

Stevia: The controversial sweetener

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In 2005, the average American consumed 2-3 pounds of added sugar per week or approximately 5,600 calories per week from added sugar (Bilton, 2013). The demand for non-caloric sweeteners (NCS, or non-nutritive sweeteners NNS) has increased over the last two decades in order to both satisfy sweetness cravings and attenuate the deleterious effects of sugar. "Stevia" (stevioside or rebaudioside A, highly purified compounds from the leaf) powder seemed to be the plant-based, natural "magic bullet"— non-caloric, good mouth-feel, 200-300 times sweeter than sucrose, robust in cooking, health benefits, nonmutagenic, and noncarcinogenic (Arora et al., 2010; Boileau et al., 2012; Christaki, Bonos, Giannenas, Karatzia, & Florou-Paneri, 2013; Lemus-Mondaca et al., 2012). However, the long-term effects of stevia/NCS may be not be beneficial to the war on obesity: stevia/NCS contributes to an evolutionary deregulation in the human mind-body connection to energy requirements; using stevia/NCS in lieu of caloric sweeteners is only a superficial aid to the much larger behavioral/cognitive problems of a sweetener-driven society and obesity epidemic; the safety of stevia/NCS formulations is difficult to regulate. Furthermore, researchers have not been able to definitively form an association between the use of NCS and weight loss (Hill, Prokosch, Morin, & Rodeheffer, 2014).

From an evolutionary standpoint, sweet-tasting foods generally equated with higher-energy, calorically-denser foods (Hill et al., 2014). Sweetness used to be a generally reliable orosensory meter for energy availability in human development (Hill et al., 2014). With stevia/NCS, the sweetness is satisfied without the caloric/energy content that the body is also anticipating thereby causing a disrupted/disordered relationship between "sweetness" and energy (Hill et al., 2014; Horowitz, 2013). This disordered relationship could reinforce poor nutrition choices without any of the natural consequences (e.g. weight gain, caloric intake); society is

conditioned to prefer additional sweeteners (Hill et al., 2014; Horowitz, 2013). NCS causes a de-regulation in the body's natural food regulation/response and weight management instincts (Hill et al., 2014). NCS alters the psychology of food regulation and neural pathways as the brain's reward center is activated differently using NCS as opposed to sugar (Hill et al., 2014; Horowitz, 2013). Hill et al. (2014) found that subjects who consumed NCS were more likely to be preoccupied and have a preference for sweeter, higher-calorie foods; they would choose a sweet, higher-calorie food over a less sweet option; and NCS consumers were less satisfied after eating a sugar-sweetened snack as opposed to non-NCS consumers (Horowitz, 2013). NCS confuses the brain's ability to process sweet-tastes which also leads to impaired processing of satiety (Horowitz, 2013). While stevia/NCS may help reduce caloric intake in the short-term, the longitudinal concern is the de-regulation of the body's instinctive ability to manage food/energy intake. The over-consumption of sugar and sweetened foods/beverages and the rise of obesity is more complicated than mere caloric reduction.

Ten to twenty percent of people develop addiction-like symptoms towards hyperpalatable foods (e.g. sweet-tasting, high fat); this is the same percentage of cocaine/heroin users developing a drug addiction (Ahmed, Guillem, & Vandaele, 2013; Bilton, 2013). The use of stevia/NCS products is a temporary solution to much greater long-term problems of a sugar-conditioned society and obesity epidemic. Avoiding the consequences of sugar/sweeteners is not really solving the neuro-behavioral problems of "sugar-conditioning". New research studies support the sugar-drug-addiction analogy: sweetness/sugar induce reward/craving on the same magnitude as some drugs in humans; sugar/sweet reward is more robust/persistent than cocaine for animals; sugar/sweetness has a psychological/behavioral component similar to substance abuse in people; sugar and NCS activate the brain's neural network differently as demonstrated

in functional magnetic resonance imaging (fMRI) (Ahmed et al, 2013; Bilton, 2013; Gearhardt, Roberts, & Ashe, 2013; Horowitz, 2013). Studies have found that people select sweet foods for comfort, stress relief, mood enhancement, alleviate depression, and a host of other behavioral reasons similar to why people smoke or drink alcohol—the mental/emotional "need" (Ahmed et al., 2013; Bilton, 2013). Food/nutrition re-patterning to curb the sweetness overconsumption requires behavioral treatment. In order to make life-long healthful changes and choices, it is beneficial to use Prochaska and DiClemente's Transtheoretical Model (TTM)—particularly the Stages of Change (SOC) at the heart of TTM (Wright et al., 2015). TTM is the same model used to successfully help clients increase physical activity and stop smoking/alcoholism. Many people understand what balanced nutrition is, but lack the understanding in what motivates them to make poor choices. Stevia/NCS are like "patches" that address "cessation", but fail to address the psychology of the behavior. Another longitudinal consideration is the safety and regulation of stevia/NCS.

The 1994 Dietary Supplement Health Education Act (DSHEA) was created to facilitate access to herbal/botanical (HB) supplements (Abdel-Rahman et al., 2011). The U.S. Food and Drug Administration (FDA) and the FDA's Center for Food Safety and Applied Nutrition (CFSAN) regulate herbals and botanicals (as food additives/ingredients) in accordance with the Federal Food Drug and Cosmetic Act (FD&C Act) (Abdel-Rahman et al., 2011). Depending on the usage-intent, stevia may fall under DSHEA and/or FDA jurisdiction; stevia may be both approved by one regulatory body and disapproved by the other (Abdel-Rahman et al., 2011). Additionally, the FD&C Act permits substances as "food ingredients" if GRAS status (Generally Recognized As Safe) is granted through either scientific proof or if the substance is "historically safe" (prior to 1958) (Abdel-Rahman et al., 2011). GRAS status is a loophole that does not

require FDA/DSHEA determination (Abdel-Rahman et al., 2011). HB are risky as their purity/interactions with other substances/metabolism are typically not extensively studied. Crude stevia leaves, *S. rebaudiana* (stevia plant) whole-leaf extracts or other low-purity products from the stevia plant are considered dangerous (Abdel-Rahman et al., 2011). Only rebaudioside A and stevioside (highly purified extracts) have achieved GRAS (Abdel-Rahman et al., 2011).

Stevia/NCS should be used with caution: they potentially cause deregulation in the mind-body relationship to food and energy needs; they do not solve the behavioral/cognitive problems of a sweetener-driven society and obesity epidemic; and their safety is difficult to regulate. There really is no substitute for balance not only in nutrition, but in all aspects of life.

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