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FILE: ▪Beet (*Beta vulgaris*) Juice
▪Blood Pressure
▪Cardiovascular Disorders

HC 030682-361

Date: September 30, 2008

RE: Pilot Study Shows Beet Juice May Effect Blood Pressure and Cardiovascular System

Webb AJ, Patel N, Loukogeorgakis S, et al. Acute blood pressure lowering, vasoprotective, and antiplatelet properties of dietary nitrate via bioconversion to nitrite. *Hypertension*. Mar 2008;51(3):784-790.

Diets rich in fruits and vegetables are associated with reductions in blood pressure and the risk of adverse cardiovascular events. These effects have been attributed to antioxidant vitamins, but large clinical trials have failed to prove that there is a link. Green leafy vegetables provide protection against coronary heart disease and have high levels of inorganic nitrate. In humans, nitrate is converted into nitrite and eventually nitric oxide (NO). Reduced NO bioactivity and endothelial dysfunction are associated with cardiovascular disorders, including high blood pressure, atherosclerosis, and stroke. In addition to providing an alternative source of vasoprotective NO, nitrite causes dose-dependent vasodilation in human subjects. In this open label cross-over study, the authors have examined the effect of dietary nitrate from beet (*Beta vulgaris*) juice on plasma nitrate and nitrite levels, arterial blood pressure, endothelial function, and platelet aggregation. The location of the study is not given.

Healthy subjects (n=14) were randomized to drink either 500 ml of water or beet juice (Planet Organic; Edmonton, Alberta, Canada) containing 2.11–2.79 g/L nitrate and no detectable levels of nitrite. Blood pressure was measured every 15 minutes for 1 hour before and 3 hours following beet juice or water consumption, and blood samples were collected. Dietary nitrate is converted to nitrite by bacteria on the dorsal surface of the tongue and then swallowed. In the acidic medium of the stomach, nitrite is absorbed into the bloodstream or is converted into NO. In order to examine the effect of this system on plasma nitrate and nitrite levels and blood pressure, 6 subjects drank beet juice and spit out all of their saliva for 3 hours following consumption. In addition, the effect of beet juice on endothelial

function was measured by flow-mediated dilation (FMD) during ischemia in the arm in 10 subjects randomized to receive 500 ml beet juice or water.

The beet juice was generally well-tolerated, with red urine and red stools as the most common side effects. The ingestion of beet juice prevented ischemia-induced endothelial dysfunction ($P<0.05$). No changes in plasma nitrate or nitrite levels were observed after water consumption. Plasma nitrate levels rose 16 times higher than baseline levels 30 minutes after beet juice consumption and peaked at 1.5 hours, remaining at this peak level for up to 6 hours after ingestion ($P<0.001$ compared to water). Nitrate levels remained significantly elevated compared to water ($P=0.05$) up to 24 hours later. Plasma nitrite levels rose 2 times higher than baseline levels 30 minutes following beet juice consumption, peaking at 3 hours ($P<0.01$ compared to baseline) and remaining at peak levels for 5 hours following beet juice consumption ($P<0.001$ compared to water). Plasma nitrite levels returned to baseline within 24 hours. Both diastolic and systolic blood pressure decreased 1 hour following beet juice ingestion, when compared to the water control. At 2.5 hours the peak difference in systolic blood pressure between the control and beet juice groups was observed (-10.4 ± 3.0 mmHg, $P<0.01$). At 3 hours the peak difference in diastolic blood pressure between the control and beet juice groups was observed (-8.1 ± 2.1 mmHg, $P<0.001$). The average heart rate was not affected by beet juice consumption. There was a significant inverse relationship between the change in systolic blood pressure from baseline and the change in plasma nitrite levels ($r=-0.26$, $P=0.008$), but not change in plasma nitrate levels. When the subjects spit out their saliva, the rise in plasma nitrite levels, but not plasma nitrate or potassium levels, was significantly blocked at 2.5 hours ($P<0.05$). Spitting out all saliva also prevented the inhibition of platelet aggregation to ADP and collagen that was observed 2.5 hours following beet juice ingestion ($P<0.001$).

The authors conclude that the results demonstrate that ingestion of dietary nitrate from beet juice results in increased levels of plasma nitrite concentration through bioconversion of dietary nitrate to nitrite and NO. This resulted in positive cardiovascular effects in healthy subjects, including decreased blood pressure, inhibition of platelet aggregation, and prevention of endothelial dysfunction. The results also "suggest that dietary nitrate likely plays a major role in mediating the beneficial effects of a vegetable-rich diet." The authors suggest that it is possible that the effects seen in this study could be more dramatic in patients with high blood pressure, and they advocate a diet rich in nitrates as a natural strategy to treat and prevent high blood pressure in those at risk of adverse cardiovascular events.

—Marissa N. Oppel, MS

The American Botanical Council has chosen not to reprint the original article.