

## Dark Chocolate Reduces Blood Pressure for Short Term **CME/CE**

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July 6, 2007 — When it comes to dark chocolate and blood-pressure reduction, it would seem that a little goes a long way. A new randomised controlled study has shown that just one square of dark chocolate a day reduces blood pressure by a few mm Hg in healthy people with above-optimum blood pressure.

**Dr Dirk Taubert** (University Hospital of Cologne, Germany) and colleagues report their findings in the July 4, 2007 issue of the *Journal of the American Medical Association*. Taubert told **heartwire** that this is the first research to show the benefits of cocoa in dark chocolate long-term — the study lasted 18 weeks. They were also able to demonstrate a feasible mechanism for the blood pressure-lowering effects of dark chocolate, he noted.

Hypertension expert **Dr Franz H Messerli** (Columbia University, New York), who was not involved in this research, told **heartwire**: "This is now study 6 showing the same phenomenon. It is an exceedingly well-done, very thorough study, which I think is nothing short of revolutionary."

### Dark Chocolate Increases Production of Nitric Oxide

Taubert et al say that short-term studies have previously shown that high doses of cocoa for two weeks can improve endothelial function and reduce blood pressure, due to the action of cocoa polyphenols. "But the clinical effect of low habitual cocoa intake on blood pressure (BP) and the underlying BP-lowering mechanisms are unclear."

They conducted a randomised, controlled, investigator-blinded, parallel-group trial with 44 adults, aged 56 to 73, with untreated upper-range prehypertension or stage 1 hypertension without concomitant risk factors. The participants were randomly assigned to receive either one square (6.3 grams) of a commercial brand of dark chocolate per day, constituting just 30 kcal, or matching polyphenol-free white chocolate for 18 weeks.

The primary outcome measure was change in BP after 18 weeks. Secondary outcomes included changes in plasma markers of vasodilative nitric oxide (S-nitrosoglutathione) and oxidative stress (8-isoprostane) and bioavailability of cocoa polyphenols.

From baseline to 18 weeks, dark-chocolate intake reduced mean systolic BP by 2.9 mm Hg ( $p < 0.001$ ) and diastolic BP by 1.9 mm Hg ( $p < 0.001$ ) without changes in body weight, lipids, glucose, or 8-isoprostane. Hypertension prevalence decreased from 86% to 68%.

The BP decline was accompanied by a sustained increase of S-nitrosoglutathione by 0.23 nmol/L ( $p < 0.001$ ) and the appearance of cocoa phenols in the plasma. In contrast, white chocolate caused no changes in BP or plasma biomarkers.

"The apparent mechanisms by which dark chocolate lowered BP suggests a chronic increase in the production of nitric oxide in the vascular endothelium," the researchers explain. "It is likely that cocoa flavanols in dark chocolate were responsible for the observed effects on S-nitrosoglutathione and BP."

### Long-Term RCTs With Larger Numbers of Participants Needed

"This study provides enough evidence to suggest that low amounts of polyphenol-rich dark chocolate as an addition to a healthy diet caused progressive reductions of systolic and diastolic BP in older subjects with prehypertension without inducing weight gain or other adverse effects," Taubert said.

However, he says the findings need to be replicated in other populations (their participants were predominantly white, older, and mildly hypertensive) and that the effects of dark chocolate need to be evaluated in long-term randomised controlled studies with larger numbers of participants.

"A few hundred patients would be needed, with a follow-up of at least one year," he says. "However, we are more interested in the mechanism, and we are trying to find out which polyphenol in the cocoa is responsible. When we know the substance, we will go back and test it."

### **Small Changes in BP, but Big Implications**

Messerli says the clinical significance of these apparently small changes in blood pressure is nevertheless extremely important. "When you look at this population-wise, there's no question that this achieves a major reduction in heart attacks and stroke."

But he cautions that people must understand that the chocolate has to be dark. "Regular (milk) or white chocolate has no benefit whatsoever. It is completely useless. I now tell my patients, I will take away your Häagen-Dazs and your crème brûlée, but I give you a little bit of dark chocolate. There are no adverse events, in contrast to many BP-lowering pills, and patients are motivated to enjoy a daily treat."

He also points out that the amount of dark chocolate eaten is key, because people still need to keep within their daily limit of calories. The one square in this study was 6.3 grams and represented only 30 kcal per day, he notes, "but previous studies have shown that 100 grams of dark chocolate lowers BP by 12/8 mm Hg; however, this is somewhat of a Pandora's box."

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### **Clinical Context**

Cocoa is rich in polyphenols, specifically flavanols, which can induce expression of nitric oxide and stimulate improved endothelial function. Therefore, it is logical to expect that dark chocolate rich in flavanols might have a beneficial effect on blood pressure (BP), whereas white chocolate, which does not contain high levels of polyphenols, may not have an effect on BP. In a study of 15 healthy subjects assessed after consuming white or dark chocolate for 7 days, Grassi and colleagues demonstrated a reduction in insulin resistance and as well as a reduction in systolic BP among subjects receiving dark chocolate. However, the study, which was published in the March 2005 issue of *The American Journal of Clinical Nutrition*, failed to demonstrate a benefit of dark chocolate in terms of diastolic BP. This failure may have resulted from underpowering in this small study.

The current study examines whether consumption of dark chocolate can continue to have a salutary effect on BP during a longer treatment period, when its healthy effects might be negated by its high calorie content.

### **Study Highlights**

- Study participants were between the ages of 55 and 75 years and had systolic BPs at baseline ranging between 130 and 160 mm Hg and diastolic BPs ranging between 85 and 100 mm Hg. Subjects were otherwise generally healthy and were not receiving antihypertensive medications.
- After a cocoa-free run-in period of 7 days, participants were randomised to receive either 6.3 grams of commercially available dark chocolate or 5.6 grams of white chocolate per day during the 18-week treatment period. The energy content of both chocolate pieces was 30 kcal per serving. Otherwise, subjects were told to continue their normal patterns of diet and exercise and abstain from any other cocoa-containing foods. Study investigators, but not patients, were blinded with regard to subjects' treatment group assignment.
- The main study outcomes were morning BP values at 6, 12, and 18 weeks. Researchers also measured lipid levels, serum glucose, and concentrations of serum S-nitrosoglutathione, which reflects the vasodilating activity of nitric oxide.
- 24 women and 20 men entered the study. Baseline characteristics were similar between treatment groups. The mean age was 63 years, and the mean systolic and diastolic BPs at baseline were 147 and 86 mm Hg, respectively.

- Adherence to the study protocol was excellent. Diet and exercise diaries indicated no deviation from participants' usual lifestyle patterns. There was no difference in patient weight or levels of serum lipids or glucose during the study period.
  - At 18 weeks, systolic and diastolic BPs declined from baseline levels by -2.9 and -1.9 mm Hg, respectively, while BP values did not change considerably from baseline in the white chocolate group. The difference between treatment groups in BP values was statistically significant. Dark chocolate reduced BP progressively during the trial, with a significant reduction apparent by 12 weeks.
  - 18% of participants receiving dark chocolate had their BP classification change from hypertension to upper-range prehypertension. However, no subjects achieved optimal BP of less than 120/80 mm Hg.
  - Participants with higher BP at baseline derived more benefit from chocolate vs subjects with lower BP.
  - Levels of S-nitrosoglutathione increased progressively during the treatment period in the dark chocolate group, and higher levels of S-nitrosoglutathione correlated with lower BP measurements.
  - Chocolate consumption was not associated with an acute reduction in BP within 8 hours.
  - In a previous study, consumption of dark chocolate in the short term improved insulin resistance and systolic BP vs consumption of white chocolate.
  - The current study demonstrates that habitual consumption of dark chocolate vs white chocolate can reduce BP among patients with prehypertension or mild hypertension during an 18-week treatment period.
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