Clinical Study

The efficacy of Fucoxanthin on the prevention of obesity

Carotenoids have been shown to have beneficial health effects such as pro-vitamin A activity, immune response modulation and anti carcinogenic activity. People consuming diets rich in carotenoids from natural foods, such as fruits and vegetables, are healthier and have lower mortality from a number of chronic illnesses. (cite: Functional food science and defence against reactive oxidative species, British Journal of Nutrition 1998, 80, Suppl. 1, S77–S112). Fucoxanthin is a major marine carotenoid found in edible seaweeds such as Undaria pinnatifida, commonly known as Wakame. Fucoxanthin also has anti-carcinogenic effects, apoptotic effects in cancer cells, anti-inflammatory effects and radical scavenging activity.

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As a clinical term, medical obesity occurs when a person's Body Mass Index (BMI) exceeds a measurement of 30 or greater. http://www.nhlbisupport.com/bmi/ BMI is an internationally recognized measure of body fat based upon height and weight. According to the National Institute of Health, obesity is a serious medical condition affecting millions of Americans and people worldwide. Obesity may be the second most important preventable cause of death, exceeded only cigarette smoking. Maeda H., Tsukui T., Sashima T., Hosokawa M., Miyashita K. Seaweed carotenoid, fucoxanthin, as a multi-functional nutrient. Asia Pac J Clin Nutr 2008; 17 (SI): 196-199. Excessive fat accumulation in the body causes obesity and results in an increased risk of many serious diseases, including Type II diabetes, hypertension, coronary heart disease, angina, increased risk of heart attacks and strokes and high blood pressure. http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0004552/

According to reports published by the World Health Organization (WHO), worldwide obesity has more than doubled since 1980 and is now considered the fifth leading risk of death across the globe. WHO further reports that more people worldwide die from being overweight and obesity than from being underweight or malnourishment. WHO estimates that 1.6 billion people in the world can be considered overweight, leading to no less than 2.5 million deaths each year. Adults are not the only ones affected by this problem, children are at risk as well. In 2010, approximately 43 million children under the age of 5 were diagnosed with excessive weight disorders. There is a great likelihood that an overweight child will become obese in adulthood, and this correlates strongly with premature deaths and disabilities later in life. Obese children can also experience breathing difficulties, increased risk of fractures, hypertension and other early markers of cardiovascular disease, insulin resistance and, of course, the deleterious psychological and social effects, in addition to increased future risks. http://www.who.int/mediacentre/factsheets/fs311/en/

The prevalence of reports concerning weight issues is not confined solely to scientific journals. Lay periodicals are also replete with articles and studies concerning this malady. Americans in particular have become extremely health conscious, and indeed obsessed with weight issues. However, a global poll conducted by Reader's Digest shows that these concerns pervade nearly all peoples of various races and cultures. The poll analyzed approximately 16,000 respondents within 16 different countries and found weight loss is a prevalent obsession all over the world. (http://www.rd.com/health/global-poll-a-look-at-weight-around-the-world/) The opinions offered through the survey reveal that aside

from the obvious health risks, an overweight or obese appearance is frowned upon in most cultures and is typically deemed extremely unacceptable.

OBESITY IS PREVENTABLE. Eating a healthier diet and exercising more are crucial when it comes to controlling your weight but it must become a part of your daily routine in order to succeed. In particular, carotenoids have been shown to have beneficial health effects such as pro-vitamin A activity, immune response modulation and anti carcinogenic activity. People consuming diets rich in carotenoids from natural foods, such as fruits and vegetables, are healthier and have lower mortality from a number of chronic illnesses. (cite: Functional food science and defence against reactive oxidative species, British Journal of Nutrition 1998, 80, Suppl. 1, S77–S112). Fucoxanthin is a major marine carotenoid found in edible seaweeds such as Undaria pinnatifida, commonly known as Wakame. Fucoxanthin also has anti-carcinogenic effects, apoptotic effects in cancer cells, anti-inflammatory effects and radical scavenging activity. In a study involving obese mice, fucoxanthin was shown to suppress weight gain of white adipose tissue. So strong was this result that the researcher concluded, ―Because most body fat is stored in white adipose tissue, decreasing white adipose tissue weight by fucoxanthin might be a very effective approach for preventing and/or alleviating obesity.‖ Maeda H, Hosokawa M, Sashima T, Takahashi N, Kawada T, and Miyashita K: Fucoxanthin and its metabolite, fucoxanthinol, suppress adipocyte differentiation in 3T3-L1 cells. International Journal of Molecular Medicine 18: 147-152, 2006.

The Japanese are well recognized to have the longest life expectancies in the world. ―Japanese women and men live longer and healthier than everyone else on Earth," says Naomi Moriyama, co-author of *Japanese Women Don't Get Old or Fat: Secrets of My Mother's Tokyo Kitchen.* One extensive international study, the United Nations World Population Prospects 2006 Revision, listed Japan as first among 194 countries in life expectancy. On the other hand, the United States, even with the best health care in the world, ranked only 34th. Not coincidentally, Japan also has the lowest obesity rate in the urbanized world. Not only can the Japanese expect to live longer but they also live healthier. A native of Japan can anticipate an average of 75 years of healthy living free of disabilities, reports WHO. http://www.webmd.com/diet/features/diets-of-world-japanese-diet

In Japan, breakfast is considered to be the most powerful meal of the day. A typical breakfast menu consists of rice, egg or fish, vegetables, fruit, green tea and miso soup. The salubrious effect of Miso soup has received increased attention in recent years. Traditionally added to Miso soup is the extraordinary seaweed known as Wakame. So revered is this seaweed that the Japanese say, ―Wakame is food and medicine combined‖. It has been consumed by the Japanese as much as ten ousand years ago, long known for its beneficial health qualities.

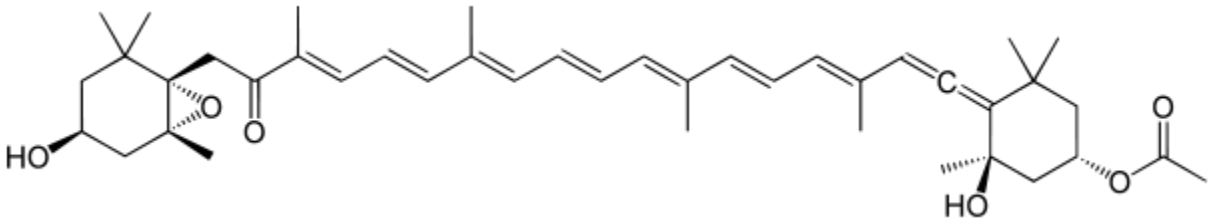
Nutraceuticals International Group®

NUTRITIONAL ANALYSIS OF WAKAME

- **Calcium** **960mg**
- **Potassium** **5,500mg**
- **Iron** **7.0mg**
- **Phosphorus** **400mg**
- **Carbohydrates** **38.0g**
- **Fiber** **2.7g**
- **Minerals** **12.9g**
- **Protein** **15.0g**
- **Water** **13.0g**
- **Lipids** **3.2g**

Wakame seaweed *(Undaria pinnatifida)* is an edible sea vegetable, thought to be one of the first types of marine vegetation appearing on the planet over one *billion* years ago. It is full of naturally occurring benefits such as Vitamin C, Fiber, Beta-Carotene, pantothenic acid and riboflavin—two B Vitamins required for your body to produce energy. It also contains the broadest range of minerals of

any food—the same minerals found in the ocean and in human blood such as potassium, calcium, magnesium, iron, and iodine. Significantly, Wakame seaweed also has the highest concentrations of naturally occurring Fucoxanthin.



Fucoxanthin Caratenoid

Commercially, Wakame seaweed is becoming known for its Fucoxanthin, a pigment in the chloroplasts of the brown seaweed responsible for its distinctive color. Fucoxanthin is thought to be a non-stimulant thermogenic, which means it has no effect on the sympathetic nervous system and can be taken without concerns of cardiovascular exhaustion or blood pressure deregulation. It is also said to initiate the breakdown of fats accumulated by the body's storing of unburned protein. Fucoxanthin extract has been reported to break apart the stored coupled proteins within the fat cell and effectively turn the stored fat back into protein to be used as energy. Fucoxanthin has been shown to increase the expression of UCP1 in white adipose tissue (WAT). WAT is typically stored by adult humans in the abdomen and is the type of fat responsible for excessive weight gain and obesity. Brown Adipose Tissue (BAT), the ―good fat‖, is important for both basal and inducible energy expenditure in the form of thermogenesis mediated by the expression of the tissue-specific mitochondrial uncoupling protein 1 (UCP1). In humans, UCP1 is usually expressed only in BAT and is a key component for metabolic thermogenesis, a process that prevents an excess of fat accumulation. BAT is considered to affect the whole-body metabolism and may modify sensitivity to insulin and induce the body to resist weight gain. However, adult humans have very little BAT and most fat is stored in WAT. Regulation of UCP1 expression in tissues other than BAT is expected to reduce abdominal fat and certainly is of great interest in the weight control industry. Fucoxanthin has been shown to upregulate the expression of UCP1 in WAT, which may contribute to reducing fatty WAT stores and assist in the battle against obesity.

Studies conducted on Fucoxanthin-fed mice at Hokkaido University indicate that Fucoxanthin has the ability to oxidize fat and release energy by adaptive thermogenesis within WAT fat cells. Research showed a reduction of abdominal WAT weights in laboratory animals by feeding Wakame lipids. This research supports the finding that through the introduction of Fucoxanthin, UCP1 protein can be un-coupled and released from WAT. In the Fucoxanthin-fed animals, WAT weight significantly decreased and UCP1 was expressed in the WAT, while there was no difference in WAT and little expression of UCP1 in the glycolipds-fed mice. The result indicates that Fucoxanthin up regulates the expression of UCP1 in WAT, which may contribute to reducing WAT weight and abdominal fats. So promising was this result that the researchers succinctly concluded that diets containing fucoxanthin might prevent obesity. Accordingly, interest in fucoxanthin has increased,

since its activity depends on the protein and gene expressions of UCP1 in WAT. Maeda H., Hosokawa M., Shashima T., Takahashi N., Kawada T., Miyashita K. Fucoxanthin and its metabolite, fucoxanthinol, suppress adipocyte differentiation in 3T3-L1 cells. Intl J Mol Med 18: 147-152, 2006.

In a follow-up study, these same researchers determined that ―[T]he induction of UCP1 in WAT by food constituent would be important and **could become an ideal therapy of obesity."** Maeda H., Tsukui T., Sashima T., Hosokawa M., Miyashita K. Seaweed carotenoid, fucoxanthin, as a multi-functional nutrient. Asia Pac J Clin Nutr 2008; 17 (SI): 196-199. The daily intake of fucoxanthin led to a significant reduction of total body weight. Body weights of laboratory animals fed Wakame lipid was significantly lower than that of controls, **even though there were no significant differences in the mean daily dietary intake between the two groups.** Essentially, the animals consumed the same amount of calories but those fed fucoxanthin did not accumulate excessive WAT. Further, Fucoxanthin intake also correlated significantly with reduced blood glucose and plasma insulin. Feeding fucoxanthin also significantly increased the level of hepatic docosahexaenoic acid (DHA), a most important n-3 functional polyunsaturated fatty acid in biological systems. The authors concluded, ―These multi-functionalities of fucoxanthin indicate that it is an important bioactive carotenoid that should be beneficial for the prevention of the metabolic syndrome.‖ Most pertinently the research confirmed that fucoxanthin is the active component in Wakame lipids that result in the anti-obesity effect. The implication for the weight control industry is clear.

Nutraceuticals International Group® offers a highly concentrated form of fucoxanthin called FucoPure®, which is a 10% extract. Wakame itself contains only 0.01% fucoxanthin, and it also contains iodine and other heavy metals which could be harmful if ingested in large quantities. FucoPure® Fucoxanthin Extract is produced via a patented extraction process which provides a highly concentrated form of fucoxanthin while reducing the amount of heavy metals and iodine without damaging or losing the dietary fibers, minerals, amino acids, vitamins, and most importantly the fucoxanthin content. Most material found on the market is only a 5% - 10% fucoxanthin via UV, while FucoPure® is a 10% HPLC, which tests out to over a 20% via UV.

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