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File: ■ Cocoa (*Theobroma cacao*, Malvaceae)
■ Cardiovascular Disease
■ Obesity

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RE: Cocoa Consumption Reduces Obesity-related Cellular Disease Factors

McFarlin BK, Venable AS, Henning AL, et al. Natural cocoa consumption: potential to reduce atherogenic factors? *J Nutr Biochem*. June 2015;26(6):626-632.

Short-term consumption of flavanol-rich cocoa (*Theobroma cacao*, Malvaceae) has been reported to improve vascular health through increased flow-mediated dilation, vascular compliance, and high-density lipoprotein cholesterol (HDL-C) levels, and decreased monocyte adhesion molecule expression. These effects are most often attributed to the catechins and polyphenols in cocoa. There is little research on the effect of short-term cocoa consumption to reduce cardiovascular disease (CVD) in individuals with differing body mass indexes (BMIs). The goal of this double-blind, placebo-controlled, crossover study was to determine the effect of 4 weeks of natural cocoa consumption on selected CVD biomarkers in young normal-weight, overweight, or obese women.

Seventy-five women were screened at the University of North Texas in Denton, Texas, and 35 met all the eligibility requirements (eligibility details not provided). Of those, 30 were available during the study's timeline. Eligibility was determined by using a medical history form, a graded exercise test, a whole body dual-energy X-ray absorptiometry, and a basal metabolic rate test. Subjects (ages, 19-25 years) were assigned to groups according to BMI – normal weight (BMI=20.0-24.9 kg/m^2); overweight (BMI=25.0-29.9 kg/m^2); or obese (BMI=30.0-39.9 kg/m^2). No one with a BMI >40 kg/m^2 was accepted into the study. Of the 30 eligible subjects, 24 completed all study requirements; 10 in the normal-weight group, 7 in the overweight group, and 7 in the obese group. Reasons for dropping out were not provided.

At baseline, obese subjects had greater body weight, BMI, fat percentage, fat mass, lean mass, and basal metabolic rate, and lower fitness levels than the overweight and normal-weight subjects. Overall, the fitness level of all subjects was low, with no reported regular physical activity.

The study's cocoa bar (12.7 g natural cocoa, 148 kcal per serving) and isocaloric cocoa-free placebo bar, both manufactured and provided by The Hershey Company (Hershey, Pennsylvania), did not differ in macronutrient composition but did differ in magnesium,

potassium, and catechins consistent with natural cocoa content. The polyphenol content of the cocoa bar included, among others, 13.6 mg catechin, 48.0 mg epicatechin, 640.0 mg total proanthocyanidins, and 309.6 mg proanthocyanidins 1-10. The placebo bar had no polyphenol content. Subjects were instructed to consume 1 bar daily for 4 weeks at the same time each day. After a 2-week washout period, they consumed the alternative bar for 4 weeks. Subjects were asked to refrain from consuming any other forms of cocoa during the study.

Fasting blood samples were drawn before and after each 4-week study phase to measure lipid levels, glucose, CVD risk biomarkers, monocytes (to determine relative concentration and expression of cell-surface adhesion molecules), and endothelial microparticle (EMP) concentrations. Elevated levels of certain biomarkers, including haptoglobin and endocan-1 or endothelial cell specific molecule-1, are associated with vascular inflammation in sedentary individuals and are elevated in patients with coronary artery disease. EMPs have been reported to reflect vascular damage and are used as an index of endothelial wall damage. An increase in monocyte expression of CD62L has been linked to increased atherogenesis.

At baseline, significantly higher levels of haptoglobin ($P<0.0001$) and EMP concentrations ($P=0.034$) were seen in obese subjects compared with overweight and normal-weight subjects. Following cocoa consumption, haptoglobin significantly decreased by 18% in the obese group, compared with no change in either of the other 2 groups ($P=0.034$). EMP concentrations decreased significantly after cocoa consumption in obese and overweight subjects but not in normal-weight subjects ($P=0.017$). EMP concentrations, which were 48% higher in obese subjects at baseline compared to normal-weight subjects, were reduced to a 4% difference after cocoa consumption.

Examining the expression of cell-surface adhesion molecules, the authors report that CD62L expression on the total monocyte population was significantly greater in obese than in overweight and normal-weight subjects at baseline ($P=0.032$). After cocoa consumption, total monocyte CD62L expression significantly decreased in obese subjects, did not change in overweight subjects, and significantly increased by 12% in normal-weight subjects ($P=0.047$). Baseline CD62L expression on proinflammatory monocytes was significantly greater in obese compared with overweight and normal-weight subjects ($P=0.030$). After cocoa consumption, proinflammatory monocyte CD62L expression decreased significantly in obese subjects and increased significantly in overweight and normal-weight subjects ($P=0.049$).

Only HDL-C and endocan-1 had no baseline differences among the 3 groups, and the natural cocoa effect was not specific to a certain BMI group. HDL-C significantly increased by 18% after cocoa consumption compared with placebo ($P=0.02$). Following cocoa consumption, endocan-1 tended to decrease more (−13%) compared to only a minor decrease with placebo (−1%). Total cholesterol, triglycerides, and glucose levels did not significantly change following either cocoa or placebo consumption.

The authors conclude that, to their knowledge, this "is the first published study to report that short-term natural cocoa consumption was associated with alterations in disease risk biomarkers, EMPs and monocyte adhesion molecules." The exact mechanism underlying the observed effects is still unknown and further research is needed. While this study was limited by a small sample size, the authors state that the findings support that small lifestyle changes, such as consuming natural cocoa daily, can potentially

affect cellular disease factors, including some CVD markers, and can play a part in long-term weight-loss intervention. This study was funded in part by a grant from The Hershey Company to the University of North Texas.

—*Shari Henson*

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