

**Studies on effects of anti-oxidant astaxanthin
supplementation in healthy and obese dogs**

Abstract

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In recent years, overweight and obesity are frequently observed also in dogs and cats. Obesity and its related disorders such as diabetes mellitus and Cushing's syndrome become social problem in veterinary medicine. In this thesis, pathophysiology and onset mechanism of obesity is reviewed, and astaxanthin (ASX) supplementation effects were investigated in healthy, obese, diabetes and Cushing's syndrome dogs.

Obesity is a risk factor to induce various metabolic disorders in both human and animals. Excess lipid as accumulated visceral fat induces proinflammatory reactions in various tissues. The most important factor for obesity to induce various metabolic disorders is remodeling of fat cells in accumulated visceral adipose tissues. Enlarged fat cells secrete various inflammatory cytokines (adipokines) such as non-esterified fatty acids (NEFA), M1 macrophages, which induce activation of NADPH oxidase and oxidative stress leading acceleration of obesity domino reaction consequently metabolic syndrome.

ASX is generally known as vigorous anti-oxidant substance. As ASX shows suppressive lipid peroxidation function and singlet oxygen elimination function, ASX is used as a functional food in various fields, food industry and fish culture, etc. Effect of ASX supplementation was investigated in healthy dogs with BCS3 (ideal body weight). ASX was orally supplemented at a dose of 0.3 mg/kg BW/day for 8 weeks, plasma TG and MDA concentrations and LDH activities decreased significantly. These results seem to clarify that ASX supplementation ameliorates liver function leading to improve lipid metabolism in dogs.

ASX was supplemented to 5 obese dogs with BCS 4 and 5 at a dose of 0.3mg/kg/day for 8 weeks. After the supplementation, plasma TG concentrations and alanine aminotransferase (AST) activities were decreased in all 5 dogs. Plasma LDH activities decreased in 4 of 5 dogs, and MDH concentrations decreased in 3 of 5 dogs. BW and BCS were not changed after the ASX supplementation.

ASX supplementation effect was investigated in dogs with diabetes mellitus and Cushing's syndrome. On 60 days after the supplementation, plasma ALT, γ -GTP, NEFA and MDA concentrations decreased significantly. Miniature Dachshund (spayed, 11 years old) with Cushing's syndrome showed overweight (BCS4). ASX was supplemented orally with this dog at a dose of 0.28mg/kg/day. On 30 days after the supplementation,

plasma total cholesterol (TC), TG, ALT and NEFA values were not changed, however, on 120 days plasma TG and NEFA concentrations decreased.

As the above results, ASX supplementation may suppress lipid peroxidation in tissues, in particular in liver, and may improve liver function, which is effective to treat metabolic disorders such as diabetes mellitus and Cushing's syndrome in dogs. It is very important to ameliorate liver function by suppression of lipid peroxidation for prolongation of lifespan in obese dogs. Therefore, supplementation of anti-oxidant substance like ASX is very effective to prevent obesity and its related metabolic syndrome.