

The True Content and Faces Behind America's Best-Selling Collagen:

Many health-conscious Americans reach for a morning smoothie for breakfast. Certified organic, Non-GMO, plant-based milk? Check. Certified Organic fresh strawberries, blueberries, and bananas? Check. A squirt of Certified Organic, Non-GMO, Clean Label Project certified agave? Check. And a scoop of Collagen Peptides? Maybe?... or maybe not.

In 2020, in the United States alone, consumers are expected to spend \$293 million on collagen supplements, up from just \$50 million in 2014, according to market research firm Nutrition Business Journal.¹ The global collagen peptide market is estimated to value at nearly US\$ 1 Billion in 2019, and is expected to register a compounded annual growth rate of 7.7%.² Globally, as collagen makes its way into more foods and beverages, topicals, and even the operating room, the market is projected to reach \$6.5 billion by 2025. Major factors driving growth of the global market include rising demand for dietary supplements, increasing adoption of collagen in the food & beverages industry, and growing inclination of consumers toward healthy and protein rich diets. At its core, the growth of collagen is fueled by the consumers' viewpoint that food is medicine and medicine is food.

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What's surprising is that for an industry category that touts itself as a health food and for one that caters to athletes and non-athletes alike who seek tendon, bone, and joint support, as well as non-invasive, more natural efforts to decrease the presence of fine lines and wrinkles, the category has, surprisingly, not embraced core consumer values like certified organic within the food and consumer packaged goods category. Looking at the Amazon.com Collagen Peptides best-sellers list, less than 10% of the top selling Collagen Peptides are certified organic. With claims like “Pure”, “All Natural”, and “Cleanest nutrition possible” coupled with pictures on packaging and websites of cows grazing, open pastures, cage-free chickens, and open-ocean fish, a consumer is expecting these brands and products to share the same values of purity, health, and animal welfare. So what's actually in America's best-selling collagen? Where does it come from? Organic Consumers Association and Clean Label Project decided to take a closer look at the true content and faces behind the ‘Fountain of Youth’¹.

What is Collagen?

According to Medical News Today,³ collagen is the most abundant protein in the human body, found in the bones, muscles, skin, and tendons. It is the substance that holds the body together and forms a scaffold to provide strength and



“When it comes to collagen supplements the most common are derived from bovine, chicken, beef, and fish.”

structure. While you can't measure your collagen level, you can tell when it's falling. Collagen decreases as you get age, contributing to⁴:

- Wrinkles and crêpey skin
- Stiffer, less flexible tendons and ligaments
- Shrinking, weakening muscles
- Joint pain or osteoarthritis due to worn cartilage
- Gastrointestinal problems due to thinning of the lining in your digestive tract

This protein is not just found in the human body, rather the bodies of many animals. When it comes to collagen supplements the most common are derived from bovine, chicken, beef, and fish. Until recently, collagen was frequently used as a cosmetic filler. Its use involves injection into the skin in order to fill or plump an area of the skin with fine lines and wrinkles. Additional cosmetic filler, including Botox and synthetic materials, are also used for facial muscle relaxation and wrinkle reduction. Collagen has been growing in popularity as a dietary supplement in the form of a tablet or a powder. It's inclusion in functional drinks and foods is also on the rise. Proponents of collagen supplements state that if taken regularly, it can reduce skin dryness, increase skin elasticity and hydration, and reduce depth of wrinkles.^{5,6} Studies also show that collagen can help with overall joint pain relief.^{7,8}

How Collagen Is Made

Collagen supplements are made from animal byproducts, including the skin or hide, tendons, scales, bones, cartilage, and connective tissues left over after cows, chickens, pigs, and fish have been processed for their meat, and in some cases, eggshells. These animal byproducts are boiled down until they turn into a

gelatin.⁹ The gelatin then undergoes hydrolyzation to break down the proteins into smaller units, called peptides, so the human body can better absorb and use them.¹⁰

Previous Studies on the True Content of America's Best-Selling Protein Powders

In 2010, Consumer Reports¹¹, purchased 15 of the top-selling protein powders and tested multiple samples of each for arsenic, cadmium, lead, and mercury. The results showed a considerable range, but levels in several products were of particular concern because consuming three servings a day could result in daily exposure to arsenic, cadmium, or lead exceeding the limits proposed by USP. The study referenced that cadmium raises special concern because it accumulates in and can damage the kidneys, the same organs that can be damaged by excessive protein consumption. And it can take 20 years for the body to eliminate even half the cadmium absorbed today.

In March 2018, the national non-profit Clean Label Project¹², completed an investigation of 134 protein powder products from 52 brands with findings that validate the work of Consumer

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Reports. Clean Label Project screened these products for over 130 toxins including heavy metals, bisphenols (plasticizers linked to endocrine disruption and infertility), pesticides, and other contaminants with links to cancer and other health conditions. Their findings revealed:

- 70% of top-selling protein powders had measurable levels of lead ranging from non-detect to 123.5ppb
- 74% of top-selling protein powders had measurable levels of cadmium ranging from non-detect to 306ppb
- This is in addition to the Bisphenol A (BPA) packaging migration observed in 55% of best-selling protein powders

The Organic Consumers Association & Clean Label Project's 2020 Collagen Heavy Metals Study

So what's in the collagen that so many people put in their morning smoothie or post-workout recovery drinks? Organic Consumers Association and Clean Label Project decided to take a closer look with a focus on heavy metals.

The Sampling and Testing Process

Organic Consumers Association and Clean Label Project used the Amazon.com best-sellers list and Clean Label Project 2018's protein powder investigation results as sources for the brands and products to use for this study.

The samples were procured from local, national, and online retailers using Clean Label Project's Consumer Chain of Custody and Sampling Methodology.¹³ This process is intended to replicate the consumer shopping experience and procure samples the same way consumers do. The only difference is instead of taking them home and putting them in the pantry or

refrigerator, the samples are sent off to an accredited analytical chemistry laboratory for testing.

Methodology

These samples were sent to accredited laboratories to test for total arsenic, cadmium, lead, and mercury. In total, 28 collagen products were tested. Food testing was performed by ISO accredited analytical chemistry laboratories using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). HRI Labs and Ellipse Analytics performed the testing. The method used for testing was the Environmental Protection Agency Inductively Coupled Plasma- Mass Spectrometry (EPA 6020A, 3015). The Level of Quantification for the testing was 8 parts per billion.

Upon completion of the testing, the results were reported on a per serving basis and compared to the Safe Harbor Levels outlined by the California Office of Environmental Health Hazard Assessment Safe Drinking Water and Toxic Enforcement Act of 1986, also known as California Proposition 65.

The test result details are provided in Chart 1, (see page 10).

Findings

The test results were compared to California Proposition 65.¹⁴ Officially known as the Safe Drinking Water and Toxic Enforcement Act of 1986, Proposition 65 was enacted as a ballot initiative in November 1986. The proposition protects the state's drinking water sources from being contaminated with chemicals known to cause cancer, birth defects or other reproductive harm, and requires businesses to inform Californians about exposures to such chemicals.

Proposition 65 requires the state to maintain and update a list of chemicals known to the state to cause cancer or reproductive toxicity.

Total Arsenic

Arsenic is metal and an element on the periodic table. It is found naturally but is also used in industrial settings such as mining and



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smelting operations. It is also toxic to humans and animals, and can leach into soil and water where it can be absorbed by plants. In areas where arsenic is not naturally present at high levels, food usually contributes most to the daily intake of arsenic. Fish, shellfish, meat, poultry, dairy products and cereals are the main sources of dietary intake. In areas where arsenic is naturally present at high levels, food (e.g. rice) prepared with high-arsenic water and food crops irrigated with contaminated water also contribute to total daily intake.¹⁵

Overall test findings:

- 36% of the collagen products tested were Non-Detect for Arsenic on a per serving basis
- 64% of the collagen products tested had measurable levels of Arsenic on a per serving basis ranging from 0.09 micrograms/serving up to 4.7 micrograms/serving
- The Garden of Life Unflavored Collagen Peptides product tested had the most amount of Arsenic among the 30 collagen products tested.
- None of the products tested exceeded the 10 micrograms/serving State of California threshold.

Cadmium

Cadmium¹⁶ is a toxic natural element found worldwide. It enters the food chain through industrial contamination of soil and water, but is also found in cigarettes. Cadmium can be found in fruits, vegetables, and grains such as rice, as well as organ meats, shellfish and protein drinks. Exposure to cadmium can damage kidneys in humans and animals.

Overall findings:

- 83% of the collagen products tested were Non-Detect for Cadmium on a per serving basis
- 17% of the collagen products tested had measurable levels of Cadmium on a per serving basis ranging from 0.23 micrograms/serving up to 9.17 micrograms/serving
- The BulletProof Collagen Protein Chocolate had the highest amount of Cadmium among the 30 collagen products tested.

- A single serving of BulletProof Collagen Protein Chocolate tested had over 2 times the State of California's Prop 65 threshold.

Mercury

Mercury¹⁷ is a metal that occurs naturally in the environment, but can also be found because of pollution, farming, industrial practices and manufacturing (e.g. processed food cans). A form of mercury (methylmercury) is found in most seafood, which is why the FDA recommends limiting how much seafood you eat. Mercury damages the central nervous system, including the brain of humans, cats, and dogs.

Overall findings:

- 66% of the products tested were Non-Detect for Mercury on a per serving basis
- 34% of the products tested positive for Mercury but only at trace levels (levels below the 8ppb level of quantification)

Lead

Like mercury, lead¹⁸ is a harmful toxic heavy metal. It is used in many industrial processes, and used to be a common material for making paints and water pipes. Like other toxins, lead can leach into water and soil and contaminate foods. Lead poisoning affects memory and learning in children, and can cause stunted growth and kidney damage. In dogs and cats, lead has been linked to brain damage, kidney damage, and death.

Overall findings:

- 63% of the products tested were Non-Detect for Lead on a per serving basis
- 37% of the products tested had measurable levels of Lead on a per serving basis ranging from 0.09 micrograms/serving up to 1.57 micrograms/serving
- The Orgain Collagen Peptides, Unflavored had the most amount of Lead among the 30 collagen products tested.
- A single serving of Orgain Collagen Peptides, Unflavored had over 3 times the State of California



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threshold. Ancient Nutrition Keto Collagen Chocolate, Bulletproof Collagen Protein Chocolate, and Preferred Elements Keto Collagen Chocolate all had over 2 times the State of California threshold.

Concentrated Animal Feeding Operations and Its Links to Heavy Metals

Some collagen manufacturers tout the health benefits of collagen-derived peptides, without disclosing the potential risks nor the fact that most collagen supplements are products of an industry at odds with the values of most environmentally and health-conscious consumers. In fact, the majority of collagen products on the market today come from animals raised on industrial factory farms—or what the industry calls Concentrated Animal Feeding Operations (CAFOs)—where among other things, the animals are exposed to heavy metals. Heavy metals, even at low levels, are known to cause organ damage, and some are classified by the U.S. Environmental Protection Agency (EPA) and the International Agency for Research on Cancer as known or probable carcinogens.¹⁹

“A large percentage of beef collagen products are made not from bone broth, but from discarded animal hides that have been soaked in vats of acid, treated with sulfides (to remove hair), chromium, bleach, color dyes, and other chemicals, leading to an increased risk of multiple contaminants).²⁰”

Animals and humans have trouble metabolizing heavy metals, so the toxins can accumulate in soft tissue and bones. These are the very parts of the animal used to make collagen.

Here are examples of problematic, potentially contaminated animal parts, derived from CAFOs, and used in popular collagen products:

- A large percentage of beef collagen products are made not from bone broth, but from discarded animal hides that have been soaked in vats of acid, treated with sulfides (to remove hair), chromium, bleach, color dyes, and other chemicals, leading to an increased risk of multiple contaminants.²⁰ When raw, newly skinned hides arrive to the tannery on large pallets, they can be left to rot for weeks before being processed. Hides with scars and imperfections are discarded once they’ve gone through this processing, and these castoffs are what are used to make bovine hide-based collagen supplements. The already processed scraps then undergo additional processing to dissolve the hide and release the collagen peptides.²¹ Even beef collagen advertised as made with the hides of grass-fed cattle are potentially contaminated. Most grass-fed beef in the U.S. comes from Brazil²² and Argentina, where “grass-fed beef” operations have been converted to U.S.-style CAFOs.

- Non-organic domestic collagen products made from chicken or eggshells likely come from poultry CAFOs or egg CAFOs. The sternum is the part of the chicken most often used for chicken collagen powder, and most of that is sourced from CAFOs in China.²³ The use of antibiotics in chicken CAFOs is widespread and well documented.²⁴ Egg CAFOs are associated with, among other things, salmonella outbreaks.²⁵

The Problem With Factory Farms

The American Public Health Association (APHA) recently called for a moratorium on CAFOs. Among the many reasons cited by the report is this: CAFOs annually generate an estimated 575 billion pounds of animal manure containing antibiotics, pathogen bacteria, nitrogen and phosphorus, as well as dust, mold, bacterial endotoxins and volatile gases—and heavy metals.²⁶ For CAFO animals, heavy metals exposure is a vicious circle. The animals are



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fed GMO grains contaminated with heavy metals²⁷, plus pesticides²⁸ (which also can contain heavy metals), hormones, antibiotics and other drugs.²⁹ When the animals excrete this toxic soup, their manure contaminates surrounding soil³⁰ and waterways—resulting in the animals’ drinking water contaminated with heavy metals, and being exposed to heavy metals through contact with the contaminated soil. If that weren’t enough, the GMO corn and soy used in animal feed are treated with synthetic fertilizer, also known to contain heavy metals. The plants take up the bioavailable heavy metals from the contaminated soil and store it in their tissues.³¹

Although many consumers may be unaware that most collagen supplements are products of the factory farm industry, many of those same consumers *are* well-informed when it comes to the many other health-related reasons to avoid all products derived from industrial livestock. Personal health is one of the top reasons health-conscious consumers steer clear of CAFO products. Consuming CAFO products increases consumers’ risk of exposure to pathogens, hormones and drugs (some of which have been banned, according to Consumer Reports).³² According to the APHA²⁶, manure pathogens, such as those linked to recent romaine lettuce e. coli outbreaks, can cause severe gastrointestinal disease, complications, and sometimes death. Increasingly, consumers are concerned about what the World Health Organization³³ says is a growing public health crisis: antibiotic resistance. The crisis is largely attributed to the reckless use of medically important

antibiotics in the industrial livestock industry. Air pollution-related health concerns are also linked to CAFOs, according to the U.S. Environmental Protection Agency.³⁴ A recent joint investigation by Food & Environment and Reporting Network³⁵ into the Texas cattle industry found that exposure to “fecal dust” containing ammonia and particulate matter, both byproducts of cow manure, caused everything from coughing and breathing difficulties to asthma, irregular heartbeat and premature death in people with heart or lung disease. According to the investigation, hydrogen sulfide, which can impair a person’s respiratory and nervous systems, can also form as manure decomposes. The authors also cited a 2009 study³⁶ by Oxford University Press revealing that doubling livestock production is correlated with a 7.4-percent increase in infant mortality due to respiratory disease.

In addition to personal health concerns, consumers are compelled by a host of other issues to reject products derived from CAFOs. Animal rights activists³⁷ have long loathed CAFOs for their history of widespread animal abuse and labor³⁸ and social justice groups consistently call out the industry for unsafe and unjust working conditions. Consumers³⁹ also cite environmental concerns, including the massive use of pesticides to grow crops that feed CAFO animals, and water pollution related to pesticides, fertilizers, antibiotics, and other chemicals and drugs. A July 2018 report⁴⁰ by the Food and Agriculture Organization of the United Nations listed agriculture, not human settlements or industry, as the world’s No. 1 source of water pollution. The industrial agriculture industry is under increasing attack by climate activists, too.

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According to some of the latest research⁴¹, together, the world's top five meat and dairy corporations are now responsible for more annual greenhouse gas emissions than Exxon, Shell or BP. Food, farming and climate groups are calling for a moratorium on CAFOs and policy initiatives, like the Green New Deal.

What should a concerned brand do?

The unfortunate reality is that the certified organic collagen supply is limited. Certified organic collagen comes from certified organic animals, and the quantity of domestic certified organic beef cattle is dwarfed by the volume of conventionally raised-cattle. According to the USAA-NASS⁴², in 2018 there were 31.8 million beef cattle. Meanwhile, according to the Agricultural Marketing Resource Center⁴³, there were 2.3 million acres of organic certified rangeland and just 46,014 organically-certified beef cows. The other collagen production limitation is the lack of segregation at slaughterhouses post-production. While procedures are in place to segregate certified organic animals prior to slaughter, after the meat is rendered, the remaining carcasses may not be segregated. In other words, unless there is down stream market demand for certified organic rendered carcasses (which yield collagen), slaughterhouses will not implement procedures to protect organic integrity after meat is rendered. This makes it extremely difficult for brands who want to source organic collagen to be able to identify reputable, legitimate, and high-quality sources. Brands that have achieved organic certification are likely able to do so because they have a more vertically integrated supply chain.

It is also important to keep in mind that rendered animals play an important role in sustainability. If an animal is destined for human consumption, ensuring the entire animal is being utilized as opposed to being discarded is important.

Ultimately, the onus is on consumers to demand certified organic collagen and the industry will follow suit and deliver on the expectation.

What should a concerned consumer do?

A few things:

1) Based on the products tested, when it comes to having the lowest levels of heavy metals. The top collagen products tested are:

- BioOptimal Collagen Powder, Unflavored
- Neocell Super Collagen
- Puori CP1 Pure Collagen Peptides

2) An honorable mention also goes to Organixx Organic Bone Broth Protein, Plain as it was a high performer as well as being certified organic and therefore fostering a supply chain rooted in transparency, animal welfare, and sustainable agriculture practices.

3) It should be noted that Zint Collagen was also non-detect for each of the heavy metals analyzed. However, on January 21st of this year ALL Zint⁴⁴ products were recalled by the FDA because of violations of current good manufacturing practice regulations.

4) Was your favorite collagen product not tested? Contact them and tell them that certified organic principles of animal welfare are important to you. Tell them that testing for heavy metals is important too.

5) Was your favorite collagen product on the list and it didn't perform as well as you had hoped? Contact them. Tell them to do better. Tell them that sourcing organic is important to health and the environment and ask them to make the switch.

6) Overall, be a conscious consumer. When you see products with claims, ask for more details. Don't just trust the marketing. Demand to know more about the data, science, and validity behind those claims.

7) Vote with your dollars. Marketing departments do an effective job at selling comfort and security. Demand that these multi-million dollar brands do better to deliver on the consumer promise of safety and quality.



About Organic Consumers Association

Organic Consumers Association (OCA) is a 501(c)(3) nonprofit grassroots organization advocating on behalf of millions of consumers for safe, healthful food and a clean environment. Visit: <https://www.organicconsumers.org/>

About Clean Label Project

Clean Label Project is a national non-profit with the mission to bring truth and transparency to consumer product labeling. To learn more, visit CleanLabelProject.org

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⁴⁴FDA. (2020, January 21). ABH NATURE'S PRODUCTS, INC, ABH PHARMA, INC., and STOCKNUTRA.COM, INC. Issues Nationwide Recall of All Lots of Dietary Supplement Products. Retrieved April 09, 2020, from <https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts/abh-natures-products-inc-abh-pharma-inc-and-stocknutracom-inc-issues-nationwide-recall-all-lots>



Chart 1: 2020 Heavy Metals In Collagen Study Test Result Details

Brand	Product	Serving Size (g)	Arenic in mcg/serving	Cd mcg/serving	Mercury	Lead in mcg/serving
Ancient Nutrition	Bone Broth Protein_Pure	22	ND	0.00	Trace	0.00
Ancient Nutrition	Multi Collagen Protein_Type I, II, III, V and X	22	1.56	0.00	Trace	0.00
Ancient Nutrition	Keto Collagen, Chocolate	20.9	0.6	1.72	Trace	1.29
BioOptimal	Collagen Powder, Unflavored	10	ND	0.00	ND	0.00
Bulletproof	Collagen Protein, Chocolate	41	2.1	9.17	ND	1.33
Code Age	Multi Collagen Peptides, Unflavored	9	0.3	0.00	ND	0.00
Correxiko	Marine Collagen, Unflavored	10	0.5	0.00	Trace	0.00
Further Food	Collagen Peptides, Unflavored	8	0.1	0.00	ND	0.14
Garden of Life	Collagen Peptides, Unflavored	20	4.7	0.00	ND	0.00
Great Lakes Gelatin	Collagen Hydrolysate, Pure Unflavored Protein	12	0.6	0.00	ND	0.00
MAV Nutrition	Collagen Peptides, Unflavored	11	0.4	0.00	ND	0.14
Neocell	Super Collagen	6.6	ND	0.00	ND	0.00
Orgain	Collagen Peptides_Unflavored	20	ND	0.00	Trace	1.57
Organixx	Clean Sourced Collagens_Anti-Aging Blend	8.5	ND	0.00	Trace	0.09
Organixx	Organic Bone Broth Protein_Plain	22	ND	0.00	Trace	0.22
Perfect	Hydrolyzed Collagen Peptides	11	0.2	0.00	ND	0.00
Perfotek	Hydrolyzed Collagen + Peptides, Unflavored	11	1.7	0.00	ND	0.00
Preferred Elements	Keyto Collagen, Chocolate	18.3	0.5	0.23	ND	1.10
Primal Kitchen	Collagen Fuel, Chocolate Coconut	16.4	0.4	0.24	ND	0.00
Puori	CP1 - Pure Collagen Peptides	20	ND	0.00	ND	0.00
Reserveage Nutrition	Collagen Replenish Powder	2.6	ND	0.00	Trace	0.00
Root Vitality	Collagen Powder, Unflavored	10	ND	0.00	ND	0.09
SkinnyFit	Super Youth Multi Collagen with Peptides	7.8	0.8	0.00	ND	0.00
Sports Research	Collagen Peptides, Unflavored	11.07	0.5	0.00	ND	0.12
Vital Proteins	Bone Broth Collagen_Beef	10	0.09	0.00	Trace	0.00
Vital Proteins	Marine Collagen, Unflavored	12	0.5	0.00	ND	0.00
Zammex	Hydrolyzed Collagen Peptides, Pure Unflavored	10	0.2	0.00	ND	0.00
Zint	Collagen	12	ND	0.00	ND	0.00



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