WHAT ARE THE LONG-TERM HEALTH EFFECTS OF PERSISTENT ORGANIC POLLUTANTS?

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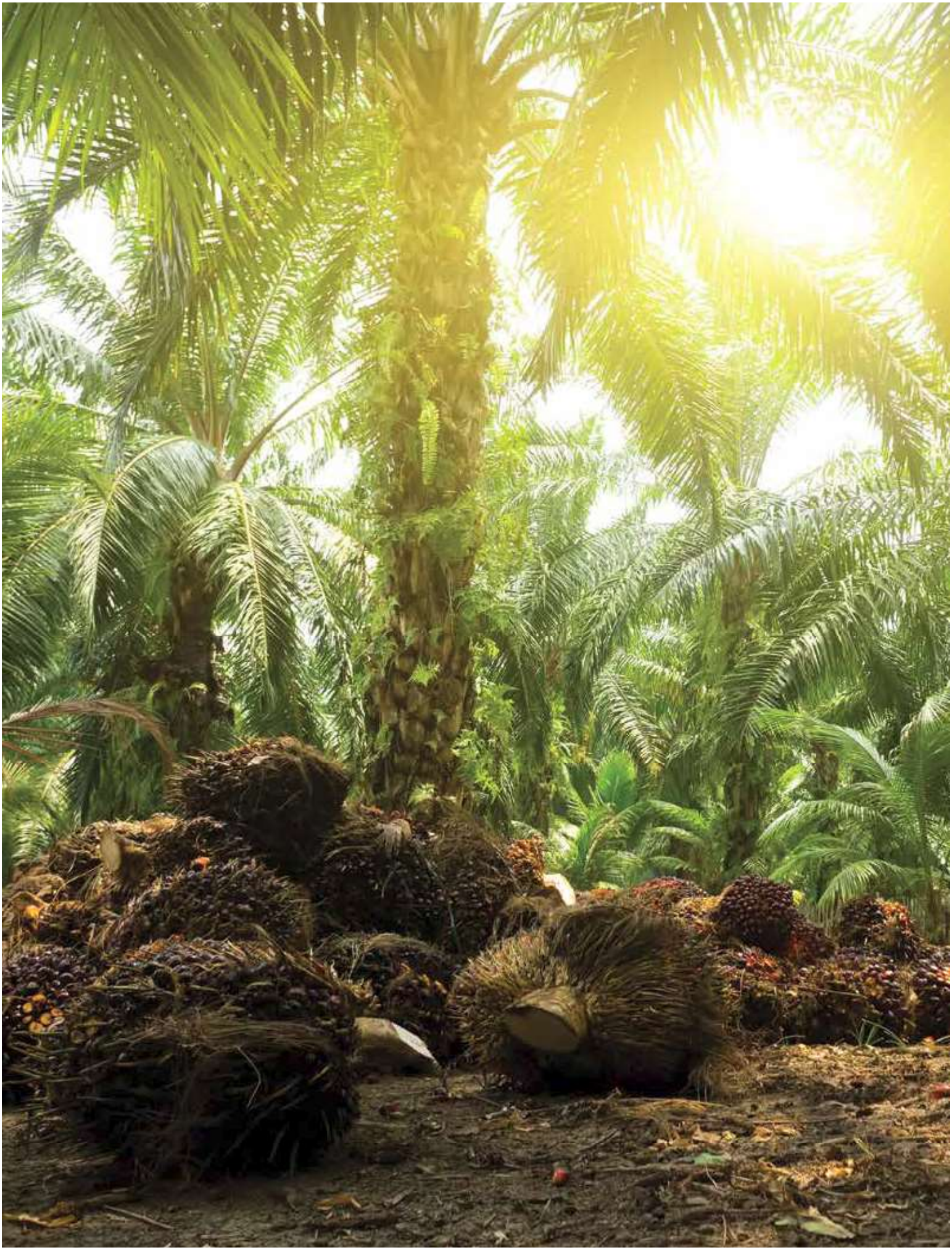

TALKING TOCOTRIENOLS

Why health professionals are taking notice of "the other" VITAMIN E

As a nutritional biochemist, I'm fascinated when research shows that simple dietary changes can have a powerful impact on our health. Lately, there's been substantial interest in a little-known group of vitamin E compounds called tocotrienols.

Tocotrienols are not the type of vitamin E found in your daily multivitamin, and you probably aren't getting enough of them from the food you eat. In recent research, tocotrienols are credited with everything from supporting brain and heart health to potentially preventing cancer.

BY SHAWN TALBOTT, PHD, MS

Understanding the two types of vitamin E

Many people think of vitamin E as single nutrient, but there are actually two forms: tocopherols and tocotrienols. Each form has different health benefits:

TOCOPHEROLS: This is the common form of vitamin E found in multivitamins and stand-alone vitamin supplements. Tocopherols are naturally found in nuts and seeds, which is one reason why they are so easy for us to include in our diets, but most supplement forms of tocopherols are derived from either soybeans (natural) or petroleum by-products (synthetic). Because they are inexpensive to obtain and process, tocopherols were used for most of the early studies showing vitamin E's antioxidant and anti-inflammatory benefits.

TOCOTRIENOLS: Tocotrienols have as many as 40 to 60 times the antioxidant power of tocopherols. Tocotrienols excel at maintaining a healthy brain and heart, as well as protecting cells throughout the body from inflammatory and oxidative damage.

The vitamin E molecule consists of eight isomers; four tocopherols and four tocotrienols, (alpha, beta, gamma, and delta). Tocopherols and tocotrienols both possess potent antioxidant activities, but tocotrienols differ from tocopherols in their chemical structure. Specifically, the tail region of a tocotrienol molecule not only performs an antioxidant function, but also is known to reduce cholesterol levels by downregulating the HMG-CoA reductase enzyme needed for cholesterol production. This downregulation of HMG-CoA reductase has been shown to decrease total and LDL cholesterol levels, and may be one of the pathways responsible for the chemopreventive properties exhibited for tocotrienols.

New discoveries

The excitement about tocotrienols is mounting as scientists around the world turn their attention toward this "other" vitamin E. Because they are potent cell protectors, tocotrienols support numerous body systems.

Palm oil has 20 times more tocotrienols than coconut oil. Red palm oil can be used in virtually any kind of cooking and is readily available in premium and international grocery stores.

Recent mechanistic studies indicate that tocotrienol forms of vitamin E have unique antioxidant and anti-inflammatory properties that are superior to those of alpha-tocopherol against chronic diseases, including antioxidant activities (fighting reactive oxygen and nitrogen species) and anti-inflammatory activity (inhibiting cyclooxygenase- and 5-lipoxygenase-catalyzed eicosanoids and suppression of NF- B and STAT signaling). The antioxidant activities of tocotrienols are mediated through induction of antioxidant enzymes such as superoxide dismutase (SOD) and glutathione peroxidase, which quench damaging free radicals such as superoxide radical. In general, tocotrienols exhibit a wide range of biological activities that are cardioprotective, neuroprotective, and chemopreventative, and thus, have a promising potential to support human health in significant ways.

Cardioprotection (cholesterol and blood pressure)

Tocotrienols have repeatedly been shown to reduce cholesterol levels, whereas alpha-tocopherol ("regular" vitamin E) has no such effects. Animal studies of tocotrienol supplementation show decreases in total and LDL cholesterol levels, while HDL/LDL cholesterol ratios are improved with tocotrienol, but not tocopherol, supplementation. In human studies, supplementation with tocotrienols (75-100 mg per day) reduced total cholesterol levels by 13-22 percent and LDL cholesterol by 9-20 percent within two months. In one of these studies, the LDL/HDL ratio was reduced by 12-21 percent.

In several studies of metabolic syndrome or diabetes patients, tocotrienol has been shown to reduce the symptoms associated with the disease, including hyperglycemia (high blood sugar) and hyperlipidemia (high cholesterol and triglycerides). In patients with type 2 diabetes, tocotrienols were shown to decrease serum total lipids by 23 percent, triglycerides by up to 30 percent, total cholesterol by 30 percent,

and LDL-cholesterol by 42 percent (from 179 mg/dL to 104 mg/dL) within 60 days.

A four-year study on patients with carotid artery arteriosclerosis showed that tocotrienol supplementation caused regression of carotid atherosclerosis. In 88 percent of patients that took the supplement, carotid artery stenosis regressed or stabilized. Another contributor to the high incidence of heart disease is hypertension. Recently, animal studies suggested tocotrienols' capacity to lower blood pressure. When hypertensive rats were treated with tocotrienols for three months, plasma and blood vessel lipid peroxides were reduced, and total antioxidant status was improved. Tocotrienol supplementation was shown to reduce systolic blood pressure significantly, and improved nitric oxide synthase activity (NOS), both of which play a critical role in the pathogenesis of essential hypertension.

Chemoprevention (reduced cancer risk)

Catapulting it further ahead of its tocopherol counterparts, tocotrienols have repeatedly been shown to have anti-tumor benefits, inhibiting proliferation and inducing cell death in cancer cells. Cancer cells are distinguished from healthy cells by several distinct characteristics related to aberrant antioxidant and inflammatory metabolism, including self-sufficiency in growth signal, resistance to growth inhibition, limitless replicative potential, evasion of programmed cell death (apoptosis), sustained angiogenesis, and tissue invasion and metastasis.

The potent anti-cancer effects of tocotrienols are thought to be due in large part to their high antioxidant and anti-inflammatory potency in areas such as regulation of Nrf2 (oxidation) and NF-kB (inflammation), respectively. Cells with the greatest degree of malignancy tend to be the most sensitive to the apoptotic action of tocotrienols (in breast, prostate, cervical, liver, and lung cancers, as well as melanoma, the most deadly form of skin cancer).

Neuroprotection (nervous system protection and stroke prevention)

Based on an ongoing NIH-funded study and in collaboration with the Ohio State University Medical Center, Professor Chandan Sen has published several peer-reviewed papers showing that alpha-tocotrienol is potent in supporting brain function in stroke-related events. Various studies suggest that tocotrienols are generally neuroprotective and act specifically against Parkinson's disease.

Palm oil represents the richest source of alpha-tocotrienol, which possesses unique neuroprotective benefits that are independent of its potent antioxidant capacity. Palm oil-derived alpha-tocotrienol has been shown to attenuate neurodegeneration in a variety of experimental models of neurological dysfunction. In one series of studies, stroke-dependent brain tissue damage was significantly reduced in tocotrienol-supplemented animals compared to controls. Both the neuroprotective as well as hypocholesterolemic properties of tocotrienols suggest a strong basis for nutrition interventions in individuals at high risk for stroke.

Dietary tocotrienols

The amount of alpha-tocopherol in supplements (commonly ~400 IU) exceeds the amount found in the American diet by a factor of 30-40 times (a heart-healthy, plant-based diet should contain approximately 20 percent tocopherols and 80 percent tocotrienols). Tocotrienols can be found in oils and fats (e.g. palm oil or rice bran oil), vegetables and grains (e.g. wheat, barley), fruits (e.g. avocados, blueberries, olives), nuts and seeds (e.g. almonds, coconut, annatto), as well as meat and eggs.

However, most of the vitamin E in our foods—about 70 percent—are tocopherols. Even if you consume vitamin E-rich foods such as nuts, seeds, and leafy greens, you may be missing out on the health benefits of tocotrienols. Vitamin E is found in the oily parts of plants, so cooking oils are often the best source. But there are no tocotrienols in "healthy oils" such as olive, soybean, and safflower. Palm oil has the most, with 20 times more tocotrienols than coconut oil. Red palm oil can be used in virtually any kind of cooking and is readily available in premium and international grocery stores. Palm-derived tocotrienols are also available in supplements, with studies suggesting that daily supplementation of 100-300 mg per day supports brain, heart, and overall health.

Sustainability

As a scientist, I recommend tocotrienols derived from Malaysian palm oil, because this is the type on which the vast majority of tocotrienol research has been conducted. As an environmentalist, I also appreciate that palm oil is a sustainable source of tocotrienols, with more than 400,000 Malaysian family farmers among the certified producers of sustainable palm oil under the Malaysian Sustainable Palm Oil (MSPO) certification standard. MSPO standards include good agricultural practices to ensure that activities are carried out sustainably to play a responsible role in reducing the environmental footprint. For example, deforestation has been outlawed in Malaysia since the 90s and Malaysia is dedicated to conserving more than 50 percent of its total land area as forest. Up to 40 percent of all of the palm fruit agriculture comes through family farms. This speaks to those hardworking farmers who want to nurture their trees and take care of their land, so they can support their families.

Shawn Talbott, PhD, MS, *has educated elite-level athletes in a variety of sports at the United States Olympic Training Centers, and is the author of hundreds of articles and more than a dozen books on nutrition and fitness. // palmoilhealth.org*