

A photograph of three researchers in a laboratory setting. A man in a dark shirt is pointing at a piece of equipment, while a woman in a striped shirt and glasses and another man in a dark shirt look on. The background shows laboratory equipment and shelves. The image is overlaid with a purple hexagonal pattern and chemical structures.

Assessment of Human Intestinal Uptake of Carotenoid Phytochemicals

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Coronary heart disease is the number one killer of both men and women in the United States, followed closely by cancer. Coupled with high mortality rates of these diseases are the high health-care costs necessary to care for those affected by these conditions. According to the American Heart Association, the estimated total direct and indirect annual economic costs for coronary heart disease is \$99.8 billion. In 2004 alone there were 1.2 million new or recurrent coronary attacks in the United States. While much research is being done to find cures for those who are diagnosed with these diseases, prevention is definitely the best medicine.

One ally in the fight against coronary heart disease is the carotenoid. Carotenoids are a lipophilic or “fat-loving” class of compounds that are commonly found in brightly colored fruits and vegetables. Beta-carotene, lycopene, and lutein are just a few of the carotenoids that have been found to be beneficial to health and prevention of diseases like cancer, heart disease, and macular degeneration. Although these compounds are prevalent in many fruits and vegetables, they must first be ingested and absorbed into the body to exert their beneficial effects.

Most of the fruits and vegetables that contain high levels of the lipophilic carotenoids have low levels of fats, which may decrease their absorption. Therefore, assessing the ability of the body to take in carotenoids when they are consumed with healthy sources of fat is of interest. In order to observe the carotenoid intake, human subjects were fed a high carotenoid food source in addition to avocado, which provided fat in a healthy monounsaturated form. In the first part of the study, salad consisting of lettuce, carrot, and spinach was consumed to provide a source of alpha-carotene; beta-carotene and lutein provided the carotenoid source. Subjects were asked to consume the salad alone and with varying amounts (half and whole fruit) of avocado fruit or equivalent amount of avocado oil. In the second part of the study, tomato-based salsa was consumed as a source of lycopene and beta-carotene with and without the addition of avocado fruit. After subjects from both the salad and salsa groups consumed the meal, blood samples were taken every hour for 9.5 hours and tested for carotenoid content.

OBJECTIVE

To determine whether frequently consumed lipid-rich fruit—such as avocado—can increase carotenoid absorption when consumed together with carotenoid-rich foods and if this increase in carotenoid absorption is comparable to the effect of adding equivalent amounts of fat or oil alone.

ACHIEVEMENTS

In the salsa study, lycopene and beta-carotene absorption increased significantly in subjects who consumed the test meal with avocado. Considerable increases in lutein, alpha-carotene, and beta-carotene absorptions were also observed after the salad with the addition of avocado fruit or avocado oil. When participants consumed salsa, the absorption of lycopene and beta-carotene was 4.5 and 2.5 times higher when consumed with avocado, respectively. Similarly, absorption of alpha-carotene, beta-carotene, and lutein was found to be 8.3, 13.6, and 4.3 times higher when salad was consumed with the addition of half-avocado fruit. Neither the avocado dose nor the lipid source affected carotenoid absorption. Avocado, or more specifically, the fat component of avocado, appears to significantly enhance the absorption of the “fat-loving” carotenoids from salad and salsa.

“The important point to this study is that we now understand that some fat is necessary in the diet to efficiently absorb fat-soluble nutrients such as carotenoids. Since most fruits and vegetables are low in fats, consuming some lipids within salads as dressings or from fat containing fruits like avocados is recommended,” said Dr. Schwartz.

THE FUTURE

With the help of a \$57,000 grant from an industry partner, scientists intend to expand these studies to determine more accurately the amount of fat that is required in the diet to absorb fat-soluble nutrients such as carotenoids. In addition, further studies need to be conducted to understand if various types of lipid (saturated, monounsaturated, or polyunsaturated oils) in the diet have a differential effect on the uptake of fat-soluble nutrients.



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