissue, and help build new tissue. In this study, the effect of various dietary vitamin E levels on *in vivo* markers of oxidative stress (alkenals) were evaluated in normal adult dogs.

CANINE STUDY DETAILS

Forty healthy adult dogs were assigned to four equal groups in a complete random block design. The control group was fed dry food containing 153 IU vitamin E/kg food (as fed). Treatment groups were fed the same basal dry food with vitamin E added at three different concentrations. The total analyzed dietary vitamin E levels for the treatment groups were 293, 445 and 598 IU vitamin E/kg food (as fed). The treatment foods also contained added vitamin C, beta-carotene and selenium for additional antioxidant activity.

CLINICAL IMPORTANCE

The findings of the canine study show that increased dietary levels of vitamin E can improve the antioxidant status of normal dogs and modulate oxidative stress *in vivo*. However, increased amounts of dietary vitamin E did not always reduce alkenal levels. Significant reductions of serum alkenal concentrations occurred only when dietary vitamin E levels reached 445 IU/kg food in dogs on an as-fed basis (**Table 1**). Since vitamin E is generally regarded as safe with relatively low toxicity in both humans and animals, it makes prudent medical sense to recommend nutrition that contains high levels of vitamin E to healthy canine patients.

DIETARY VITAMIN E (IU/KG FOOD AS FED) IN DOGS	DIFFERENCE (INITIAL VS. FINAL ALKENALS) IN DOGS
153 (control)	-0.59
293	-0.30
445	-0.89*
598	-1.46*

Table 1. Serum concentrations of vitamin E and total alkenals in dogs.

*Differences between initial and final concentrations are significant at $p < 0.05$.



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ANTIOXIDANT BENEFITS FOR PUPPIES AND ADULT DOGS STUDY SYNOPSIS

Khoo C, Cunnick J, Friesen K, et al. The role of supplementary dietary antioxidants on immune response in puppies. *Vet Therapeutics* 2005;6:43-56.

BACKGROUND

During periods of immune stimulation such as vaccination, immune cells generate free radicals. These free radicals have the potential to damage cells and tissues in the body. The body's antioxidant defense system as well as exogenous antioxidants in the food may help to promote formation and maintenance of healthy immune cells by reducing oxidative stress in the body and protecting the cells from harmful free radicals.

Previous studies have demonstrated a beneficial effect of administering a single antioxidant nutrient on immune response. In this study, the standard vaccination protocol for puppies with a canine distemper (CDV) and parvovirus (CPV) combination vaccine was used as a measure of immune function stimulation to determine the effect of an antioxidant-enhanced food on the immune function health of the puppies.

STUDY DETAILS

Four groups of 10 puppies each were fed a control and three different test foods [Control (Ctrl), control + antioxidants (AOX), control + AOX + 1% whey protein (WPI), and a grocery brand (GROC)] over a 6-week period. The AOX combination consisted of vitamin E [500 IU/kg dry matter (DM)], vitamin C (70 mg/kg DM), β -carotene (0.4 mg/kg DM) and selenium (0.8 mg/kg DM). Body weights were recorded weekly and blood was drawn on days 1 and 42 of the study.

The combination vaccine (Progard[®]-7, Intervet Inc., Millsboro, DE) was given on day 14 of the study with a booster on day 28. Blood samples were obtained weekly and serum was sent for measurement of titers from day 14 to day 42. Leukocytes were isolated from peripheral blood to measure lymphocyte proliferation and natural killer cell activity.

Puppies consuming high AOX foods without whey protein had significantly higher CPV titers at weeks 2 and 3, and CDV titer at week 4, than puppies receiving the control food. Puppies consuming both high AOX foods had significantly increased memory CD4+ cells and serum vitamin E concentrations compared with the control and grocery brand groups. Serum E concentrations were significantly decreased from pre-feeding values for the group on the grocery brand food. This suggests that immune stress adversely affects serum E concentrations and that this is prevented by supplementing vitamin E.

CLINICAL IMPORTANCE

The combination of antioxidants in this study, vitamin E, vitamin C, β -carotene and selenium, was found to improve the response to CDV and CPV vaccination and to increase the number of memory T cells, which may help to provide longer-lived protection against infections. The minimum AAFCO recommendation for dietary vitamin E (50 IU/kg food) may not be sufficient to protect cells during periods of immune stress. Hill's[®] Science Diet[®] Puppy and Puppy Large Breed dry pet foods contain superior antioxidant formulas to help ensure that puppies develop a healthy immune system.