

**Examining Popular Detox Diets — Learn About Their Efficacy and Safety for Weight Loss, Their Components, and Potential Adverse Effects**  
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Detox diets have been particularly popular with consumers since the 1976 publication of ***The Master Cleanser***.<sup>1</sup> Through television shows, websites, and books, celebrity fans of detox diets have convinced consumers that the regimens are safe and effective for both weight loss and the release of toxins. Beyoncé, for example, announced on ***The Oprah Winfrey Show*** that she lost 20 lbs for her role in ***Dreamgirls*** by following the Master Cleanse diet.<sup>2</sup> Mehmet Oz, MD, promotes a three-day detox diet to “eliminate harmful toxins and reset your body,” claiming that “all you need is three days, a blender, and \$16 a day!”<sup>3</sup> Gwyneth Paltrow’s seven-day detox diet, according to her website [Goop.com](http://Goop.com), prohibits alcohol, caffeine, added sugar, gluten, dairy, soy, corn, and nightshade plants (eg, potatoes, tomatoes, and eggplant). The website also provides recipes for specific low-calorie meals and snacks, mostly soups and smoothies. She advises her readers to drink hot lemon water every morning and consider spa treatments such as infrared saunas and colonics.<sup>4</sup>

In addition, recent books such as ***The 10-Day Green Smoothie Cleanse*** by JJ Smith have reinvigorated interest in detox diets. It’s the most popular detox diet book for weight loss and has frequented ***The New York Times*** Food and Fitness Best Seller list since its release in July 2014.<sup>5</sup> It’s been reviewed more than 7,100 times on Amazon, and its Facebook page has more than 54,000 likes.

Despite the popularity of detox diets, there’s little scientific evidence that they actually remove toxins, improve health, or induce permanent weight loss.

This continuing education course explores whether there’s scientific evidence for the efficacy and safety of detox diets for weight loss, examines the components of popular detox diets, and discusses potential adverse effects.

### **Chemical Toxins**

The Centers for Disease Control and Prevention (CDC) defines a toxic agent as a “chemical or physical (eg, radiation, heat, cold, and microwaves) agent that, under certain circumstances of exposure, can cause harmful effects to living organisms.”<sup>6</sup> Health effects from exposure to toxic substances can vary depending on the timing of the exposure in the life cycle as well as the duration and dose of the exposure.

The National Toxicology Program (NTP) was established in 1978 to coordinate toxicology research and testing across the agencies of the Department of Health and Human Services.

NTP conducts studies on rodent models and in vitro cell lines to evaluate toxicology, carcinogenicity, and the effects of chemicals on reproduction, genetics, and immune function. Of the 80,000 chemicals registered by the NTP for use in food, personal care products, household cleaners, and lawn care products, few have been rigorously tested for potential risks to humans.<sup>7</sup> Many people who advocate for detox diets, such as Mark Hyman, MD, author of *The Blood Sugar Solution 10-Day Detox Diet: Activate Your Body's Natural Ability to Burn Fat and Lose Weight Fast*,<sup>8</sup> use this information as evidence that people need detox diets to protect themselves from the unknown effects of these chemicals.

Several US government agencies monitor the health effects of toxic substances. The Department of Health and Human Services' Agency for Toxic Substances and Disease Registry (ATSDR) monitors the health risks associated with exposure to hazardous substances. There are 275 chemicals on its most recent Substance Priority List ranked in order of their potential to cause harm due to frequency of human exposure and toxic potential.<sup>9</sup> The ATSDR website also has a toxic substance portal that describes characteristics, exposure risks, health effects, and results of health studies and assessments for close to 200 toxic substances. See Table 1 for ATSDR categories of environmental toxins and examples of substances in each category.<sup>10</sup>

**TABLE 1**  
**Agency for Toxic Substances and Disease Registry: Environmental Toxins<sup>10</sup>**

CLASSIFICATION	EXAMPLES
Benzidines/aromatic amines	Atrazine, benzidine
Dioxins, furans, polychlorinated biphenyls	Polybrominated biphenyls
Halogenated pesticides	DEET*
Hydrocarbons	Benzene, jet fuels, toluene
Inorganic substances	Arsenic, cadmium, lead
Metals/elements	Chlorine, fluoride
Nitrosamines/ethers/alcohols	2,3-Benzofuran, chlorophenols
Organophosphates and carbamates	Chlorfenvinphos, chlorpyrifos
Pesticides	DDT, DDE, DDD, atrazine
Phenols/phenoxy acids	Chlorophenols, cresols
Phthalates	Di(2-ethylhexyl)phthalate (DEHP)
Radionuclides (radioactive materials)	Cesium, cobalt, radon
Volatile organic compounds	Acetone, acrolein, benzene
Warfare and terrorism agents	Phosphine, sulfur mustard

\* N,N-diethyl-meta-toluamide

The ATSDR website also provides results from research on organ systems that are negatively affected by environmental toxins, offering detailed information about the level of significance of exposure. Table 2 summarizes the information available on this website.<sup>11</sup>

**TABLE 2**  
**Agency for Toxic Substances and Disease Registry:  
 Organ Systems Negatively Affected by Environmental  
 Toxins and Examples of Toxins Involved<sup>11</sup>**

SYSTEM	TOXINS INVOLVED
Cardiovascular	Acrolein, cadmium
Dermal	Arsenic, dichlorobenzenes
Developmental*	Atrazine, vinyl chloride, DDT
Endocrine	Aldrin, DDT, polychlorinated biphenyls
Gastrointestinal	Formaldehyde, pyrethroids
Hematological	Napthalene, 1,2-dichloroethene
Hepatic	Hydrazines, hexachlorobenzene
Immunological	Chlorodibenzofurans, PAHs**
Musculoskeletal	Aluminum, hydrogen fluoride
Neurological	Acetone, DEET***
Ocular	Styrene, ammonia
Renal	Petroleum hydrocarbons, ethylene glycol
Reproductive	Acrylamide, CDDs****
Respiratory	Asbestos, hydrazines

\* From fertilization through sexual maturity  
 \*\* Polycyclic aromatic hydrocarbons  
 \*\*\* N,N-diethyl-meta-toluamide  
 \*\*\*\* Chlorinated dibenzo-p-dioxins

The Environmental Protection Agency (EPA) was established in 1970 by executive order of President Nixon to enforce federal laws and set standards for toxic substances in the environment. The Office of Research and Development within the EPA conducts research on the health effects of toxic exposures.

The Stockholm Convention, an international treaty established in 2004 with the mission to reduce persistent organic pollutants (POPs) worldwide, focuses its efforts on the “dirty dozen” POPs that are highly toxic to humans and the environment. These are the following: aldrin, chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans.<sup>12</sup> These toxic substances are found in many products such as food, clothing, soaps and detergents, building materials, fertilizers, pesticides, and food packaging. The Stockholm Convention, through its international efforts, seeks to remove and replace these substances with safer alternatives.

Many detox diets claim to remove endocrine disruptors and obesogens from the body. Endocrine disruptors are chemicals that interfere with the body’s endocrine system and cause adverse developmental, reproductive, neurological, and immune effects especially during the prenatal and early postnatal periods. PCBs, DDT and other pesticides, and plasticizers such as bisphenol A are examples of endocrine disruptors. These chemicals can be found in many products including plastic bottles, metal food cans, detergents, flame retardants, food, toys, cosmetics, and pesticides.<sup>13</sup> Obesogens are chemicals that can promote weight gain and are also thought to be most harmful during prenatal and early life periods. Animal and human studies have identified many suspected chemical obesogens, including nicotine, fructose, genistein, monosodium glutamate, and pharmaceuticals like estradiol.<sup>14</sup>

In March 2015, the National Academies of Sciences, Engineering, and Medicine held a workshop, “The Interplay Between Environmental Chemical Exposures and Obesity,” to explore the role chemical exposures play in the development of obesity.<sup>15</sup> The 173-page report of this workshop provides a wealth of information on the current research findings related to POPs, endocrine disruptors and nutrients, antibiotics, and additives on obesity as well as thorough discussions of research gaps and public policy solutions.

The CDC also studies and monitors toxic exposures in the population, publishing the ***Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables, February 2015***. This report includes biomonitoring data from National Health and Nutrition Examination Survey (NHANES) on direct measurements of people’s exposure to toxic substances as measured by blood, urine, and tissue analyses. Acrylamides, cotinine, trihalomethanes, bisphenol A, phthalates, chlorinated pesticides, triclosan, organophosphate pesticides, pyrethroids, heavy metals, aromatic hydrocarbons, polybrominated diphenyl ethers, benzophenone from sunblock, perfluorocarbons from nonstick coatings, and many polychlorinated biphenyls and solvents were found in most of the samples tested.<sup>16</sup>

While it’s true that many chemicals in use aren’t adequately tested, the message that our bodies are loaded with toxins may be a good marketing tool for detox diet book authors, but it’s not good science. One of the conclusions of “The Interplay Between Environmental Chemical Exposures and Obesity” was that more research is clearly needed to determine whether toxins can be removed from the body through dietary manipulation.<sup>15</sup>

## What Is Detoxification?

Detoxification can be defined as the process of removing toxic substances from a living organism or environment and also as a medical treatment for alcoholism or drug addiction. Methods for removing toxins include chelation therapy, colon hydrotherapy, dietary supplements, special diets, and liquid fasts. People typically think of detox diets when they think of detoxification. Most of these “diets” are regimens that include a special diet along with the use of colon hydrotherapy and dietary supplements. There are no clinical guidelines or definitions for the components of a detoxification diet in either the mainstream medical literature or the complementary and integrative literature.

Chelation therapy is an established therapy for removing iron, lead, mercury, cadmium, zinc, and other metals from humans. Chelating agents such as ethylenediaminetetraacetic acid or dimercaptosuccinic acid are infused into a vein and bind with the heavy metals to remove them from the body. The FDA has approved this therapy only for heavy metal poisoning. In response to a dramatic increase in over-the-counter chelation products promoted by dietary supplement manufacturers, the FDA issued letters to eight companies in 2010 warning that the claims they were making for their products were in violation of federal law. These claims included that the oral chelation products could treat a range of diseases such as autism spectrum disorder, cardiovascular diseases, Parkinson’s disease, and Alzheimer’s disease by removing toxic metals from the body.

Colon hydrotherapy, also known as colonic irrigation, is the infusion of a large amount (up to 16 gallons) of warm water into the colon through the rectum. Herbs and coffee are sometimes added to the water. Advocates for combining this therapy with detox diets claim that the cleanses are needed to remove undigested food and toxins from the colon.

Dietary supplements also are included in most popular detox regimens. Multiple supplements often are recommended to remove toxins and boost immune function. These include digestive enzymes, probiotics, alpha-lipoic acid, green tea catechins, cinnamon, *Spirulina platensis*, nori, *Chlorella pyrenoidosa*, and special organ “cleanser” supplements such as “liver cleanses.”

Other therapies commonly recommended in detox diet plans for removing toxins from the body include infrared sauna, body brushing, and foot detox baths. Table 3 provides explanations of these therapies.<sup>17-25</sup>

TABLE 3

## Additional Therapies Frequently Recommended in Popular Detox Diets

THERAPY	PURPORTED BENEFIT IN DETOX REGIMENS	IS THERE EVIDENCE OF SAFETY?	IS THERE EVIDENCE OF TOXIN REMOVAL?	MORE INFORMATION
Colon hydrotherapy	Removes undigested materials from the colon	There is evidence of harm <sup>16-18</sup>	No evidence	<a href="http://www.mayoclinic.org/healthy-lifestyle/consumer-health/expert-answers/colon-cleansing/faq-20058435">www.mayoclinic.org/healthy-lifestyle/consumer-health/expert-answers/colon-cleansing/faq-20058435</a>
Spirulina oral supplements	Recovery from arsenic poisoning, protection from free radicals	Possibly safe but potential for contamination with microbes <sup>19</sup>	Yes, in cell cultures <sup>20</sup> Possibly useful in treatment of chronic arsenic poisoning <sup>21</sup>	<a href="http://www.webmd.com/vitamins-supplements/ingredientmono-923-spirulina%20(blue-green%20algae).aspx?activeingredientid=923&amp;activeingredientname=spirulina%20(blue-green%20algae)">www.webmd.com/vitamins-supplements/ingredientmono-923-spirulina%20(blue-green%20algae).aspx?activeingredientid=923&amp;activeingredientname=spirulina%20(blue-green%20algae)</a>
Nori supplements	Prevent dioxin absorption	No evidence	Yes, in rats <sup>22</sup> but may contain arsenic <sup>19</sup>	<a href="http://www.sciencedaily.com/releases/2013/01/130110094417.htm">www.sciencedaily.com/releases/2013/01/130110094417.htm</a>
Chlorella supplements	Protect against lead and mercury poisoning	Possibly safe when used orally for up to two months <sup>19</sup>	Yes, in mice <sup>23</sup>	<a href="http://www.webmd.com/vitamins-supplements/ingredientmono-907-chlorella.aspx?activeingredientid=907&amp;activeingredientname=chlorella">www.webmd.com/vitamins-supplements/ingredientmono-907-chlorella.aspx?activeingredientid=907&amp;activeingredientname=chlorella</a>
Liver cleanse supplements	Remove toxins that are stored in the liver; contain multiple ingredients but all include milk thistle	Milk thistle is likely safe <sup>19</sup> but interacts with many medications	No evidence <sup>19</sup>	<a href="http://www.berkeleywellness.com/supplements/herbal-supplements/article/beware-liver-supplements">www.berkeleywellness.com/supplements/herbal-supplements/article/beware-liver-supplements</a>
Infrared sauna	Eliminates toxins such as lead, mercury, and nickel	Yes, in animal models <sup>24</sup>	No, although there's the potential for health benefits <sup>24</sup>	<a href="http://www.mayoclinic.org/healthy-lifestyle/consumer-health/expert-answers/infrared-sauna/faq-20057954">www.mayoclinic.org/healthy-lifestyle/consumer-health/expert-answers/infrared-sauna/faq-20057954</a>
Body brushing (also known as dry brushing)	Stimulates the lymphatic system to reduce waste, bacteria, and dead cells	No evidence	No evidence	<a href="http://www.nytimes.com/2010/12/16/fashion/16Skin.html?_r=0">www.nytimes.com/2010/12/16/fashion/16Skin.html?_r=0</a>
Foot detox bath	Removes toxins from the body	No evidence	No evidence	<a href="http://insideedition.com/investigative/3347-inside-edition-detox-foot-baths">http://insideedition.com/investigative/3347-inside-edition-detox-foot-baths</a>

### Popular Detox Diets for Weight Loss

While there's scant evidence that detox treatments are effective in eliminating toxic substances, they're promoted heavily for weight loss, ridding the body of waste and toxins, enhancing beauty, and decreasing the effects of aging. There's wide variation in the components of a detox program from one diet to another. Some allow only liquids and no solid food, while others allow certain foods but require dietary supplements and colon cleansing. Criteria for evaluating detox diets are shown in Table 4.

TABLE 4

## Suggested Criteria for Evaluating Popular Detox Diets

Author	What are his or her credentials, training, professional history, potential conflicts of interest?
Cost	What is the price of the book or diet, membership, follow-up, supplies, etc?
Food	Are special foods eliminated or required? Are all food groups present in adequate amounts? Is there variety?
Dietary supplements	Which are required? Are they safe and efficacious?
Weight loss	Is the rate of weight loss realistic and safe?
Scientific basis	Is there evidence in peer-reviewed journals that the diet is effective for the stated purpose?
References	Are references cited in text or in a list at the end of the book? Are the references recent and relevant and published in peer-reviewed journals? Or are there only testimonials?
Exercise	Is it discussed or recommended?
Medical disclaimer	Is there a disclaimer that the diet is not intended to diagnose, treat, or cure any medical condition and the author is not intending to dispense medical advice?
Additional procedures	Are colon cleanses with herbs, teas, or coffee enemas required? How often?
Special supplies	Are filtered water, ionized water, a juicer, or a blender required?
Diet	Is it safe? Can it realistically be followed? Is there enough information? How long does the diet last?
Nutrition	Is the calorie level specified? Is it safe? Are macronutrients and micronutrients present in adequate amounts?

**1 Pound a Day**

**1 Pound a Day: The Martha's Vineyard Diet Detox and Plan for a Lifetime of Healthy Eating**, written by Roni DeLuz, RN, ND, PhD, and James Hester, was published by Gallery Books in 2013.<sup>26</sup> The diet claims to allow users to lose one pound per day and rid their bodies of endocrine disrupters and obesogens. The author, however, doesn't offer any scientific evidence for these claims. The book has no references to medical literature, only numerous testimonials from people who claim to have lost weight on the diet. A medical disclaimer states that the book contains "the opinions and ideas" of the author and is a "source of information only with the understanding that the authors and publishers are not engaged in rendering medical, health or any other kind of personal professional services." The book also includes a statement advising readers to consult with their physicians before adopting any of the suggestions it presents. The program discussed in the book provides options for two-day and seven-day detox regimens, but the primary focus is on the 21-day detox plan.

DeLuz, a registered nurse and certified colon hydrotherapist who holds a naturopathic doctor degree and a PhD in natural health from Clayton College of Natural Health<sup>26</sup> has promoted her diet on the *TODAY* show, *The Oprah Winfrey Show*, and *The View*.

The diet allows for very specific liquids to be consumed every two hours in small doses. No solid foods are allowed. Recommended intake is the same every day of the 21-day detox, starting with an antioxidant berry drink with 8 oz of distilled water and hot herbal tea at 8 AM and again at 4 PM. A green drink, mixed in 8 oz of distilled water with an additional 8 oz of distilled water, vegetable broth, or herbal tea is to be consumed at 10 AM and 2 PM. Fresh vegetable juice and 8 oz of distilled water or herbal tea is to be consumed at noon. At 6 PM, homemade soup and herbal tea is permitted. Recipes are provided for the antioxidant berry drink, the green drink, fresh vegetable juices, and homemade soup. All of these recipes include only fruits, vegetables, spices, and herbs. Specific recommendations are made for purchasing a juicer, and there's an extensive list of medical conditions and vegetables that help to correct these conditions. Dietary supplements required for the detox include probiotics to be taken every morning, digestive enzymes every evening, and an aloe vera or herbal cleanse at bedtime. Colon cleanses and coffee enemas are required once a week. Dieters are advised to avoid intense exercise, but are encouraged to jump on a trampoline or rebounder. Vegetables and fruits, whole grains, fat, eggs, white meat, and red meat are gradually added back to the diet after the 21-day detox diet ends.

Overall, the diet can be expensive because it requires dieters to have a blender and a juicer and to purchase multiple dietary supplements. The 21-day diet is very low in calories (about 400 per day), protein (about 10 g per day), and carbohydrate (about 90 g), and is completely fat-free. There's no scientific evidence that this type of diet will rid the body of endocrine disruptors or obesogens, but the very low calorie level certainly will induce rapid weight loss. The diet is unrealistic and dangerous considering the length of time the author expects users to adhere to it and the very rapid rate of weight loss. While there's no scientific evidence to support the effectiveness of colon cleansing and coffee enemas in removing toxins, these therapies may increase weight loss through increased loss of fluid.

### ***The 10-Day Green Smoothie Cleanse***

In contrast to the 1 Pound a Day diet, the regimen described in ***The 10-Day Green Smoothie Cleanse***<sup>27</sup> is a much simpler approach to detox. The full cleanse consists of three smoothies, snacks (unspecified amounts of apples, celery, unsweetened peanut butter, hard-boiled eggs, and a handful of raw unsalted nuts or seeds), and 64 fluid oz of water or a special detox or herbal tea for the full 10 days. This is followed by a gradual reintroduction of raw and cooked vegetables, chicken, and fish. More than 100 recipes for smoothies are included. About one-third of the book contains testimonials from people who claim to have lost weight on the diet. There are no references to scientific evidence. Like the 1 Pound a Day diet, this cleanse can be very expensive, as a blender is required for the detox portion and foods to include when the detox is over also are expensive, such as organic produce and wild-caught salmon. A saltwater flush or laxatives are recommended for users who go more than one day without a bowel movement while on the diet. The saltwater flush involves drinking two teaspoons of sea salt in 8 oz of water followed immediately with three additional 8 oz glasses of water. The author states that the constipation will be resolved within 30 to 60 minutes if the saltwater flush occurs early in the morning on an empty stomach. Colonics and liver cleanse supplements also are recommended along with infrared saunas, body brushing, and detox foot baths to increase the removal of toxins from the body. (These nonnutrition therapies are described in

Table 3.) The author states that people who follow the diet can expect to lose 10 to 15 pounds in 10 days.

Smith holds certifications as a nutritionist from the International Institute of Holistic Healing and a weight management specialist from the National Exercise and Sports Trainer Association. She's also a member of the American Nutrition Association. The book's medical disclaimer states that the publication contains the "opinions and ideas" of the author and is intended to provide "helpful and informative material."<sup>28</sup>

It's difficult to determine the calorie level for the 10-day detox portion of the diet because there are no guidelines for the portion sizes of allowed snacks. Every smoothie recipe for the detox phase includes at least two cups of two different fruits (to total four cups of fruit) and two to three "handfuls" of a leafy green vegetable along with stevia and two tablespoons of ground flaxseeds. The diet requires three smoothies per day, so there are plenty of fruit and vegetable servings. Every recipe includes the option to add one scoop of protein powder, which could provide up to 60 g of complete protein per smoothie depending on the brand and whether the dieter actually adds the protein powder to every smoothie. Overall, this detox diet is less complicated, easier to follow, and potentially contains more calories and nutrients than those a user would obtain following the 1 Pound a Day diet. The rate of weight loss, however, is prohibitively rapid (10 to 15 lbs in 10 days), and the saltwater flush is potentially dangerous due to the electrolyte imbalance from excessive sodium intake (4,600 mg) in one dose.

### ***The Master Cleanse Diet***

***The Master Cleanser*** by Stanley Burroughs called for restricting dietary intake to a mixture of lemon water, maple syrup, and cayenne pepper along with herbal detox tea for 10 days.<sup>1</sup> The goal of the diet was to detoxify the body, not specifically to lose weight. A new version of Burroughs' diet became popular in 2003 when Peter Glickman, a website developer who had previously worked as the director of both a chiropractic and chelation therapy clinic, created <http://themastercleanse.com>.<sup>29</sup> The success of the website lead him to write ***Lose Weight, Have More Energy and Be Happier in 10 Days: Take Charge of Your Health With the Master Cleanse***, which is now in its third edition.<sup>30</sup>

This detox diet book claims to promote rapid weight loss, remove toxins from the body, increase energy, and reduce the effects of aging.<sup>30</sup> Dieters are instructed to drink six to 12 glasses of lemonade made with 1 fluid oz of fresh-squeezed lemon or lime juice with 1 oz of grade B organic maple syrup, one-tenth of a teaspoon of cayenne pepper, and 8 oz of spring, purified, or distilled water every day for a minimum of 10 days. (Glickman reveals in his book that he has followed the cleanse for as many as 28 days.) Dieters must drink one cup of herbal laxative tea before bed on the day before they start the diet and every night thereafter while on the cleanse. Before drinking any lemonade, 32 oz of spring, purified, or distilled water with two teaspoons of noniodized sea salt must be consumed. No other food or drinks are permitted.

After the cleanse, readers are advised to add back several glasses of fresh squeezed orange juice on the first day, homemade vegetable soup made with vegetable broth on the second day, and fresh fruit and raw vegetable salads on day three.

There's no evidence that this diet will remove toxins or reduce the effects of aging. It's very likely that people will experience rapid weight loss due to severe energy deficiency. The diet lacks important nutrients such as protein, fat, dietary fiber, calcium, and vitamin D. For this reason, the Master Cleanse diet is potentially dangerous if followed for more than a few days.

### **Do Detoxification Diets Work?**

It's clear that many environmental toxins that have serious negative effects have been identified, and these toxins are present in many people's bodies. That being said, is there evidence that detox diets can eliminate these toxins from the body, improve health, or induce weight loss?

A recent survey of 1,442 licensed naturopathic doctors in the United States showed that of 196 respondents, 92% reported using detoxification therapies to treat a variety of conditions including environmental exposure, general cleansing/preventive medicine, gastrointestinal diseases, autoimmune diseases, and inflammation, while 65% used it for weight loss.<sup>31</sup> More than 75% of the respondents used dietary measures to achieve detoxification including adding cleansing foods (such as cruciferous vegetables, beet root, and dandelion) to the diet, increasing fruits and vegetables, and adding dietary supplements and probiotics. The respondents also used therapies such as infrared sauna, chelation therapy, fasting, and herbal laxatives.

While an important limitation of this study was selection bias (the survey was e-mailed to potential participants), the results show that even among complementary and integrative practitioners, there's no standard for what constitutes detoxification.

Research studies published in peer-reviewed journals of detox diets for the removal of POPs first appeared in 1989. In one study, 14 firemen with neurobehavioral dysfunction after exposure to PCBs in a transformer explosion were assessed with 22 tests including memory, cognitive function, and body balance six months after the exposure.<sup>32</sup> Six weeks later they were treated for two to three weeks with a detox diet, exercise, and sauna treatments. The description of the detox program given in the manuscript was limited to the following: "Polyunsaturated oil supplements, increasing doses of niacin, 30 to 60 minutes of aerobic exercise two times per day alternating with sweating in a sauna at 155 degrees Fahrenheit."<sup>32</sup> Serum electrolytes were monitored and replaced as needed. Although serum and adipose tissue PCB content were analyzed at baseline, there was extreme variation among all subjects and there was no correlation found between the test scores and the PCB content of either serum or adipose tissue. The measurement of PCB levels in serum and adipose tissue wasn't repeated after the detox program. The exposed firemen were matched with 14 firemen not exposed to the fire but in the same fire company, and the exposed firemen had significantly lower scores on 13 tests. The exposed firemen improved their scores significantly on seven tests after undergoing the detox program.<sup>32</sup> Because of the limitations of the study design, there's no evidence that the detox program was effective in reducing the toxic effects of PCB exposure in these subjects.

A seven-day detoxification program was tested in a study of 25 disease-free naturopathic medical students at the National College of Natural Medicine in Portland, Oregon.<sup>33</sup> The

Metabolic Screening Questionnaire (MSQ) was used to assess changes in physical well-being in response to the detox program. The MSQ is a tool derived from the Cornell Medical Index (deemed outdated by Cornell and since 1991 no longer available) and is used by complementary and integrative practitioners to assess symptoms related to inflammation. Lactulose and mannitol challenge tests were administered “to determine intestinal permeability,” along with a caffeine clearance test and measures of hepatic cytochrome P450 A1 activity, hepatic glycine conjugation, and urinary sulfate-to-creatinine ratio.”<sup>33</sup> The detox program consisted of a hypoallergenic diet (no dairy, wheat, concentrated sweets, caffeine, alcohol, eggs, peanuts, or oats), six scoops of a medical food supplement, and at least two quarts of filtered water daily. The participants were instructed not to make any other changes in their diets or exercise regimens.

The study authors reported a statistically significant reduction in MSQ scores (indicating improvements in subjective health reports) and a 23% increase in liver detoxification capacity as measured by hepatic cytochrome P450 A1 activity, hepatic glycine conjugation, and urinary sulfate-to-creatinine ratio before and after intervention.<sup>33</sup> These findings are questionable, however, due to flaws in study design such as a lack of a control group, bias in subject selection (the subjects were naturopathic medical students), the subjective nature of the MSQ, questionable validity of the biochemical measures taken, and a lack of evidence to distinguish whether the diet or the medical food supplement caused the results.

The first clinical trial of a dietary intervention to reduce PCB body burden was published in 2014.<sup>34</sup> Previous results from NHANES data showed a strong association between serum PCB levels and diabetes and hypertension in adults in Anniston, Alabama. Twenty-eight adults were randomized to intervention and control groups with no significant differences in age, gender, race, BMI, lipid panels, fasting glucose, insulin, and serum  $\alpha$ -tocopherol. Both groups received monthly supplies of a special potato crisp that provided the same number of calories, but the intervention group received crisps made with olestra while the control group received crisps made with vegetable oil. Since olestra can't be absorbed in the intestines, the research team speculated that toxins would be removed from the gut along with the unabsorbed olestra. The daily dose of crisps provided 15 g of olestra. Follow-up occurred monthly for 12 months, and supplies of crisps were given bimonthly.

The results of the study showed significantly reduced mean serum concentrations of PCBs in the olestra group but with great variation in response between subjects. The strengths of this study include the randomized placebo-controlled design, but the small sample size is an important limitation.<sup>34</sup>

To date, no randomized controlled trials have tested the effectiveness of any popular detox diet for the removal of toxins from the body.

A study of a lemon detox program was published in 2015 and used a very low-calorie diet based on the Master Cleanse diet first proposed by Burroughs. The subjects were 84 premenopausal Korean women who responded to advertisements for the study and had a BMI  $>23 \text{ kg/m}^2$ . The women were divided into three groups: a lemon detox group, a pair-fed juice placebo group, and a normal diet without restrictions group. The two study diets of about 400

kcal were given for seven days followed by four days of a transitioning diet, which was about 1,000 kcal.<sup>35</sup>

Both study diet groups showed significant changes in weight, BMI, percentage of body fat, serum insulin, insulin resistance scores, leptin, and adiponectin levels as compared with the normal diet group. High-sensitive C-reactive protein levels were reduced only in the lemon detox group. Hemoglobin and hematocrit levels were found to be stable in the lemon detox group but decreased in the other two groups.<sup>35</sup>

While this study provides some evidence for the effectiveness of a Master Cleanse-type regimen in promoting weight loss, the authors noted the short duration of the study as an important limitation. In addition, there was no effort to identify or quantify any potential release of toxins through urinary or other measures.<sup>35</sup>

Evidence for the effectiveness of dietary supplements recommended to enhance toxin removal in the 1 Pound a Day diet, such as nori and chlorella, is limited to rodent and cell culture studies (see Table 3).<sup>23,24</sup> While these supplements were found to protect against free radical damage to cells and dioxin accumulation in mice and rats, it's not possible to apply these findings to humans without targeted testing.

### **Negative Consequences of Detox Diets**

While there are no reports in the literature of direct harm to people who have followed detox diets, there are documented negative effects from some of the additional therapies such as colon cleansing that are frequently recommended in popular detox diet books. Two cases of serious gastrointestinal problems with hospitalization due to colon cleansing were reported in 2011.<sup>17</sup> One patient received the colon cleanse at a “cleansing center” and the other self-administered the cleanse. A case of proctocolitis (severe inflammation of the rectum and colon) in a 60-year-old female caused by repeated coffee enemas taken on advice of a detox diet was reported in 2010, and there were earlier reports of two deaths due to frequent coffee enemas.<sup>18,19</sup>

Several studies have examined the effects of rapid weight loss on serum levels of pollutants. Because these chemicals are stored in adipose tissue, researchers have questioned what health effects might accompany the release of these toxins with lipolysis during weight loss. Increased serum plasma pollutants have been identified in humans after moderate calorie restriction and weight loss and in people who have undergone gastroplasty.<sup>36,37</sup> More recent studies have demonstrated that changes in POP concentrations in serum and adipose tissue samples after weight loss may alter energy and lipid homeostasis and contribute to liver dysfunction.<sup>38,39</sup> More research is needed on these significant health effects.

Nutrition professionals are likely to question the safety of the very low calorie levels that often are recommended in detox diets. Very low calorie diets with high-quality protein appear safe when limited to three months or fewer under careful medical supervision, according to Wadden and colleagues.<sup>40</sup> However, many detox diets such as 1 Pound a Day specifically exclude protein and are unlikely to be used under medical supervision. Severe energy and protein

restriction of extended duration can lead to fatigue, compromised immune function, constipation, and gallstones.

### **Bottom Line**

Detox diets are extremely popular with consumers and are widely promoted through books, magazines, and websites. While there's substantial research supporting the presence of environmental toxins in human bodies and the negative health effects of these substances, there's no evidence that popular detox diets have any effect on toxin elimination. There are some good diet-related recommendations given by some of the authors of these diets such as increasing fruit and vegetable consumption and focusing on whole grains and lean protein sources.

Detox diets for weight loss are popular with consumers because typically they're easy to follow in terms of specific foods to eat or avoid; this differs substantially from guidelines for healthful eating and exercise. On the other hand, they're very restrictive, expensive to follow, and generally not sustainable.

People can have great difficulty sticking to the diet and maintaining the weight loss once the diet has ended. There are serious risks associated with following these diets and using the recommended procedures and dietary supplements. Nutrition professionals should help clients explore their reasons for wanting to try these diets that are extreme, expensive, and provide no proven benefit. Dietitians should evaluate detox diets objectively with respect to calorie level, macronutrient composition, rate of weight loss expected, length of time on the diet, and additional therapies, treatments, and dietary supplements required by the detox regimen. Clients who choose to follow a detox diet always should inform their physicians before starting the diet and follow up during the weight loss phase of the diet. Adverse health effects from detox diets should be documented by RDs in the medical record and published as case studies in peer-reviewed journals.

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## Quiz

**1. How many chemicals that have potential to cause harm to humans are listed on the Agency for Toxic Substances and Disease Registry's Substance Priority List?**

- A. 275
- B. 500
- C. 1,200
- D. 8,000

**2. Dietary supplements such as nori, spirulina, and chlorella often are recommended to enhance detoxification. Are these supplements safe?**

- A. They should be considered unsafe because there's no research to support their use.
- B. They are likely safe and effective in removing toxins.
- C. They may be safe and possibly effective in removing toxins.
- D. They may be safe with some exceptions but are not well studied in humans.

**3. The FDA has approved chelation therapy for which of the following?**

- A. Removal of heavy metals such as iron and lead from the human body
- B. Oral administration of chelating agents to remove polychlorinated biphenyls (PCBs) and BPA from the body
- C. Oral administration to reduce coronary artery plaque
- d. Oral administration to reduce cholesterol and blood pressure

**4. Which is true of the popular detox diet book *1 Pound a Day: The Martha's Vineyard Diet Detox and Plan for a Lifetime of Healthy Eating*?**

- A. Its author gives scientific proof that the diet will remove obesogens and endocrine disruptors from the body.
- B. The diet described consists of only specific liquids and various dietary supplements for 21 days.
- C. The diet described allows snacks like apples, celery, and hard-boiled eggs.
- D. The author encourages intense exercise.

**5. Infrared sauna, liver cleanse supplements, body brushing, and foot detox baths are recommended by the author of *The 10-Day Green Smoothie Cleanse* for what purpose?**

- A. To maximize weight loss
- B. To reduce oxidation in the body
- C. To increase immune function
- D. To eliminate toxins

**6. Which of the following is true about the Master Cleanse diet?**

- A. It was introduced in 1976 as a weight loss diet.
- B. It was introduced in 1976 as a method to remove toxins.
- C. It was made popular again in 2003 by a physician.
- D. It should be followed for a minimum of 28 days.

**7. Which of the following characterizes detoxification regimens published in the literature that studied firemen exposed to PCB contamination and healthy naturopathic medical students?**

- A. They were well-designed trials with large numbers of participants.
- B. They used the same/similar protocols and diet intervention.
- C. They involved diets similar to those found in *The 10-Day Green Smoothie Cleanse* and *1 Pound a Day: The Martha's Vineyard Diet Detox and Plan for a Lifetime of Healthy Eating*.
- D. They involved a small number of participants and relied on questionable methodology and non-validated measurement tools.

**8. Which of the following is a negative consequence of popular detox diets that has been identified in the scientific literature?**

- A. Decreased quality of life
- B. Increased incidence of cardiovascular disease
- C. Increased toxins in the blood due to increased mobilization from adipose tissue breakdown
- D. Increased prevalence of eating disorders

**9. Wadden and colleagues reported that medically supervised very low calorie diets are safe as long as the diets have an adequate amount of which of the following?**

- A. Carbohydrate
- B. Protein
- C. Fat
- D. Vitamins and minerals

**10. Which of the following is an appropriate take-away message that RDs can provide to clients who inquire about a popular detox diet?**

- A. Avoid them at all costs because they're proven to be extremely dangerous.
- B. There's no scientific evidence that popular detox diets have any effect on removing toxins from the body.
- C. Follow the diet, but avoid the dietary supplements.
- D. Detox diets can remove obesogens and endocrine disruptors from the body, so they're worth trying.