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**File: ■ Cocoa (*Theobroma cacao*)
■ Chronic Fatigue Syndrome**

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RE: Polyphenol-rich Chocolate Improves Chronic Fatigue Syndrome Symptoms

Sathyapalan T, Beckett S, Rigby AS, Mellor DD, Atkin SL. High cocoa polyphenol rich chocolate may reduce the burden of the symptoms in chronic fatigue syndrome. *Nutr J.* 2010;9:55. doi: 10.1186/1475-2891-9-55.

The debilitating chronic fatigue syndrome (CFS) is associated with high morbidity and reduced quality of life. Therapies include antidepressants, cognitive behavior therapy, and graded exercise therapy, which offer varying results. An imbalance of various neurotransmitters, including serotonin, has been reported in subjects with CFS. Chocolate (made in part from the seeds of *Theobroma cacao*) is known to increase certain neurotransmitters in the brain. The effects of cocoa in subjects with CFS, however, have not been studied. These authors hypothesized that chocolate might reduce the burden of CFS symptoms by modulating neurotransmitters. They conducted a double-blind, randomized, clinical pilot crossover study to compare the effects of high-cocoa liquor/polyphenol-rich chocolate with those of simulated iso-calorific chocolate (cocoa liquor-free and low polyphenol) on fatigue and residual function in subjects with CFS.

Ten subjects (6 females and 4 males) with CFS were recruited from a secondary care setting in the United Kingdom for this study. Their mean age was 52 ± 8 years; mean body mass index was 28.3 ± 2 kg/m². Criteria from the Centres for Disease Control and Prevention (UK) were used to diagnose CFS. Subjects with severe fatigue of at least 10 out of 11 on the Chalder Fatigue Scale were enrolled. Exclusion criteria included any co-morbid psychiatric disorders, consumption of >10 g of chocolate per day, or use of any prescription or herbal medicines.

The authors used block randomization to assign the subjects to study groups. The subjects had 8 weeks of the initial intervention and then 8 weeks of the crossover intervention, separated by a 2-week washout period. Fatigue severity was analyzed by using validated self-report questionnaires before and after each trial phase.

The active product (chocolate bar) was polyphenol-rich chocolate containing 85% cocoa solids (derived from a high-cocoa liquor content). The cocoa liquor-free control product (chocolate bar) was simulated iso-calorific chocolate containing cocoa butter alone with

no nonfat cocoa solids (cocoa liquor). Both products came from Nestle PLC, York, UK. The subjects were asked to consume one 15-g chocolate bar 3 times daily.

The authors report that Chalder Fatigue Scale scores improved significantly after 8 weeks of the active chocolate phase, while scores deteriorated significantly when the subjects consumed the cocoa liquor-free control chocolate product. The residual function, assessed by the London Handicap Scale, also improved significantly during the active phase and deteriorated during the control phase. A similar trend was also found in scores on the Hospital Anxiety and Depression Scale.

The mean weight of the subjects was unchanged before and after both phases. A potential weight gain may have been offset by improved functional status and physical activity when the subjects were consuming the high-cocoa liquor/polyphenol-rich chocolate. This would not explain, however, why the weight was unchanged in the control group.

Increasing evidence suggests that oxidative stress contributes to CFS. Flavonoids have been shown to have a protective effect on cells, including neuronal cells, from oxidative stress; however, say the authors, this mechanism needs to be further explored.

Another possibility the authors discuss is that compounds called anandomides, which have structural similarity to tetrahydrocannabinol, and other related compounds in cocoa may act synergistically to produce the results seen in the study.

Results of this study show that consuming high-cocoa liquor/polyphenol-rich chocolate 15 g/3 times daily for 8 weeks was beneficial in improving fatigue and residual function in subjects with CFS compared with the consumption of simulated iso-calorific low polyphenol chocolate. As both types of chocolate were iso-calorific and had similar glycemic indices and loads, the improvement was likely due to the high polyphenol content in the active chocolate, rather than a difference in the micro- or macro-nutrient composition of the two chocolates, say the authors. They also noted that the positive results are surprising given the small number of subjects, and that larger studies are necessary to confirm their findings.

—*Shari Henson*

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