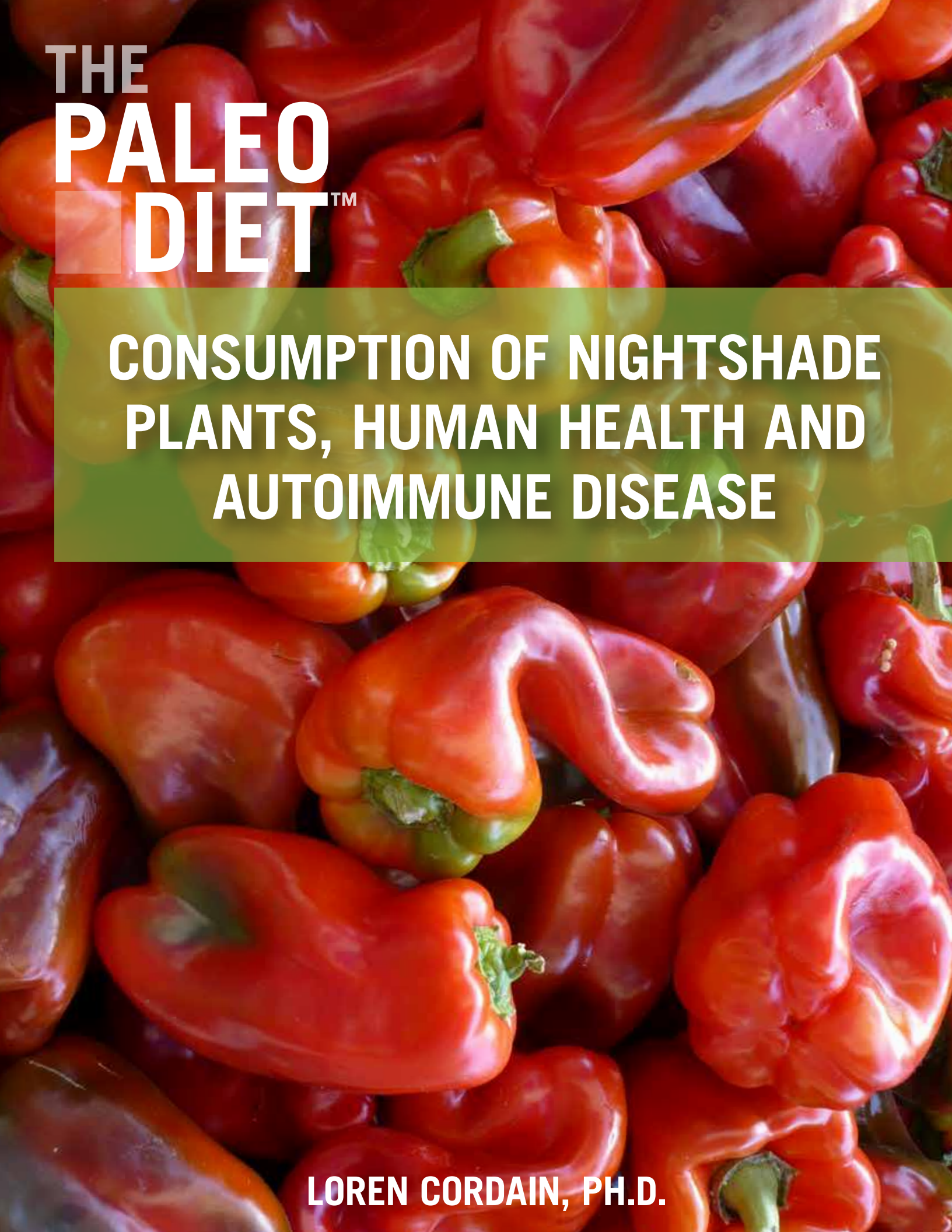

THE
PALEO
DIET™
CONSUMPTION OF NIGHTSHADE PLANTS, HUMAN HEALTH AND AUTOIMMUNE DISEASE
LOREN CORDAIN, PH.D.

CONSUMPTION OF NIGHTSHADE PLANTS, HUMAN HEALTH AND AUTOIMMUNE DISEASE

By Loren Cordain, Ph.D., Professsor

Previously, I have not specifically commented about the nightshade family of plants in any of my three books, however I have written a brief paper (Tomatoes, Vaccines and Autoimmune Disease) demonstrating a possible link between tomato consumption and autoimmune disease.

Nightshade is the common name for flowering plants belonging to the botanical family Solanaceae, which contain more than 75 genera and 2,000 species.[1] Some notorious non-edible nightshades include tobacco, petunias, jimson weed, mandrake, and deadly nightshade. The family comprises well known food plants such as potatoes, tomatoes, green peppers, chili peppers, eggplants and tomatillos. Note that chili peppers include all varieties of peppers from the genus Capsicum, including bell peppers, jalapeno, wax, cayenne, habanero, Anaheim, Thai, Tabasco, cherry, pepperoncini and Serrano among others. Chili peppers are commonly consumed as dried powders such as paprika, chili powder and cayenne, and are near universal ingredients in hot sauces, Tabasco sauces, and salsas. Some more obscure edible plants from the Solanaceae family are listed in Table 1.

Table 2 shows the recent per capita consumption of commonly eaten nightshades. Potatoes come in first (126 lbs) followed by tomatoes (85.7 lbs, including both fresh and processed), peppers (15.5 lbs) and eggplant (0.8 lbs). These figures clearly show that nightshades are a staple food, universally consumed in the U.S. diet. This raises the question: Are there any health hazards associated with eating almost 230 pounds of nightshades on a yearly basis?

Table 2. U.S. per capita nightshade consumption. Data from USDA Economic Research Service.[2]

ITEM	POUNDS	YEAR
Potatoes (total)	126.0	2007
Frozen	53.0	2007
Fresh	44.0	2007
Chips	16.0	2007
Dehydrated	13.0	2007
Fresh Tomatoes	18.5	2008
Processed Tomatoes (total)	67.2	2008
Tomato sauces	23.5	2008
Tomato paste	12.1	2008
Whole tomatoes (Canned)	11.4	2008
Catsup	10.1	2008
Tomato juice	10.1	2008
Bell peppers	9.1	2008
Chili peppers	6.4	2008
Eggplant	0.8	2008
TOTAL	228.0	2008

Table 1. Some obscure and infrequently consumed edible plant foods within the Solanaceae family (adapted from: United States Department of Agriculture, Agricultural Research Service, Beltsville Area, Germplasm Resources Information Network (GRIN). http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl

COMMON NAME OR NAMES	SCIENTIFIC NAME
Tamarillo, Tree tomato, Terong belanda	Cyphomandra betacea
Goji Berry, Wolfberry	Lycium barbarum
Purple ground cherry, Chinese lantern	Quincula lobata
Chinese lantern, Winter cherry, Bladder cherry, Strawberry cherry	Physalis alkekengi
Cut leaf ground cherry	Physalis angulata
Hairy ground-cherry, Dwarf cape gooseberry	Physalis grisea
Cape gooseberries, Golden berry, Husk cherry, Peruvian ground cherry, Poha berry, Giallo grosso	Physalis peruviana
Tomatillo, husk tomato	Physalis philadelphica (formerly Physalis ixocarpa)
Husk tomato, Strawberry tomato, Ground cherry	Physalis pubescens
Sticky gooseberry, Sticky Physalis	Physalis viscose
Gilo, Kumpa, Scarlet eggplant	Solanum aethiopicum
American nightshade, Black nightshade	Solanum americanum
Tzimbalo	Solanum caripense
Kangaroo apple	Solanum laciniatum
Indian nightshade	Solanum lasiocarpum
Garden huckleberry	Solanum melanocerasum
Pepino melon	Solanum muricatum
Lulo, Naranjilla	Solanum quitoense
Cocona, Orinoco-apple, Peach-tomato	Solanum sessiliflorum
Wonderberry, Sunberry	Solanum retroflexum (formerly Solanum X burbankii)
Ashwagandha, Withania, Winter cherry, Indian winter cherry, Indian ginseng	Withania somnifera

POTATOES

Let's first examine potatoes. Potatoes generally maintain one of the highest glycemic index and load values of any food.[3-6] Regular consumption of high glycemic index carbohydrates may promote obesity and diseases of insulin resistance, including type 2 diabetes, cardiovascular disease, abnormal blood lipids, gout, acne, polycystic ovary syndrome, epithelial cell cancers (breast, colon and prostate), acanthosis nigricans (a skin disease), and male vertex balding.[7] Consequently in both of my books I do not recommend that potatoes be included as a regular component of Paleo Diets. Additionally, as you can see from Table 1, most of the potatoes consumed in the U.S. are highly processed in the form of french fries, mashed potatoes, dehydrated potato products, and potato chips. Processed potato foods typically are made with multiple additives (salt, vegetable oils, trans fats, refined sugars, dairy products, cereal grains, preservatives, and other food additives) that may adversely affect health in a variety of ways.

An additional nutritional property of potatoes that is rarely considered in regard to human health is their saponin content. Saponins derive their name from their ability to form "soap" like foams when mixed with water. Chemically, saponins are classified as either steroid glycosides or triterpenoid glycosides. A glycoside is any of a group of organic compounds occurring abundantly in plants that yield a sugar and one or more non-sugar substances upon hydrolysis (chemical decomposition in which a compound is split into other compounds by reacting with water). Steroid glycosides are commonly called glycoalkaloids.

Both categories of saponins are widely distributed throughout the plant kingdom including many cultivated crops. The primary function of saponins is to protect the plant from microbial and insect attack by dissolving cell membranes of these potential predators.[8] In mammals, including humans who consume saponin containing plants, these substances frequently create pores in the gut lining, thereby increasing intestinal permeability.[8-10] If they enter the bloodstream in sufficient concentrations, they cause hemolysis (destruction of the cell membrane) of red blood cells.[8-10]

Figure 1. The proposed mechanism by which dietary saponins may elicit pores in intestinal cells leading to a "leaky gut".[9]

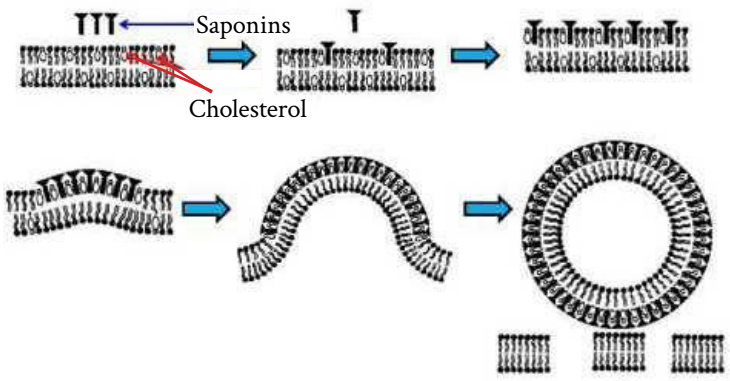


Figure 1 shows how saponins disrupt cell membranes which may lead to a leaky gut. Saponins first bind cholesterol molecules in intestinal cell membranes due to the affinity of a saponin component (the aglycone moiety) for the membrane sterol (cholesterol).[9] In the series of steps that follows, you can see how saponins cause portions of the cell membrane to buckle and eventually break free, forming a pore or a hole in the membrane.

Potatoes contain two glycoalkaloid saponins: α-chaconine and α-solanine which may adversely affect intestinal permeability and aggravate inflammatory bowel disease.[11, 12] Even in normal healthy adults, a meal of mashed potatoes results in the rapid appearance of both α-chaconine and α-solanine in the bloodstream.[13] The toxicity of these two glycoalkaloids is dose dependent – meaning that the greater the concentration in the bloodstream, the greater is their toxic effect. At least 12 separate

cases of human poisoning from potato consumption, involving nearly 2000 people and 30 fatalities have been recorded.[10] Potato saponins can be lethally toxic once in the bloodstream in sufficient concentrations because these glycoalkaloids inhibit a key enzyme (acetyl cholinesterase) required for the synthesis of acetylcholine, a neurotransmitter required for nerve impulse conduction.[10] The concentration of both α-chaconine and α- solanine in a variety of potato foods are listed in Table 3. Note that the highest concentrations of these toxic glycoalkaloids appear in potato foods containing the skins

Table 3. Concentrations (mg/kg) of total glycoalkaloids (α-chaconine + α-solanine) in a variety of potato foods.[10]

Food Item	α-chaconine + α-solanine (mg/kg)
Fried skins	567-1450
Chips with skins	95 - 720
Chips (US potatoes)	23 - 180
Frozen baked potatoes	80 - 123
Frozen skins	65 - 121
Baked potato w/jacket	99 - 113
Dehydrated potato flour	65 - 75
Boiled peeled potato	27 - 42
Canned whole new potatoes	24 - 34
Frozen fried potato	4 - 31
Frozen French fries	2 - 29
Dehydrated potato flakes	15 - 23
French fries	0.4 - 8
Frozen mashed potatoes	2 - 5
Canned peeled potato	1 - 2

So the next logical question arises: Should we be eating a food that contains two known toxins which rapidly enter the bloodstream, increase intestinal permeability and potentially impair the nervous system?

In the opinion of these authors: ". . . if the potato were to be introduced today as a novel food it is likely that its use would not be approved because of the presence of these toxic compounds." [11]

Other researchers state: "Available information suggest that the susceptibility of humans to glycoalkaloids poisoning is both high and very variable: oral doses in the range 1 - 5 mg/kg body weight are marginally to severely toxic to humans whereas 3 - 6 mg/kg body weight can be lethal. The narrow margin between toxicity and lethality is obviously of concern. Although serious glycoalkaloid poisoning of humans is rare, there is a widely held suspicion that mild poisoning is more prevalent than supposed." [10]

The commonly accepted safe limit for total (α-chaconine + α-solanine) in potato foods is 200 mg/kg, a level proposed more than 70 years ago, whereas more recent evidence suggests this level should be lowered to 60 – 70 mg/kg.[10] If you take a look at Table 2 you can see that many potato food products exceed this recommendation.

I believe that far more troubling than the potential toxicity of potato glycoalkaloids is their potential to increase intestinal permeability over the course of a lifetime, most particularly in people with diseases of chronic inflammation (cancer, autoimmune disease, cardiovascular disease and diseases of insulin resistance). A leaky gut has been recently proposed to be a universal initiating trigger for autoimmune diseases[14] – a conclusion that I agree with,[15] as well as promoting cardiovascular disease[16, 17] and diseases of insulin resistance.[18] When the gut becomes "leaky" it is not a good thing, as the intestinal contents may then have access to the immune system which in turn becomes activated thereby causing a chronic low level systemic inflammation known as endotoxemia.[16– 18] In particular a component of the cell walls of gut gram

negative bacteria called lipopolysaccharide (LPS) is highly inflammatory. Any LPS which gets past the gut barrier is immediately engulfed by two types of immune system cells (macrophages and dendritic cells). Once engulfed by these immune cells, LPS binds to a receptor (toll- like receptor-4) on these cells causing a cascade of effects leading to increases in blood concentrations of pro-inflammatory cytokines (localized hormones) including interferon gamma (INF-γ),interleukin 1 (IL- 1), IL-6, IL-8 and tumor necrosis factor alpha (TNF-α)16, 19. Two recent human studies have shown that high potato diets increase the blood inflammatory marker IL-620, 21. Without chronic low level systemic inflammation, it is unlikely that few of the classic diseases of civilization (cancer, cardiovascular disease, autoimmune diseases and diseases of insulin resistance) would have an opportunity to take hold and wreak their fatal effects.

A final note on potatoes – to add insult to injury, this commonly consumed food is a major source of dietary lectins. On average potatoes contain 65 mg of potato lectin per kilogram. As is the case with most lectins, they have been poorly studied in humans, so we really don't have conclusive information how potato lectin may impact human health. However, preliminary tissue studies indicate that potato lectin resists degradation by gut enzymes, bypasses the cell wall barriers and can then bind various tissues.[22,23] Potato lectins have been found to irritate the immune system and produce symptoms of food hypersensitivity in allergenic and non-allergenic patients.[24] Just say "no" to potatoes!!

TOMATOES

In addition to potatoes, tomatoes represent another nightshade which increases intestinal permeability.[25] The primary tomato saponin which causes a leaky gut is the glycoalkaloid, α-tomatine. Table 4 below shows the concentration of α-tomatine in a variety of tomatoes and tomato food products. Note that smaller and unripe tomatoes have noticeably increased concentrations of α-tomatine, whereas this compound is barely detectable in a standard ripe, red tomato. In contrast, ketchup, green salsa, pickled green tomatoes and cherry tomatoes are all concentrated sources of α-tomatine. Although tomatoes typically maintain lower concentrations of glycoalkaloids than potatoes, they are more potent than potatoes in disrupting the intestinal membrane and promoting a "leaky gut".[27]

In addition to α-tomatine, tomatoes contain another anti-nutrient called tomato lectin (TL) which rapidly crosses the gut barrier and enters into the bloodstream in humans.[28] The concentration of TL in tomatoes and tomato products is between 3.0 – 6.0 mg/kg29. More recently, TL has been employed by the pharmaceutical industry to experimentally deliver large molecular weight drugs across the gut barrier.[30, 31]

The simultaneous presence of a saponin and a lectin capable of binding gut tissue has an additive effect upon intestinal permeability.[32] Hence, certain tomatoes and tomato food products contain both saponins and a lectin which compromise intestinal function and promote a "leaky gut." No dietary interventions have ever been carried out in living humans to determine if tomato or potato consumption may adversely affect the immune system and promote inflammation, autoimmune disease and other chronic inflammatory diseases.

TOMATOES AND AUTOIMMUNE DISEASES

Having said this, a convincing body of literature from animal studies shows that α-tomatine is a powerful stimulator of the immune response – so much so that it is employed in vaccines as an adjuvant. Any substance which increases the potency of a vaccine is called an adjuvant. Autoimmune diseases and vaccines have numerous immunological similarities: vaccines "pre-program" the immune system using elements within the vaccine to attack a foreign invader; whereas autoimmune diseases result in the immune system attacking one or more of the body's own tissues.

Table 4. α-tomatine concentrations (mg/kg) in tomatoes and tomato food products.[26]

Type of Tomato or Tomato Product	α-tomatine concentration (mg/kg)
1. Unripe, small immature green	548.0
2. Unripe medium immature green	169.0
3. Pickled green tomatoes (Brand A)	71.5
4. Unripe pickled green	28.0
5. Pickled green tomatoes (Brand B)	28.0
6. Green salsa	27.5
7. Sundried red tomatoes	21.0
8. Unripe green large	16.0
9. Unripe large immature green	10.0
10. Sungold cherry tomatoes	11.0
11. Fried Green tomatoes	11.0
12. Microwaved green tomatoes	11.0
13. Yellow cherry tomatoes	9.7
14. Ketchup	8.6
15. Red Sauce	5.7
16. Yellow pear cherry tomatoes	4.5
17. Tomato juice	2.8
18. Red cherry tomatoes	2.7
19. Condensed tomato soup	2.2
20. Red pear cherry tomatoes	1.3
21. Medium yellow tomatoes	1.3
22. Large yellow tomatoes	1.1
23. Stewed canned tomatoes	1.1
24. Ripe red beefsteak tomato	0.9
25. Green zebra tomatoes	0.6
26. Roma	0.4
27. Standard red ripe tomato	0.3

Before I can address how tomatoes may be involved with autoimmune diseases, I've got to briefly explain how vaccines and adjuvants work. The immune response is normally a healthy reaction because it allows our bodies to detect foreign antigens (proteins) derived from invading microbes and take appropriate steps via the immune system to destroy these organisms. Medicine has taken advantage of this naturally occurring response and has utilized it to prevent diseases in the form of vaccines. With a typical vaccine, dead or weakened microorganisms are injected into the body with a hypodermic needle and syringe. The immune system then recognizes the vaccine antigens as foreign and destroys them, and in the process learns to "remember" them. When the "real" (virulent) version of the vaccine antigen appears, the immune system recognizes the invading microbe and destroys it thereby preventing the disease. With an autoimmune disease, it is as if this very same process occurs, except that the immune response is directed at one or more of the body's own tissues or organs.

When immunologists first began to manufacture vaccines they realized that many vaccines simply didn't work with weakened viruses or bacteria alone. They simply didn't "rev" up the immune system sufficiently to result in a full blown immune response. It was eventually discovered that by mixing weakened or dead microbes with another compound called an adjuvant the effectiveness of the vaccine was increased and full immunity could be established. The three most commonly used adjuvants are 1) alum (aluminum hydroxide), 2) Freund's adjuvant (an antigen solution emulsified in mineral oil, used as an immunopotentiator or compound that boosts the immune system) and 3) Incomplete Freund's adjuvant (the same adjuvant, but without the mycobacterial components). Of these three, only alum is licensed for human use; the other two are used primarily in animals.

So from what I've explained, you might expect it possible for scientists to cause autoimmune diseases by creating vaccines containing some of the body's own tissues (antigens). Clearly, it would be unethical to deliberately cause an autoimmune disease in humans, but experiments in animals confirm that organ specific autoimmune diseases can be caused by injecting a self-antigen with a powerful adjuvant such as Freund's.[33, 34] Neither the adjuvant alone nor the self-antigen typically results in autoimmunity in animals.[33-35] Now the question arises, is it possible that

we can unknowingly be exposed to "natural" vaccines (containing pathogens plus adjuvants) that trick our immune systems into developing immunity against our own tissues?

As immunologists further developed vaccines, instead of injecting the foreign antigen with a hypodermic needle through the skin, they attempted to initiate an immune response by having subjects swallow a capsule containing the foreign antigen. Invariably, these experiments failed because dendritic cells in the gut which normally process foreign antigens did not elicit an immune response, but rather were nonreactive. This nonreactive state by dendritic cells is actually the normal or default response called oral tolerance, and prevents immune responses to non-harmful dietary and microbial antigens. Immunologists discovered that if they administered the foreign antigen containing capsule along with an adjuvant, they could now prevent oral tolerance by dendritic cells and cause a full blown immune response.[36-38] So if a gut borne antigen is simultaneously present with a gut borne adjuvant, the stage is set for promoting an immune response that may lead to an autoimmune disease if molecular mimicry exists between the gut borne antigen and one of the body's own tissues.

Of the common autoimmune diseases (Table 5), infectious agents such as viruses and bacteria are thought to be the most likely environmental trigger.[39] How viruses and bacteria ultimately set off an autoimmune response is not completely understood, but many scientists[40-42] (including me[15]) believe it is through a process called molecular mimicry whereby

Table 5. Common autoimmune diseases.

DISEASE	TISSUE/ORGAN AFFECTED	PREVALENCE
Alopecia areata	Hair follicle	170 per 100,000
Ankylosing spondylitis	Spine and sacroiliac joints	129 per 100,000
Autoimmune urticaria	Skin	330 per 100,000
Celiac disease	Small intestine	400 per 100,000
Crohn's disease	Gastrointestinal tract	184 per 100,000
Diabetes (type 1)	Pancreas	120 per 100,000
Graves' disease	Thyroid gland	1,120 per 100,000
Hashimoto's thyroiditis	Thyroid gland	9,460 per 100,000
Lupus erythematosis	Any tissue in the body	510 per 100,000
Multiple sclerosis	Central nervous system	140 per 100,000
Psoriasis	Skin	2,020 per 100,000
Rheumatoid arthritis	Joints	920 per 100,000
Scleroderma	Skin, many other organs	110 per 100,000
Sjögren's syndrome	Salivary and tear glands	370 per 100,000
Ulcerative colitis	Colon	35-100 per 100,000
Uveitis Anterior	eye	850 per 100,000
Vitiligo	Skin	740 per 100,000

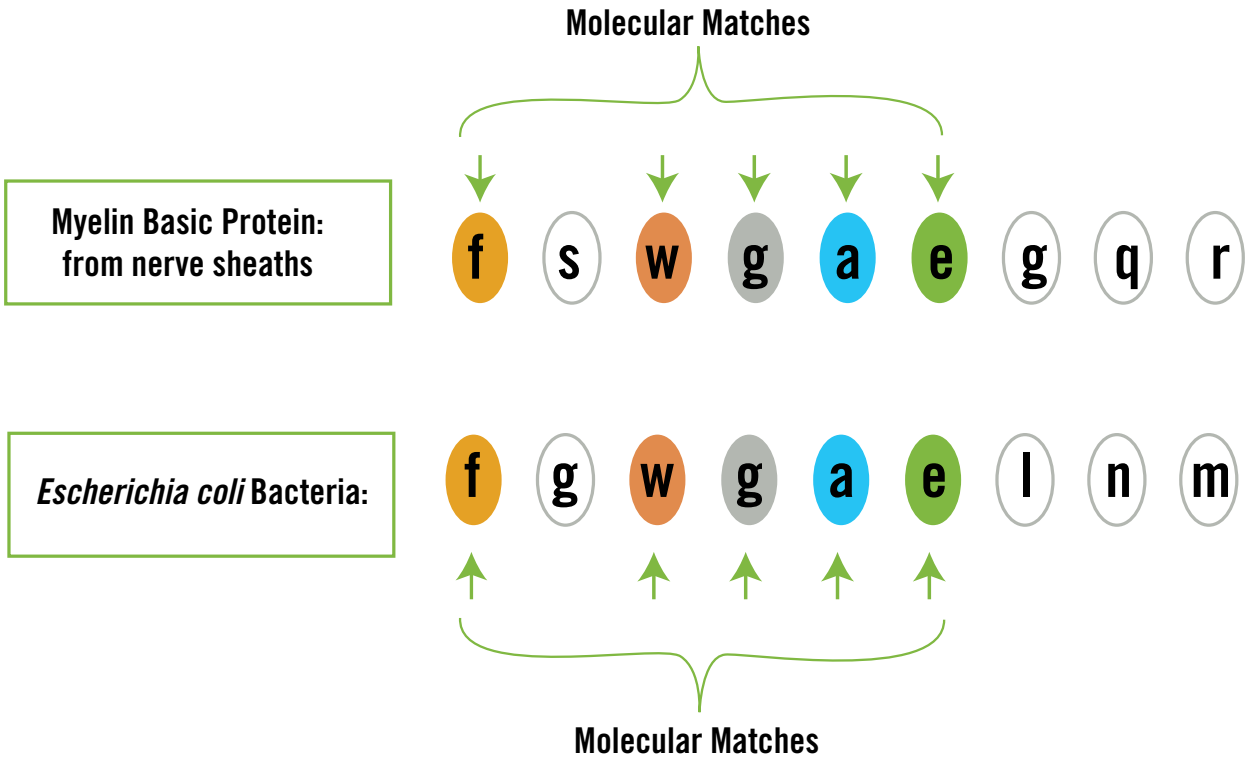
amino acid sequences from viruses and bacteria resemble amino acid sequences in our body's organs and tissues (see Figure 2). This similarity in molecular structure between infectious agents and our body's own tissues sometimes confuses certain components of the immune system causing "self tolerance" to break down, thereby resulting in the destruction of tissues and organs by the immune system.

Exposure to viruses, bacteria and other microbes most typically occurs in a number of ways: 1) the microbe may enter your body through mucous membranes in your nose, mouth or gastrointestinal or genitourinary tracts, or 2) it enters your body through a break in your skin caused by a wound or insect/vector bite. On a daily basis, we are regularly exposed to microbes via all of these pathways, however far and away the greatest regular exposure to microbes comes from viruses and bacteria that reside in our intestines.[43] In healthy people the gut tissue represents a powerful barrier that prevents microorganisms within the gut from entering the bloodstream. Additionally, certain components of the immune system and the liver act to prevent proteins (antigens) from gut microbes from entering circulation. However, under certain circumstances gut permeability may increase thereby facilitating the first step for entry of microbe antigens and food antigens into circulation.[14, 15]

An emerging consensus among scientists who study autoimmune disease is that a number of autoimmune diseases (including type 1 diabetes, Crohn's disease, dermatitis herpetiformis, rheumatoid arthritis, celiac disease, and ankylosing spondylitis) have an environmental trigger that originates from a leaky gut, thereby allowing microbe and food antigens continual access to the immune system.[14, 15, 44, 45]

As I have previously outlined, tomatoes contain two antinutrients (tomato lectin and α-tomatine) which increase intestinal permeability. Additionally, both of these compounds may simultaneously bind the cell walls of various gut bacteria, viruses and partially digested bacteria/viruses thereby forming complexes containing: 1. tomato lectin + viral or bacterial antigen[46, 47] and/or 2. α-tomatine + viral or bacterial antigen. In other words, both tomato lectin and α-tomatine may act as a "Trojan Horse," thereby causing the intestines to become leaky while simultaneously binding to and pulling bacterial and viral antigens past the gut barrier. A healthy immune system response to these foreign antigens

Figure 2. Schematic representation of the molecular mimicry process.



is "oral tolerance" (ignoring) of these gut borne invaders. However if an adjuvant is simultaneously present with these bacterial or viral antigens, then a full blown immune response can occur. Well you guessed it, α-tomatine not only increases intestinal permeability but also is a powerful immunological adjuvant[48-54] used in the manufacture of vaccines. Similarly, tomato lectin acts as a potent adjuvant.[46]

In the wild world of the internet and elsewhere, urban legend has it that consumption of nightshade (tomato, potato, eggplant, bell peppers, hot peppers, and paprika) free diets may improve symptoms in some rheumatoid arthritis patients.[55, 56] Is there any scientific basis for these alleged anecdotal observations? Indeed, in theory a growing body of scientific studies points toward the use of nightshade-free diets in the treatment of rheumatoid arthritis and other autoimmune diseases. To date, no animal or human experiments have been conducted that confirm or deny this hypothetical evidence. As has been my policy in the past, I believe that anyone suffering from an autoimmune disease should remove suspect foods from the diet for an extended period and then monitor symptoms. If conditions get worse after you re-introduce the food, then this particular food may be problematic for you and should not be part of your lifelong diet.

Because the effects of saponins on membrane function and intestinal permeability are dose dependent,[25, 27] then the more saponins you consume the greater the potential for your gut to become leaky. To date, little is known about the dietary threshold concentrations of saponins required to elicit a leaky gut in humans and its associated adverse health effects. My recommendation for healthy people would be to avoid potatoes for all of the reasons I have previously listed. However, because ripe red tomatoes have such low concentrations of α-tomatine, and because they are rich sources of vitamins, minerals and other healthful nutrients, only people with an autoimmune disease or allergies should consider limiting their fresh ripe tomato intake.

CHILI PEPPERS

All chili peppers belong to the genus Capsicum (family Solanaceae) and are among the most heavily consumed spices throughout the world.[57] There are 22 wild species within the Capsicum genus, and five domesticated species,[58] of which more than 200 or more varieties have been produced depending upon various environmental factors to which the plants are exposed.[59] Table 6 shows the five domesticated species and lists a few of the more common varieties of chili peppers.

Botanically speaking, the fruit of capsicums are berries. However, the peppers are considered vegetables (bell peppers) or spices (e.g. cayenne pepper) for culinary purposes, based on factors including fleshiness and intensity of flavor.

Table 6. Some common names for the five domesticated species of the Capsicum genus.

COMMON NAME OR NAMES	SCIENTIFIC NAME
Bell pepper, Cayenne pepper, Cherry pepper, Chili pepper, Paprika, Jalapeno pepper, pimento, Serrano pepper	*Capsicum annuum*
Aji, Brown's Pepper, Peruvian pepper	*Capsicum baccatum*
Habanero chili, Bonnet pepper	*Capsicum chinense*
Tabasco pepper	*Capsicum frutescens*
Rocoto pepper	*Capsicum pubescens*

The sensory "heat" from chili peppers comes from a group of compounds called capsaicinoids. More than 20 capsaicinoids are found in chili peppers, and their concentrations range from 0% by weight to more than 2% by weight.[60] Daily per capita consumption of capsaicinoids from chili peppers in the U.S. and Europe is ~1.5 mg, whereas in India, Mexico and Thailand it is ~25-200 mg.[60] Chili peppers are favorite spices throughout the world because of their pungent or "hot" taste and aroma. So, the greater the concentration of capsaicinoids in the chili pepper, the "hotter" it tastes. Table 7 shows the concentrations of total capsaicinoids in a variety of chili peppers and chili pepper containing foods.

Table 7. Concentrations of total capsaicinoids in a variety of chili peppers and chili pepper containing foods.[60]

PEPPER/FOOD PRODUCT	TOTAL CAPSAICINOID CONTENT (MICROGRAM/G)
McCormick ground cayenne pepper	3,588
Habanero pepper, fresh	2,261
Thai pepper, fresh	1333
McCormick original chili seasonings	830
McIlhenny hot habanero sauce	547
Hungarian hot paprika	439
La Costena Chipotle, whole, canned	416
McCormick hot taco seasoning	394
Mezzetta hot chili, canned	306
La Costena jalapeno green whole pickledcanned	210
Lawry Choula hot sauce	201
McIlhenny Tabasco original hot sauce	195
McCormick mild taco seasoning	186
Lawry Crystal hot sauce, extra hot	174
La Costena seranno, green whole pickled canned	164
Star Foods pepperoncini canned	82
Serrano, fresh	77
Green jalapeno, fresh	76
Red jalapeno, fresh	46
Safeway hot pepper sauce	45
Mezzetta sliced jalapeno, canned	19
Green, red and yellow bell peppers, fresh	0
Roasted red canned	0
Roasted green canned	0
Whole canned peppers	0

Capsaicinoids seem to have both beneficial and deleterious health effects.[60, 61] They have long been used in Mayan and Ayurvedic therapeutic remedies[62] and more recently have found therapeutic application in pain relief.[63]

One of the potential shortcomings of chili peppers is their ability to increase intestinal permeability[64-69] - and this may be their greatest threat to human health. As far back as 1998 it was suggested that chili peppers - because of their capsaicinoids - "may modulate the absorption of low molecular weight food constituents that are involved in the pathogenesis of food allergy and intolerance". [69] More recently, many scientists now believe that increased intestinal permeability, often times called "leaky gut" represents a universal environmental triggering event for autoimmune diseases.[14, 15, 44, 45] As stated earlier, when the gut becomes "leaky" it is not a good thing, as the intestinal contents may then have access to the immune system (which in turn becomes activated), thereby causing a chronic low level systemic inflammation known as endotoxemia[16 – 18] that may promote cardiovascular disease[16, 17] and diseases of insulin resistance.[18] To date, this chain of physiological events (e.g. consumption of chili peppers increases intestinal permeability which increases low level inflammation, which increases the risk for disease) has not yet been demonstrated in living (in vivo) humans. As always, I believe that

anyone suffering from an autoimmune disease should remove suspect foods from the diet for an extended period and then monitor symptoms. If conditions get worse after you re-introduce the food, then this particular food may be problematic for you and should not be part of your lifelong diet.

SUMMARY

In the U.S. we consume almost 230 pounds of nightshades per person on a yearly basis. These common foods (potatoes, tomatoes, chili peppers, and eggplants) have become such staples in our diets that few people rarely - if ever - consider that they are very recent additions to worldwide human nutrition. In fact, prior to 1492 and Columbus' "discovery" of the new world, no Europeans, Middle Easterners, Africans or Asians ever had access to these foods, as they are all indigenous to Central and South America. Hence, humanity as a whole has had very little evolutionary experience with foods that contain multiple toxins (saponins and lectins primarily), which cause numerous adverse health effects in humans and animals. For Paleo Dieters my advice would to be to eliminate or drastically reduce potato consumption and for autoimmune and allergy patients to be cautious with the consumption of tomatoes, chili peppers and eggplants.

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