Toxins, Toxicity, and Endotoxemia: A Historical and Clinical Perspective for Chiropractors

David R. Seaman, DC, MS

ABSTRACT

Objective: The purpose of this commentary is to review the notion of toxicity in the context of chiropractic practice.

Discussion: The belief that body toxicity is the cause of disease has been promoted for thousands of years. Prior to the emergence of the chiropractic profession, the medical profession embraced the notion that the body becomes “toxic,” requiring detoxification interventions or surgery. The legacy of body toxicity within the chiropractic approach to patient care began with Daniel David Palmer. Today, some sectors within the medical and chiropractic professions continue to embrace the concept of body toxicity and the related need to engage in detoxifying treatments. The most common areas of focus for detoxification are the intestines and liver; however, the nature of the toxicity in these organs has yet to be defined or measured. In contrast, diet-induced systemic bacterial endotoxemia is a measureable state that is known to be promoted by a diet rich in sugar, flour, and refined oil. This suggests that bacterial endotoxin may be a candidate toxin to consider in the clinical context, as many common conditions, such as obesity, metabolic syndrome, diabetes, interstitial cystitis, depression, and migraine headache, are known to be promoted by endotoxemia.

Conclusion: A diet rich in refined sugar, flour, and oils may induce proinflammatory changes within intestinal microbiota that lead to systemic, low-grade endotoxemia, which is a common variety of “toxicity” that is measurable and worthy of research consideration. Introducing a diet to reduce endotoxemia, rather than attempting to target a specific organ, appears to be a rational clinical approach for addressing the issue of toxicity. (*J Chiropr Humanit* 2016;23:68-76)

Key Indexing Terms: *Detoxification; Toxicity; Toxins; Endotoxin; Endotoxemia*

INTRODUCTION

Body toxicity has been viewed as a health risk since the time of ancient Egypt, when it was believed that stool putrefaction would lead to systemic disease.¹ The ancient Greek humoral theory of disease extended the concept of putrefaction to bile, phlegm, blood, and residues of food. In the late 1800s, Metchnikoff hypothesized that intestinal toxins shortened lifespan.¹ Modern medicine embraced toxicity until at least the 1920s, when a colectomy was viewed as a cure for autointoxication.¹ Clearly, the notion of “body toxicity” as a health risk for disease development has been part of patient care for a long time. It therefore might be expected that various sectors of health care, and

individuals within health care, might still embrace and promote the issue of body toxicity as a treatment target.

The purpose of this commentary is to discuss the issue of toxicity in the context of chiropractic practice, including Daniel David Palmer’s impression of toxicity, a consideration of toxicity regarding the liver and colon, bacterial endotoxemia, and a rational approach to dietary detoxification in the context of addressing bacterial endotoxemia.

TOXINS FROM THE PERSPECTIVE OF EARLY CHIROPRACTIC HISTORY: DANIEL DAVID PALMER

The notion that toxins are related to chiropractic and subluxation is attributed to Palmer. Chiropractors routinely cite Palmer in this regard: “In his 1910 text, *The Chiropractor’s Adjuster*, DD Palmer identified the causes of vertebral subluxation as the Three T’s—thoughts, trauma and toxins.”² Although this statement is commonly attributed to Palmer, did he actually mention the so-called 3 T’s?

Senzon explains that “thoughts, trauma, and toxins have been described for years as the three causative agents of

National University of Health Sciences, Pinellas Park, FL.

Corresponding author: David R. Seaman, DC, MS, SPC-Health Education Center, 7200 66th St N, Pinellas Park, FL 33781. Tel.: +1-727-803-6129. (e-mail: dseaman@nuhs.edu).

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vertebral subluxation.”³ However, we are further told by Senzon that Palmer never actually stated that subluxation is caused by the 3 T's. Senzon properly quotes Palmer's original statement, which had nothing to do with subluxation specifically. Palmer stated that “the determining cause of disease are traumatism, poison, and autosuggestion.”⁴(p359) Palmer also made the following statement⁴:

Impingements, poisons and intense thinking, auto-suggestion, unrelieved change of thot, insufficient rest and sleep, increase or decrease the momentum of impulses. In the study of pathology we should look to the etiological factors which, by their exciting or debilitating effects, retard or liberate stored up energy, resulting in abnormal functioning and morbid structure.

Palmer operationally defined traumatism, autosuggestion, and poisons. Traumatism is the condition of one suffering from injury. Autosuggestion is described in the context of a psychosomatic illness. Palmer defined poison as follows: “Poison is any animal, vegetable, or mineral substance which when applied externally or taken into the body by ingestion or injection, causes such a change in the animal economy as to produce abnormal functioning, disease or death.”⁴(p360)

Palmer uses the terms *poison* and *toxin* interchangeably in several places in his text; however, in the index he cites only 1 page for “toxin,”⁴(p473) wherein he describes strychnine as a poison or toxin. The index lists several pages wherein poison is to be discussed. The commentary from each page is quoted here⁴:

Page 77: “Why and how luxations of the vertebrae are caused by poisons, vaccine virus, tobacco, alcohol, and ptomaine poison, is taught by actual clinical work.”

Page 116: “Poisons are substances which, when introduced into the body, either impair the function of one or more of its organs or destroy life. All poisons lead to a disturbance of the nervous system, no matter by what avenue it is introduced. The lesions due to poisons may be local, as those from corrosives or caustics. In others the place of entrance is not affected, the pathological manifestations being due to nervous disturbance...The effect of a poison depends upon the nature of the substance, the amount and the individual.”

Page 124: “Life is action. Intelligent life is the soul... Poison destroys that which intelligent life has accomplished; changes physiological to pathological action.”

Page 147: In the context of abnormal tone in the nervous system, Palmer states that “this prerequisite to disease is due to pressure, poison or lack of control

of the emotions and acts of the patient, a morbid self-consciousness.”

Page 554: “Toxicosis is a disease caused by poisons; a toxic or poisoned state; the conditions of disease induced by poisons.” Palmer then gives examples of poisons as being chloroform, chloral, alcohol, digitalis, strychnine, nicotine, picrotoxin, veratrum, and laudanum.

Page 675: “Poisons are not gathered in the tissues or cavities of the body. Poison is any animal, vegetable, or mineral substance which when applied externally, or taken into the stomach, or injected into the body by physician or reptile, causes such a change in the animal economy as to produce abnormal functioning, disease or death. A chemical may be poisonous or otherwise.”

Page 835: In the context of developing typhoid fever, Palmer states, “The predisposing cause is poison from some decaying animal or vegetable matter. Nerves sense this poison and as a consequence vertebrae are drawn out of alignment impinging upon the ganglionic chain of the sympathetic nervous system.”

Page 955: “Irritant or acrid poisons are those which produce irritation or inflammation. Narcotic poisons are such as produce stupor or delirium. Sedative poisons are those which directly reduce vital powers.”

Page 974: “The Osteopath and Allopath believe poisons to be the cause of fevers. The Chiropractor finds bone pressure on nerves the direct cause; however, these bones may have been drawn out of alignment by poisons. He, therefore, removes the impingement.”

The statements on pages 835 and 974 indicate that poisons, not toxins, cause bones to be drawn out of alignment and impinge upon the spinal nerves. Thus, although Palmer never specifically said that toxins cause a misalignment type of subluxation, the implication is arguable based on these statements. However, to date, research is lacking that would otherwise support the notion that an individual vertebra can be pulled out of alignment in the fashion posited by Palmer. Furthermore, a correction of a supposed misalignment subluxation by manipulation has yet to be identified. In fact, the use of premanipulation and postmanipulation radiographs by Hart⁵ and magnetic resonance images by Cramer et al⁶ suggest that adjustments do not correct misalignments. This requires doctors of chiropractic (DCs) to consider the issue of “toxins” in a

subluxation context that is not related to misalignments. A more functional view is needed, which may involve inflammation and nociceptive processes, rather than pathoanatomical changes.⁷⁻⁹

It is important to note that Palmer never described which specific toxins, if any, could promote misalignment subluxations. Current discussions about toxins and spinal subluxation also do not implicate specific toxins.^{2,3} In other words, the terms *toxins* and related *toxicity* have been consistently described in an imprecise and nebulous fashion in the context of spinal subluxation. Nonetheless, many DCs maintain the general perception that an overexposure to yet unnamed toxins can prevent patients from “holding” adjustments. A similar nebulous scenario applies to colon and liver toxicity, for which nutritional interventions are recommended. No study has yet to define a specific toxin in the colon or liver that then responds to a specifically related detoxification nutritional protocol. This remains the challenge for those within chiropractic who embrace detoxification as a clinical tool. Toxicity needs to be properly defined by the advocates of detoxification.

TOXICITY OF THE COLON IN RELATION TO CHIROPRACTIC PRACTICE

Colon cleansing for the purpose of reducing intestinal toxicity and improving systemic health was popularized by a DC, Bernard Jensen, who wrote a text titled *Tissue Cleansing Through Bowel Management*.¹⁰ The 1-week cleansing process involved taking several doses of psyllium husk powder per day, consuming vegetable broths, and supplementing with chlorella. The ingested psyllium is claimed to remove built-up toxic debris, aided by a daily colema, which is a variation of an enema and colonic. After the cleansing period, the recommendation is to avoid processed foods. In other words, the dietary recommendation after the cleanse is to eat more vegetation and avoid refined sugar, flour, and omega-6 fatty acids, which has been termed an “anti-inflammatory” diet.¹¹⁻²¹

A PubMed search using the phrase “colon cleansing and health” leads to 87 published articles, most of which involve cleansing before a colonoscopy. None of the articles involves colon cleansing for body detoxification or purification. One author criticizes the unfounded claims by those who promote colon cleansing²²:

Colon cleansing is a popular therapy among alternative practitioners, but many myths surround it. The scientifically inaccurate way many traditional healers try to explain therapeutic mechanisms is one of the obstacles that inhibits dialog between traditional healers and practitioners of modern medicine. The therapy actually has clinical value, but the explanations used to promote the therapies are the stuff of herbal legends, not scientific fact.

Because colon cleansing involves increasing fiber intake as well as eating more vegetables and fruit and avoiding refined sugar, flour, and omega-6 oils, inflammation is reduced.²² In other words, “toxic” foods such as refined carbohydrates and oils create inflammation and so should be characterized as “pro-inflammatory.” Thus, the consideration should be that, by “detoxifying” the diet, the beneficial outcome is inflammation reduction rather than physical or physiological detoxification of the human body.

Claims that toxic materials can be pulled off the walls of the intestine by fiber, such as powdered psyllium husk, are also inaccurate. The stools of those taking psyllium husk have been studied, and the larger stool mass was determined to contain psyllium fiber, rather than “toxins.”²³ In other words, the more psyllium one takes, the more psyllium that will be eliminated, leading individuals to misinterpret the eliminated psyllium to be built-up toxins.

Because we lack data to support the notion that the intestines can be cleansed of built-up debris and toxins, the appropriate choice for promoting intestinal health is to eat fiber-rich vegetation and perhaps supplement with psyllium husk powder to help regulate bowel function.²³ In particular, supplemental psyllium has been reported to be of benefit for patients with constipation, diarrhea, irritable bowel syndrome, inflammatory bowel disease, colon cancer, and type 2 diabetes.²³

TOXICITY OF THE LIVER IN RELATION TO CHIROPRACTIC PRACTICE

The liver has also been targeted as an organ in need of detoxification to help reduce chronic fatigue, food allergies, migraine headaches, fibromyalgia, and generalized arthralgias, which are common presentations in chiropractic practice. Practitioners in both the medical and chiropractic professions are guilty of embracing the concept of liver toxicity, despite the lack of scientific evidence. To date, no studies have ever identified specific toxins in the liver that are detoxified by a specific nutritional detoxification program to help such conditions. This approach was popularized by Bland et al²⁴ and appears to have begun with an article published in the *Journal of Applied Nutrition*.²⁵

This study argued that a powdered supplement consisting of rice protein, rice syrup solids, and a low-dose multivitamin had the ability to “upregulate” hepatic detoxification, yet no measures of toxicity were performed. In other words, no specific liver toxin was identified, nor has been identified, that was subsequently “detoxified” by this nutritional supplement. Liver toxicity remains a nebulous condition that has yet to be defined. Thus, the appropriateness or clinical relevance of this nutritional approach has yet to be demonstrated in the context of chiropractic practice and health care in general. Despite this

fact, DCs find this to be a topic of interest and promote this approach for use in clinical practice.²⁶⁻²⁸

BACTERIAL ENDOTOXIN IN RELATION TO CHIROPRACTIC PRACTICE

As outlined earlier, the issue of toxicity as a cause of spinal dysfunction, and as an intestinal and liver condition, is of therapeutic interest to DCs. The general topic of body cleansing and detoxification also appears to be of great interest to the general public. A Google search performed on June 20, 2016, using the phrases “detox diet” and “body detoxification” resulted in 13 100 000 and 12 900 000 results, respectively. The challenge thus far, from a scientific and clinical perspective, is that the term *detoxification* is inappropriately used in a vague and general sense. We supposedly need to detoxify our bodies because air, water, and food contain toxins; however, no specific toxins have been implicated and measured. In contrast, bacterial endotoxin may be a candidate toxin to consider as a cause of spinal dysfunction, as a therapeutic target to restore intestinal and liver health, and as a promoter of other common conditions encountered in chiropractic practice.

The human gastrointestinal tract contains gram-negative bacteria, of which lipopolysaccharide is a structural component of the outer cell membrane. Lipopolysaccharide is also known as bacterial endotoxin, which circulates at very low levels in normal disease-free humans²⁹; however, this changes as individuals become unhealthy³⁰:

Although endotoxin (lipopolysaccharide (LPS)), derived from the cell wall of Gram-negative bacteria, circulates at low concentrations in the blood of healthy individuals, the presence of genetic and diet-induced obesity and other metabolic disorders has been associated with a substantial increase in LPS concentrations, a condition termed “metabolic endotoxemia.”

The only source of circulating endotoxin can be from the gastrointestinal tract because that is where gram-negative bacteria reside in the human body, which speaks to the importance of maintaining gastrointestinal tract health to promote a homeostatic or symbiotic relationship with our intestinal microbiota.²⁹ The large intestine appears to be adapted to the presence of high concentrations of bacteria; compared with the small intestine,³¹ it has a relatively small surface area and is not designed for macronutrient and micronutrient absorption, save for short chain fatty acids, vitamin K, sodium, and water. Because the small intestine is where the vast majority of nutrients are absorbed, it is supposed to contain far less bacteria.^{32,33} In other words, we are supposed to absorb nutrients and not bacterial components from the small intestine.^{32,33} Consider that

jejunal cultures may not identify any bacteria in as many as 33% of healthy volunteers.³³

Although the jejunum contains bacteria, the concentration should not exceed 10^3 organisms per milliliter,³³ which is also considered the normal concentration of bacteria in the ileum. In contrast, in the terminal ileum near the ileocecal valve, bacterial concentrations range from 10^5 to 10^9 organisms per milliliter, whereas colonic concentrations can reach 10^{12} .³³ Consequently, bacterial levels in the small intestine that exceed 10^3 per milliliter have been referred to as uninvited guests.³³ The diagnosis of small intestinal bacterial overgrowth (SIBO) is applied to patients when the concentration of bacteria exceeds 10^5 organisms per milliliter in the jejunum and ileum.^{33,34} Not surprisingly, patients with SIBO have increased circulating levels of bacterial endotoxin.^{35,36}

Whether a patient develops SIBO or not, research has demonstrated that it is possible to create a state of low-grade metabolic endotoxemia based on poor dietary choices. For example, when normal-weight participants, with an average body mass index of 23, were fed a typical American breakfast including a cup of tea, 3 slices of toast, and butter, which amounted to 900 calories, lipopolysaccharide levels increased significantly compared with controls, indicating that this common breakfast promotes low-grade endotoxemia.³⁷ A subsequent study indicated that the overconsumption of calories from refined carbohydrates and fat is also associated with endotoxemia in apparently healthy men.³⁸ More recently, plasma endotoxin levels increased by 71% when 8 healthy participants were placed on a Western dietary pattern characterized by higher intakes of refined grains, sugar, processed meats, and red meat.³⁹ In contrast, there was a 31% reduction in endotoxin when participants consumed a prudent-style diet characterized by higher intakes of fruits, vegetables, fish, whole grains, and legumes.³⁹ In these short-term studies, there were no reported symptomatic changes associated with low-grade endotoxemia, which suggests that acute diet-induced endotoxemic events in otherwise healthy individuals go unnoticed.

The transition from acute to chronic endotoxemia, and the point at which symptoms may appear, is not clear and obvious, which can be confusing for patients and clinicians and complicates the identification of a cause-effect relationship. In the absence of overt diseases that cause SIBO, such as achlorhydria, diabetic autonomic neuropathy, scleroderma, and Crohn disease,⁴⁰ the most common cause promoter of bacterial overgrowth is a diet that is low in fiber and rich in refined sugar, flour, and oils. The chronic consumption of such a diet will simultaneously reduce gastrointestinal tract motility and “feed” gastrointestinal tract bacteria, allowing them to overgrow in the small intestine to varying degrees, which can promote chronic low-grade endotoxemia.^{31,41,42} Whether varying degrees of SIBO are related to all conditions that are associated with low-grade endotoxemia is not known.

Whether or not SIBO develops, multiple conditions are known to be associated with elevated levels of circulating endotoxin, such as irritable bowel syndrome and fatty liver disease.^{32,41,43-45} This suggests that DCs can still view bowel and liver function in the context of toxicity, with the treatment goal being that of endotoxin reduction.

Regarding subluxation, no evidence speaks to a relationship with bacterial endotoxemia. However, bacterial endotoxemia is known to be a promoter of obesity, metabolic syndrome, type 2 diabetes, and depression, all of which are associated with an increased risk of back pain,⁴⁶ which again permits a DC to embrace the notion that toxins may promote spinal dysfunction.

Additional common conditions that patients may present with to a chiropractic office and that are known to be promoted by chronic endotoxemia include chronic fatigue, anxiety, impaired cognition, migraine headache, impaired sleep, interstitial cystitis, type 2 diabetes, atherosclerosis, hypertension, general feeling of ill health, and widespread pain that may be diagnosed as fibromyalgia.^{31,32,47-62} Bacterial endotoxemia is also associated with childhood obesity and may be a key contributor to type 2 diabetes and cardiovascular disease later in life.⁶³

MEASURING BACTERIAL ENDOTOXIN LEVELS

Although assessing bacterial endotoxin levels is performed in the research setting, a clinical laboratory test is not available. This should not dissuade clinicians from embracing endotoxin as a candidate toxin in need of detoxification for a few reasons. First, as described earlier, we know that the consumption of refined sugar, flour, and oil leads to postprandial low-grade endotoxemia that has been measured in the clinical research setting.³⁷⁻³⁹ In other words, a patient who regularly eats these foods is measurably “toxic.”

Second, chronic low-grade endotoxemia is correlated to various surrogate markers that can be readily measured and tracked in clinical practice, including elevations in waist circumference, waist-to-hip ratio, total cholesterol, triglycerides, hemoglobin A1c, and serum insulin levels.^{64,65} These objective markers, which are diagnostic for metabolic syndrome, diabetes, and heart disease, can also be viewed as surrogate markers of chronic endotoxemia. Thus, a patient with abnormal surrogate markers could be considered “toxic.”

Third, patients who suffer from postprandial abdominal bloating that occurs within 1 hour of eating could be considered “toxic.” In the absence of gluten sensitivity, celiac disease, or other gastrointestinal tract pathologic conditions, the most common cause of such bloating is the fermentation of consumed carbohydrates by an overgrown small intestine bacterial population,^{32,49} which leads to endotoxemia.^{35,36} Postprandial bloating is an almost

universal symptom in patients with irritable bowel syndrome.³² The prevalence of irritable bowel syndrome is estimated to be between 3% and 28%,⁴⁹ suggesting that a substantial number of patients are symptomatically “toxic” on a regular basis.

Although no clinical laboratory test is available to measure endotoxin in a practice setting, the condition of endotoxemia is measurable and correlated with various clinical markers. The presence of these clinical markers can be used as evidence for engaging patients in the process of detoxification. In this context, the mental orientation for patients is that the diet is “toxic” because of an excessive intake of refined sugar, flour, and oils, and it is the diet that should be detoxified.

MANAGING BACTERIAL ENDOTOXIN BY DETOXIFYING THE DIET

As described earlier, circulating levels of bacterial endotoxin are directly influenced by diet. Sugar and flour serve to promote bacterial growth, which has been referred to as an inflammatory microbiota.³¹ Thereafter, the consumption of refined carbohydrate and lipid calories from refined oils and animal products will stimulate the release of endotoxin from small intestine gram-negative bacteria, leading to the development of systemic low-grade endotoxemia and related low-grade chronic inflammation.³¹ This relationship between diet and endotoxemia indicates that the diet should be viewed as the promoter of toxicity, and the diet should be considered “toxic” and in need of detoxification. Unlike the previously described vague notions of toxicity, viewing the diet as being toxic is very precise and can be made very personal based on the types of refined sugar, flour, and oils preferred by individual patients.

A “detoxified” diet would contain little to no proinflammatory sugar and flour, which would eliminate the calories required to create an inflammatory microbiota and reduce systemic endotoxemia. The elimination of lipid calories from the diet is a more complex issue and should focus on avoiding the refined seed oils from corn, sunflower, safflower, cottonseed, peanut, and soy, rather than animal fats. Saturated fatty acids, most commonly associated with the consumption of animal fat, are actually involved in the detoxification of circulating endotoxin, which means that dietary saturated fatty acids are actually healthy and anti-inflammatory. This controversial topic will be discussed in more detail in the remainder of this section of the article.

Consider the fact that the consumption of saturated fatty acids in meat and dairy is encouraged as part of a ketogenic diet, which is anti-inflammatory. Studies have demonstrated that ketogenic diets can reverse proinflammatory conditions, such as metabolic syndrome and fatty liver,

and reduce blood levels of inflammatory mediators.⁶⁶⁻⁶⁹ If animal fats and saturated fatty acids, in particular, were proinflammatory and disease promoting, these anti-inflammatory outcomes would not be possible. In fact, research is emerging that may support the use of a ketogenic diet for other proinflammatory conditions, such as obesity, epilepsy, diabetes, cardiovascular disease, cancer, polycystic ovarian syndrome, acne, Parkinson disease, Alzheimer disease, and brain trauma.⁷⁰ Additionally, the diets of tropical islanders are not inflammatory when they are devoid of refined sugar, flour, and seed oils but rich in coconut oil.^{31,71}

In short, we have been told incorrectly for decades that the saturated fatty acids in both animal products and coconut oil somehow clog blood vessels in a monocausal fashion.⁷²⁻⁷⁴ This notion has never been supported by evidence, and recently, even cardiologists are becoming more vocal about this misinformation⁷⁴:

Recent prospective cohort studies have not supported any significant association between saturated fat intake and cardiovascular risk. Instead, saturated fat has been found to be protective....Red meat is another major source of saturated fat. Consumption of processed meats, but not red meat, has been associated with coronary heart disease and diabetes mellitus, which may be explained by nitrates and sodium as preservatives.

From a purely empirical perspective, one could logically conclude that saturated fats could never build up on the walls of arteries, and this is because they are liquid at body temperature and never solid. The only time we witness saturated fatty acids in a solid, or crystallized, form is at room temperature or when refrigerated, with butter being the most obvious example. It is quite disingenuous to suggest that hardened saturated fatty acids at room temperature or in a refrigerator will be similarly hardened in the human body that runs at a temperature of almost 100°F.

Experimental evidence also allows us to conclude that saturated fatty acid and cholesterol cannot build up on artery walls.⁷² It is common knowledge that high-density lipoprotein (HDL) cholesterol is protective against atherosclerosis because of its participation in reverse cholesterol transport. Thus, dietary factors that support appropriate HDL levels should be embraced as heart healthy. Interestingly, the consumption of dietary saturated fatty acids is known to increase circulating levels of cardioprotective HDL cholesterol,^{73,75} which means that saturated fatty acids are actually heart healthy.

More germane to the issue of toxicity is that HDL cholesterol also functions to reduce endotoxemia. In other words, the consumption of saturated fatty acids from animal fat serves to increase circulating levels of HDL that bind to and clear endotoxin from the body,⁷⁶⁻⁸⁰ which has been

referred to as a humoral detoxification mechanism.⁷⁷ This means that dietary saturated fatty acids from animal products have detoxifying properties and also represent a specific example of a named toxin and its detoxification.

In summary, a detoxified diet is one that is free of proinflammatory calories from refined sugar, flour, and omega-6 oils. The consumption of meat, cheese, yogurt, and eggs should not be discouraged because they deliver many nutrients, including saturated fatty acids, that aid in the detoxification of circulating bacterial endotoxin. The proinflammatory calories from refined sugar, flour, and oil should be replaced by vegetation, including vegetables, tubers or roots, fruits, nuts, and legumes, which offer anti-inflammatory benefits,^{11,12,14-16,66-68,71,81} including the modulation of proinflammatory gastrointestinal tract bacteria and the inhibition of endotoxemia.⁸²⁻⁸⁹ Polyphenolic substances found in vegetation tend not to be absorbed and thus appear to exert their anti-inflammatory actions during their passage through the small and large intestine as they interact with microbial cells.⁸⁴⁻⁸⁹ Accordingly, when an anti-inflammatory diet was adopted by patients with the metabolic syndrome, both stool and plasma endotoxin levels were reduced,⁹⁰⁻⁹² indicating that endotoxemia can be managed by appropriate dietary changes.

LIMITATIONS

A general limitation is that we currently lack an operational definition of “toxicity,” and likely will continue to, because there are potentially many toxic substances that affect the human body. For example, in patients with chronic kidney disease, a diet low in plant fiber and symbiotic organisms can alter the normal gastrointestinal microbiome, leading to overgrowth of bacteria that produce renal toxins such as cresyl and indoxyl molecules.⁹³ Endotoxin was chosen as a focus in this article because endotoxemia is a measurable state that has been associated with the expression of many chronic conditions. However, the singular focus in this article on endotoxin is also a limitation. Other toxins are potentially viable candidates and should be evaluated by those interested in this field. This is a commentary and therefore is the author’s opinion. Research studies need to be performed to test if any of the recommendations are viable and can be applied in clinical practice.

CONCLUSION

The issue of toxicity has been a clinical interest within the chiropractic profession since the time of Palmer. A common perception that continues today is that “toxicity” promotes subluxation or leads to a biological state in which adjustments do not “hold.” It is also believed that “toxicity” of the intestines and liver can compromise overall health

and wellness. Unfortunately, to date, none of these perceptions of toxicity is coupled with measurement of an actual toxin or its reduction via an interventional therapy. In contrast, bacterial endotoxemia is a measurable state of toxicity that is associated with many common conditions and is correlated to multiple surrogate clinical markers. Endotoxemia also has been correlated directly to the consumption of refined sugar, flour, and oils, which suggests that the focus of detoxification should be the diet itself. Until more research is available, bacterial endotoxin is a candidate toxin that has the most promise.

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CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): D.S.

Design (planned the methods to generate the results): D.S.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): D.S.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): D.S.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): D.S.

Literature search (performed the literature search): D.S.

Writing (responsible for writing a substantive part of the manuscript): D.S.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): D.S.

Practical Applications

- A diet rich in refined sugar, flour, and oils may induce proinflammatory changes within intestinal microbiota that may lead to systemic low-grade endotoxemia.
- A diet to reduce endotoxemia, rather than attempting to target a specific organ, may be a rational approach for addressing the issue of toxicity.

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