# ThinOgen™ Fucoxanthin

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## Introduction

Edible brown seaweed (kelp) has long been known to be one of the most nutritious foods on earth; for centuries it has been a traditional staple and source of nutrition, particularly in many parts of Asia including China, Korea, Japan, and some Pacific islands – Hawaii being one.

In Japan especially, people consume kelp on an almost daily basis, believing that a high consumption of kelp helps them to live longer; certainly life expectancy in Japan is among the highest recorded in the world, though of course many factors may be at work here. To enable the reader to investigate further and learn about the considerable research undertaken into fucoxanthin, this White Paper is designed to set out as many facts and published research findings as possible and present BGG's research and analysis regarding BGG's highly potent fucoxanthin we brand as ThinOgen™.

### BGG harvests from the finest seaweeds using proprietary technology

The seaweeds used to manufacture BGG's ThinOgen™ fucoxanthin are harvested from clean and cold sea areas with no industrial pollution. Our propriety technology ensures the product's superior quality and creates a highly concentrated natural fucoxanthin which is thousands of times higher than wild seaweed that contains only 0.01% - 0.02% fucoxanthin.

Clinical trials also demonstrate that BGG's ThinOgen™ fucoxanthin supplement is safe and has no adverse effects.

Recently, brown seaweed has been attracting closer interest and attention from those involved with natural extracts in North America and Europe; Among the ingredients extracted from brown seaweed is fucoxanthin; please read-on to learn more about fucoxanthin's special and unique biology and qualities and potential benefits to health, and how and why BGG's ThinOgen fucoxanthin is the superior product in today's

market.

**White Paper**

Fucoxanthin is a natural carotenoid specific to several different types of brown seaweed. It is a brownish pigment that gives brown seaweed its characteristic color; it also participates in photosynthesis [1].

It is a type of non-pro-vitamin A carotenoid and belongs to xanthophylls. Fucoxanthin has an alkene structure and epoxide and hydroxyl groups as shown in Figure 1.

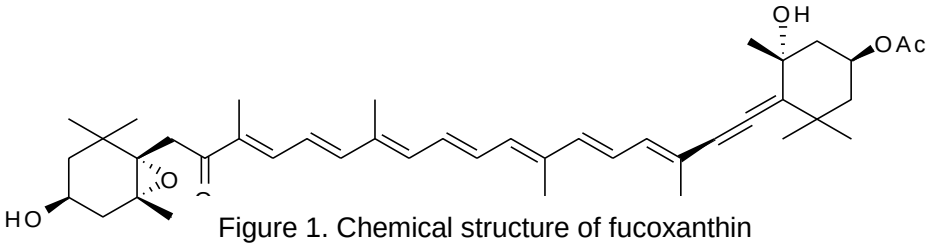


Figure 1. Chemical structure of fucoxanthin

Fucoxanthin is the first marine algae-derived ingredient with a clinically proven thermogenic effect and can be used for weight loss. Metabolic and nutritional studies have demonstrated that fucoxanthin promotes fat burning within fat cells [2].

Unlike other weight loss products like caffeine, ephedra and synephrine (that also add toxins to human body), fucoxanthin can help boost the fat metabolism rate without stimulating a person's central nervous system, thus helping to ensure that weight lost does not creep back. And BGG's fucoxanthin is not just safe, it has a higher concentration and potency.

Fucoxanthin can reduce fat in different ways [2, 3]. It is noteworthy that the fat loss effect is specific to fucoxanthin and has not been found to be present in other carotenoids.

In addition, fucoxanthin has undergone research to explore potential benefits in the areas of diabetes and heart protection [4].

In mammals, fucoxanthin is metabolized to fucoxanthinol. Both fucoxanthin and fucoxanthinol possess high biological activity. As a result, fucoxanthin and/or fucoxanthinol have other potential benefits. Fucoxanthin displayed beneficial effects on cancer chemoprevention in cell culture studies [5-7] and in animal experiments [8-11].

Research has also found that fucoxanthin and its metabolite fucoxanthinol induce

apoptosis (cell suicide) of human leukemia, breast and colon cancer cells [12] as well as human prostate cancer cells [13].

## Biological Activities of Fucoxanthin

1. Fat Burning and Weight Loss Effect

Currently drug therapy is the main treatment for obesity. Fat loss drugs can be pharmacologically categorized into two kinds: central (like Sibutramine) and peripheral (like Orlistat) pathways. Both drugs take effect by suppressing the appetite and decreasing the calorie intake which will lead to a negative energy and nutrition balance. Moreover, Sibutramine has been reported to do harm to human learning and memory and may even cause temporary amnesia. So far all marketed fat loss drugs have different side effects.

Fucoxanthin implements body fat and weight loss effect through two different mechanisms. Study of more than 200 obese rats and mice fed fucoxanthin showed that fucoxanthin upregulates gene expression of mitochondrial uncoupling protein 1 (UCP1) which is responsible for conversion of energy to heat through fat oxidation (Figure 2 & 3). As UCP1 is found in white adipose tissue (WAT) and the abdominal area contains abundant adipose tissue, fucoxanthin is particularly effective in shrinking oversized guts [2]. Fucoxanthin is the first natural food component that has been shown to reduce fat by targeting the UCP1 protein.

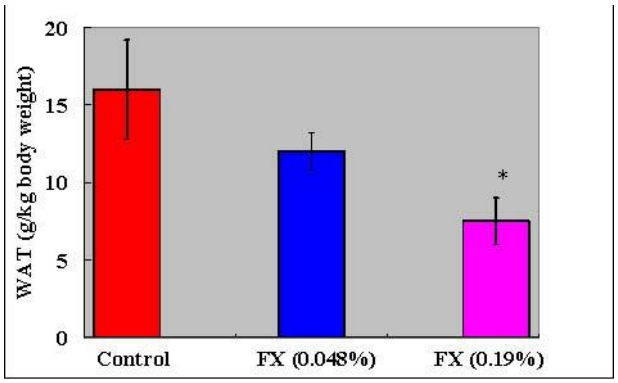


Figure 2. WAT Weight of rats fed fucoxanthin and control diet.
*Significantly different from control (P < 0.01)

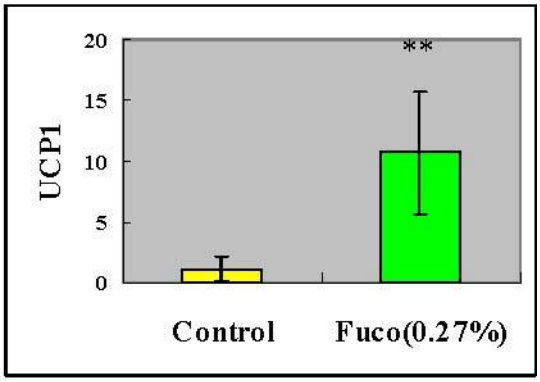


Figure 3. UCP1 protein expression in WAT of mice fed with fucoxanthin and control diet.
**Significantly different from control (P < 0.05).

Fucoxanthin also appeared in animal studies to stimulate the liver to produce docosahexaenoic acid (DHA) (Figure 4), a type of omega-3 fatty acid, at levels comparable to fish oil supplementation [3]. Increased levels of DHA reduce 'bad cholesterol' (low density lipoprotein), which is known to contribute to obesity and heart disease. Unlike fish oil supplements, fucoxanthin does not have an unpleasant smell. No adverse effect of fucoxanthin was found on mice and rats used in the study.

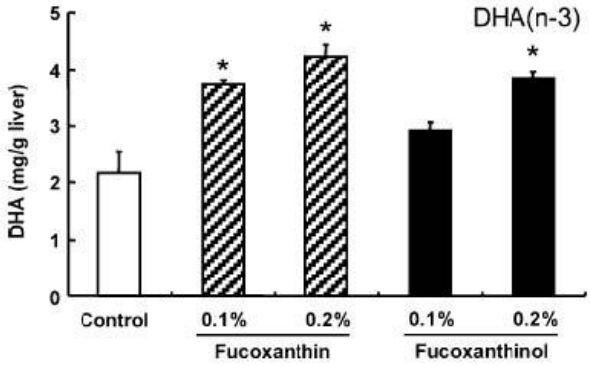


Figure 4. Effect of fucoxanthin and fucoxanthinol on the mice liver DHA amount

## 2. Diabetes Prevention

An excessive accumulation of fat in WAT induces some diseases such as type II diabetes. Direct conversion of fat to heat by fat oxidation in WAT, therefore, will lead to a decreased diabetes risk in humans. Fucoxanthin can promote fat burning and diminish fat accumulation in human body [14].

## 3. Anti-oxidant

Fucoxanthin can effectively scavenge free radicals and avoid the potential damages caused by free radical attack, thus decrease the incidence of many diseases related to free radicals like heart disease, atherosclerosis, inflammation and skin-aging [15].

## 4. Anti-cancer

Fucoxanthin treatment greatly induces cancer cell DNA fragmentation which results in apoptosis. Fucoxanthin can also enhance the anti-proliferative effect of the PPARgamma ligand, troglitazone, on colon cancer cells, Caco-2, HT-29 and DLD-1 [16].

Fucoxanthin was shown to inhibit chemical carcinogenesis. In a study, all mice were given 0.01 % carcinogen N-ethyl-N'-nitro-N-nitrosoguanidine and then followed by

0.005 % fucoxanthin addition in the drinking water for 4 weeks. In the fucoxanthin-treated group both the percentage of tumor-bearing mice and the average number of tumors per mouse were significantly lower than those of the control group. The results indicate that fucoxanthin inhibited duodenal carcinogenesis induced by N-ethyl-N'-nitro-N-nitro- soguanidine in mice [17].

## Clinical Study of ThinOgen™ on Weight Loss

In a randomized, placebo controlled clinical trial to observe the weight loss effect of ThinOgen™, 19 volunteers (12 males and 7 females) aged between 25 and 50 years old with BMI ranging from 23.0 to 40.0 were divided into three groups: 2 mg/d group, 4 mg/d group and placebo group. The 2 mg/d group was given ThinOgen™ containing 2 mg of pure fucoxanthin per day, while 4 mg/d group was given ThinOgen™ containing 4 mg of pure fucoxanthin per day. The administration lasted for three months and at the end of each month medical examinations including body weight and CT scans of both subcutaneous and visceral fat area were taken. After the administration, the subjects were examined by the end of another month in order to observe the subsequent body weight regain.

After 3 months administration, the subjects in ThinOgen™ dosage groups displayed similar weight loss rate, and with the administration going on, could get more weight loss. For the 4mg/d group, the body weight loss showed significant difference in the first month and second month ($p < 0.05$), and very significant difference in the third month ($p < 0.01$) comparing with placebo group. In the fourth month following the administration, there was no administration of any sample, just observing the body weight regain. It was observed that even stopping the administration of ThinOgen™ for one month, the body weights loss trend still kept continuously (Figure 5). The results showed that ThinOgen™ had slow but stable weight loss effect in administration groups especially for 4 mg/d group showing significant difference comparing with the placebo group. There's no body weight regain one month after the administration stopped, and no abnormal symptom was found in blood test and clinical examination. This study suggests that ThinOgen™ has weight loss effect without body weight regain and free of side effects.

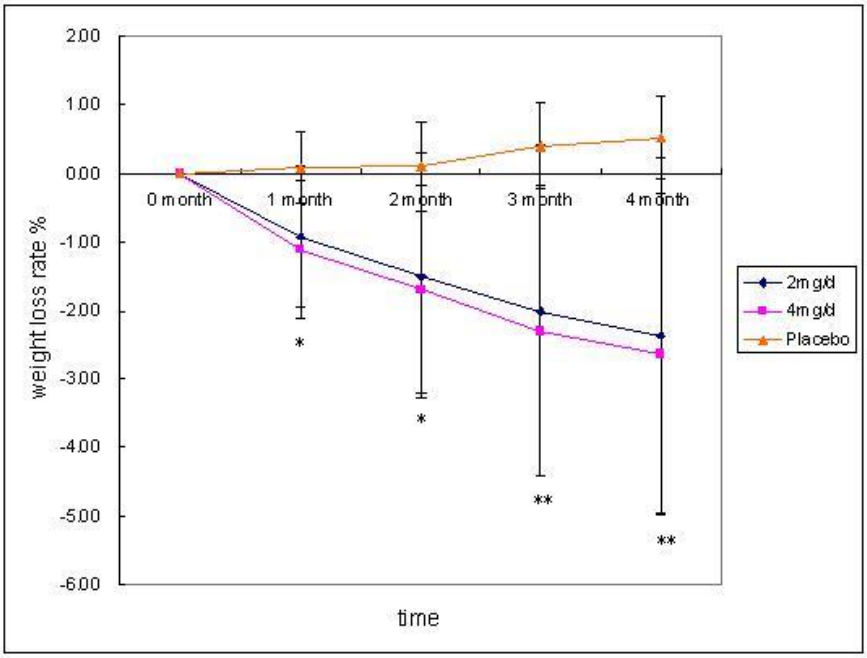


Figure 5. The weight loss effect in different dose groups

## Other Health Benefits of Fucoxanthin

1. Diabetes Prevention

A study of 1,079 participants aged 25 - 84 years (mean 50.6 years) revealed that weight loss was the dominant way to reduce diabetes incidence. For every kilogram of weight loss, there was a 16% reduction in risk [18]. Study has shown that a 7% decrease of fat and heat consumption can result in a 58% reduction in the incidence of diabetes over almost 3 years.

Fucoxanthin can also enhance the amount of docosahexaenoic acid (DHA), an important fatty acid in fish oil, in the liver of obese/type II diabetic mice model. Feeding fucoxanthin to animals demonstrated that fucoxanthin administration can increase liver DHA level, therefore decrease the blood sugar [3] and consequently decrease diabetes risk.

2. Anti-oxidant

Highly unstable and destructive free radicals arise from normal body metabolism and environmental exposure to inflammation, cigarette smoke, air pollutants, radiation and other environmental toxins. Free radicals can attack lipids in cell membranes to destroy

cellular enzymes and even to damage DNA. Free radical attacks do great harm to humans, therefore result in many diseases such as cancer, inflammation and caducity. Prevention of free radical attack is important for human health.

Fucoxanthin is a powerful antioxidant that protects cells from free-radical damage. Reactions between fucoxanthin and a free radical 1,1-diphenyl-2-picrylhydrazyl (DPPH) both under anoxic and aerobic conditions showed that fucoxanthin can efficiently scavenge DPPH [15].

3. Anti-cancer

Fucoxanthin is effective in treating certain types of cancer, particularly cancers of digestive system like liver cancer, duodenum cancer and colon cancer [8, 12, 16-17]. High consumption amount of seaweed derived products may be a contributing factor to well-established low incidence of breast cancer, prostate cancer and obesity in Asian counties as compared to western countries.

Among men in the United States, prostate cancer is the most frequent form of cancer and the second leading cause of cancer death [19]. It has been demonstrated that fucoxanthin reduces the viability of prostate cancer cells by inducing apoptosis to a greater extent than the other carotenoids present in foodstuffs [20].

Moreover, fucoxanthin can also be used as an anti-cancer agent for leukemia [21].

## Safety

Unlike other anti-obesity products, fucoxanthin's thermogenic effect is realized without affecting the central nervous system. There is no loss of sleep or over-stimulation happens. Dietary fucoxanthin supplement does not result in addiction or any side effect.

## Product Superiority

Source superiority: seaweed sources of ThinOgen™ fucoxanthin are from particular sea areas without any pollution.

Technique superiority: With our up-to-date techniques, arsenic content is lower than 4 ppm and total heavy metal is lower than 20 ppm in ThinOgen™ fucoxanthin, which assures the product safety.

Quality superiority: Identification and quantification were done by HPLC to assure the accuracy and authenticity. HPLC excludes the interfering compounds that have similar

UV absorption with fucoxanthin and often used to make adulterated product.

## Dosage

The dosage of 2 – 4 mg pure fucoxanthin per day is suggested.

## Stability

The product is stable at room temperature for 3 years when properly stored. Preserve in tight containers, protected from light. Avoid excessive heat & oxygen.

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