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Journal of Health and Healing

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Francis M. Pottenger, Jr., MD

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FROM THE EXECUTIVE DIRECTOR

Dear Members and Friends,

We are pleased and honored to support your journey toward health and well-being, and like you, we are hopeful for what the new year will bring. While 2021 was a year of unimaginable challenges, it revealed truths about the power of food as medicine, our urgent need and responsibility to take better care of one another and our planet, and the strength of the human spirit.

Many of us are once again feeling the freedom to roam. I'm grateful that several of my friends and family crisscrossed the U.S. to be home for Thanksgiving. After being absent since March of 2020, connection and community have thankfully returned to our lives. However, with reports of virulent COVID-19 variants, we must remain watchful.

In this issue, Linda L. Isaacs, MD, who uses nutritional protocols to treat people diagnosed with cancer and other degenerative diseases, shares how pancreatic enzymes have helped her patients. Based on personal interviews, we have included three inspiring stories of success from patients of Dr. Isaacs.

With so much interest in natural antiviral remedies, we are pleased to introduce our readers to a brilliant naturopath and researcher, Anna Sitkoff, ND. Dr. Sitkoff vividly presents the remarkable constituents of mushrooms in her timely and informative article.

Finally, we feature an article from our Research Archives, by Dr. Francis M. Pottenger, Jr., about dry skin and the curative qualities of lamb fat. Also included is our holiday recipe section, where you will discover nutrient-dense and delicious meal ideas and recipes!

Your membership supports our mission, and your donations empower our impact. Thanks to generous contributions from other members like you, this year we launched more free-to-the-public nutrition guidance initiatives than ever—positively impacting the lives of tens of thousands of new followers!

One of these initiatives is News for Now. In early November, we reported that the Senate Agriculture, Nutrition and Forestry Subcommittee on Food and Nutrition introduced the Protect America's Children from Toxic Pesticides Act of 2021. This historic legislation would overhaul the nation's pesticide laws protecting farmworkers, our children, and every one of us. You can help ensure its passage by informing your representatives of your support.

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Together, we will soon welcome a new year and a new beginning. Today's heightened attention to the importance of nutrition and immunity gives us an unparalleled opportunity to make a positive difference in the health of more people everywhere. Thank you for your support of the Price-Pottenger Nutrition Foundation.

Wishing you health and joy,

Steven Schindler
Executive Director
ExecutiveDirector@price-pottenger.org

Pancreatic Enzymes: Not Just for Digestion

by Linda L. Isaacs, MD

You may have heard of enzymes before or had them recommended to you by a health practitioner to improve your digestion. But do you know what they are, how they have been used historically to improve health, and how they can help you in other ways?

WHAT ARE ENZYMES?

Enzymes are proteins made by a living being (animal or plant) to initiate chemical reactions that would not occur without them. For example, if you mix starch into water, then add the enzyme amylase by spitting into the solution, the starch is broken down into glucose. But without the enzyme, the change will not occur; the starch will just sit there.

Plants and animals have many different enzymes to manage all the chemical reactions that make life possible. Each type of enzyme is specific for a certain kind of chemical and/or reaction. Using our example above, starch fits neatly into a specific area in the amylase enzyme. The amylase then changes its shape, turning the starch into glucose as it does so. As the glucose is released from the starch, the amylase goes back to its original shape, waiting for the next starch molecule to come along.

Here are the major classes of enzymes made by the pancreas and then secreted into the intestine to digest food:

- Protease: breaks down proteins (trypsin and chymotrypsin are examples)
- Amylase: breaks down starch
- Lipase: breaks down fat

Early investigators called digestive enzymes "ferments," because they recognized the similarities between fermentation and the actions of digestive enzymes. In fermentation, enzymes produced in microorganisms change the properties of food. Mankind was fermenting food for millennia, making beer, yogurt, and sauerkraut, before the underlying mechanisms were discovered.

USE FOR DIGESTIVE DISTURBANCES

As might be expected, once the existence of digestive enzymes was established, preparations of them were used for digestive disorders. The 1892 book *Fairchild's Hand-Book of the Digestive Ferments* describes a number of preparations and their uses for complaints referred to as dyspepsia and intestinal indigestion.[1]

In current medical practice, pancreatic enzyme supplementation is typically reserved for patients with overt pancreatic insufficiency, caused by damage to the pancreas from cystic fibrosis or chronic alcohol overuse. These patients lose weight because they cannot digest their food properly, especially fat. They report loose stool with an oily character, and pancreatic insufficiency is usually easy to confirm by laboratory testing.

However, various investigators throughout the 20th century studied whether enzyme supplements could help with milder digestive symptoms, such as distension, bloating, and gas after meals. In a 2018 article, the authors reviewed 60 years' worth of such studies and concluded that there is good reason to believe that enzyme supplementation can be helpful for these conditions.[2]

RATIONALE FOR USE IN CANCER

While I recommend that enzymes be taken with meals to aid digestion, the main thrust of

the work I do involves utilizing them in the management of cancer. In the early 20th century, John Beard, DSc, Professor at the University of Edinburgh, was the first to propose that pancreatic enzymes could play a role in cancer treatment. His theory had its roots in his own field, embryology, the study of the very early stages of life. Many before him had noted that cancer under the microscope looks much like the cells of the developing embryo.

Beard suggested that cancer arises from a very specific type of embryonic cell, the trophoblast, the early stage of the placenta. The trophoblast's job is to create a firm anchor between mother and baby, and a blood supply for the exchange of nutrients and wastes. The trophoblast invades the maternal womb, acting much like cancer, which also invades tissue and creates a blood supply. But there is one key difference between cancer and the trophoblast: cancer keeps invading, but the trophoblast stops. At a certain point early in the pregnancy, the trophoblast changes from an invasive tissue into the mature placenta. Beard found that in a number of species, this change took place when the baby's pancreas began making proteolytic enzymes—months before they would be needed to digest food.[3]

While I recommend that enzymes be taken with meals to aid digestion, the main thrust of the work I do involves utilizing them in the management of cancer.

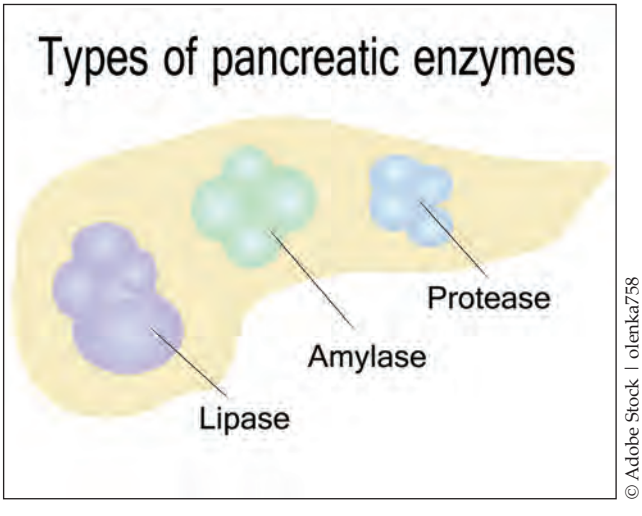
Pancreatic enzymes were subsequently tested in a mouse model of cancer, then tried in humans, with some successes and some failures. In his 1911 book, *The Enzyme Treatment of Cancer and Its Scientific Basis*, Beard exhaustively reviewed these early cases, along with the wide variation in the quality of available enzymes that explained why sometimes the treatment was unsuccessful.[4] But the medical world decided that Beard was wrong, and by the time he died in 1924, interest in his work had gradually trickled away to almost nothing.

CLINICAL RESULTS

Over the following decades, a few physicians heard of Beard's theories and implemented cancer treatment with proteolytic enzymes.[5,6] In the 1950s and 1960s, Franklin L. Shively, MD, a surgeon in Ohio, administered various pancreatic enzymes, purified by the methods available at the time, intravenously to cancer patients. In response, in 1964, the Food and Drug Administration outlawed intravenous and injectable enzymes, so Shively stopped his work, turned his research notes into a book, *Multiple Proteolytic Enzyme Therapy of Cancer*, and sent copies free of charge to medical libraries throughout the United States.[7,8]

Shively described multiple cases where masses or fluid collections resolved. Diagnostic methods such as CT scans did not exist then, so assessments were based on physical examination only. Sometimes, after an initial success, the treatment was stopped and then the disease recurred, suggesting that neither Shively nor the patient understood that maintenance therapy might be needed to keep the disease under control.

Around the time Shively's work was ending, in Texas, William Donald Kelley, DDS, was told he had terminal cancer. He never had a formal tissue diagnosis—not unusual in the era prior to scans and needle biopsies—but he had lost



massive amounts of weight and had a tumor in his abdomen. In desperation, Kelley created a protocol for himself that included a plant-based diet and coffee enemas, as well as large amounts of oral pancreatic enzymes. When he got better, others with cancer came to him to find out how he did it, and his practice gradually migrated from orthodontics to controversial cancer treatment.

Kelley did not know of Beard's work when he started taking large amounts of enzymes; he did that to help with his digestion, and then noted a change in the tumor he could feel in his abdomen. Beard and others believed that pancreatic enzymes would be destroyed in the digestive tract if swallowed, and so had to be given by injection. But Kelley found that if the enzymes were administered away from meals, patients responded positively.

Nick found that many patients with appropriately diagnosed cancer whom Kelley had treated were still alive years after they should have died.

In the early 1980s, Nicholas J. Gonzalez, MD, conducted a multi-year review of Kelley's methods and records. I met Nick Gonzalez while he was in the middle of this project, and the cases he found in Kelley's files convinced both him and me that we needed to dedicate our careers to following up on these methods. As an example, one of Kelley's patients had a hysterectomy for uterine cancer in 1969, but in 1975 she had a pelvic mass removed that was found to be recurrent disease. Multiple masses were seen on a chest X-ray, indicating spread to the lungs. She then started the Kelley program, and years later, a repeat chest X-ray demonstrated that the masses were no longer there. She died in 2009 at age 95, more than 30 years after a diagnosis that usually kills within months.

Nick found that many patients with appropriately diagnosed cancer whom Kelley had treated were still alive years after they should have died. There were far too many to be explained away as spontaneous remissions.[9] Fifty of these cases are included in Nick's monograph about Kelley's results, which is available under the title *One Man Alone*.[10]

In 1987, Nick opened a practice in New York City to recreate Kelley's methods, hoping to eventually proceed with formal research. I helped administratively for two years, took a break to finish my internal medicine training, then rejoined him in 1991. In 1993, after only six years in practice, Nick presented 25 "best cases"—patients he treated who had unusually good outcomes—to the National Cancer Institute.[11] A monograph Nick and I put together for him to hand out at the session, with details of the patients' histories and medical records, is available, entitled *Proof of Concept*.[12]

Subsequently, Nick and I completed a pilot study with 11 patients suffering from pancreatic cancer, with an 81% survival rate at one year and a 45% survival rate at two years, well above the usual statistics for this particularly dismal cancer.[13] We then embarked on a controlled clinical trial comparing our methods to chemotherapy, administered through one of the major medical centers in New York City. The academics involved published their version of the results in 2010, but their article does not mention that adherence to our arm of the protocol had been a huge problem, acknowledged by a representative of the governmental funding agency as "clouding the interpretation of the data."[14,15] While a detailed explanation of the problems with the study is beyond the scope of this article, as an example, we calculated that 11 of 38 patients assigned to the nutritional arm of the study never started or quit within seven days.

Nick and I each published our reservations about the administration and outcome of the trial, he as the book *What Went Wrong*, I as an article about trial design.[16,17] A patient of mine with appropriately diagnosed pancreatic cancer was refused entry to the trial because she technically could have undergone surgery to remove it. She followed our treatment outside of the trial and is still alive, more than 20 years since her diagnosis, never having had surgery, chemotherapy, or radiation. [See patient's story, page 9.]

After the bitter disappointment of the failed clinical trial, Nick and I returned to writing up case reports discussing patients with lengthy—and in many cases, continuing—survival.[18-21] These case reports are available as downloadable articles on my website (drlindai.com) or in book form. Since his death in 2015, I have continued this effort, publishing two more case reports in 2019.[22]

Others have used the oral enzyme product Wobe-Mugos to treat cancer; a review of studies using Wobe-Mugos has been published elsewhere.[8] Pancreatic enzymes have also been administered rectally, as described in a 2017 article that includes discussion of a series of patients with a variety of cancer types.[23] Nineteen of 46 patients reportedly survived longer than expected.

HOW THEY WORK SYSTEMICALLY: PROTEASE-ACTIVATED RECEPTORS

From Beard's time until recently, scientists believed that proteases digested food, nothing more. But with the discovery that proteases make up more than 2% of the human genome, it is becoming clear that protease systems regulate a lot of different activities in the body.[24] There is a complex web formed by proteases and other proteins that inhibit them, as the enzymes work on the different proteins that carry out the processes on which life depends.

A Patient's Story: Backpacking and Rafting at Age 69

In 1995, I was diagnosed with stage 4 non-Hodgkin lymphoma, and my brother had been diagnosed six months earlier with basically the same thing. A friend of our sister-in-law was on the Gonzalez program for pancreatic cancer and had had some success. After learning about the program, I decided that this might be the best approach for me because I really didn't want to face chemo or radiation therapy.

I went on the program in the fall of that year after meeting with Dr. Isaacs, Dr. Gonzalez' colleague. It's a program of diet, nutrition, pancreatic enzymes, vitamin supplements, and detoxification. I was put on a moderate carnivore diet—one of the approximately 50 diets that they had. I was supposed to eat lots of fatty, red meat, and mostly root vegetables.

In addition, I followed a very rigorous supplementation schedule, taking about 150 pills a day, including the pancreatic enzymes. It's a very strenuous program, but I told myself that no matter what Dr. Isaacs said to do, I was going to do it. I was thoroughly committed to the program.

When I was first diagnosed, I had all kinds of ailments and no energy whatsoever. I could barely walk a hundred yards without having to sit down and rest. But once I got on the program, I experienced improvements very quickly, and was soon back to my old self and able to do all kinds of physical activities. Within the year, I climbed one of the 14ers [mountain peaks with an elevation of at least 14,000 feet] in Colorado.

In 2001, I was still on the program, and I had a CT scan that came back "unremarkable," which means the tumors were gone. I was feeling great and performing the way I used to—and I never did any chemo or radiation.

My brother had started on the Gonzalez program with Dr. Isaacs, too. He'd had initial success, but he started questioning the protocol and doing things he shouldn't have done, and he got sick again. Due to his inability to follow the program completely, he decided to pursue another type of treatment. He underwent chemo, and he died from his cancer. A week or so before he passed away, he told me to make sure to stick with the program—that he'd made a big mistake by not following it.

Meanwhile, I continued to improve. I've had two kids since then who are now 22 years old, and the program has been a blessing to me and my family.

In 2018, I did a 917-mile backpacking trip on the Pacific Crest Trail, and I'm still very active. This year, I did a 40-mile backpacking trip and four multi-day rafting trips. It's been 26 years since my diagnosis, and I'm quite sure I wouldn't be here today if it wasn't for the Gonzalez program. I'm 69 years old, and I've had a lot of people comment on how physically active and strong and healthy I am. When I tell them I'm a cancer survivor, they just can't believe it. —*Michael M.*

Proteases can affect metabolism by their action on protease-activated receptors (PARs) on the surface of cells. These receptors exist inside the cell membrane, and have bits of protein sticking out that can be clipped off in different ways by different proteases.[25,26] The mechanisms are extremely complicated and are still being worked out; studies show that differences in concentration, the presence of inhibitors and other proteases, or repetitive treatments can modify the effects.[27,28]

PARs have been found on the surface of both cancer cells and trophoblast cells, and this may explain how proteases could have an effect on both types of cells (as Beard predicted).[29,30] Current review articles mainly state that activation of PARs stimulates cancer growth.[25,29,31] However, there is conflicting data.[32-34] In any case, the key components in the pancreas products used by clinicians in Beard's era, as well as by all the practitioners who have followed afterwards, may not be the same compounds that have been used by researchers to study PARs.[35,36]

All this says to me that orally administered pancreatic enzymes and precursors *are* absorbed.

Pancreatic enzymes such as trypsin and chymotrypsin are stored in the pancreas as precursors (for example, trypsinogen and chymotrypsinogen); otherwise, the pancreas would digest itself. In response to a meal, the pancreas secretes these precursor forms, which are then activated by other enzymes in the intestine.

Beard advised that the best product to treat cancer was an extract made from freshly minced pancreas, which would have contained enzymes in both their active and precursor forms. Shively used crystallized enzymes intravenously that were as pure as the standards of the day allowed, but the preparation methods were fairly crude by today's standards and the final product would quite possibly have included precursors.[37]

Kelley used a product made by removing the fat and water from pancreatic tissue, with the enzymes activated to a greater or lesser degree.[38] After his review of Kelley's files, Nick came to believe that Kelley's best results occurred when the product he used had more than half its potential enzymatic activity from the precursor form.[39] Nick and I designed and used a less processed pancreas product that should have had almost all of the enzymes as precursors.

In support of a wider role for enzyme precursors in physiology, I would add that trypsinogen is produced early in fetal life, well before trypsin is needed to digest food.[40] Also, precursor forms of trypsin are present in the blood serum of healthy adults.[41]

CAN ENZYMES BE ABSORBED?

One question other practitioners and prospective patients frequently ask: Can enzymes taken by mouth be absorbed into the body? Conventional wisdom would say that such products would be destroyed in the digestive tract, and even if they were not, the enzyme molecules would be too big to be moved across the lining of the intestine.

From my point of view, oral pancreatic products have been used by Kelley, Nick, and myself with multiple positive case reports, and the enzyme product Wobe-Mugos has also been used orally with some success.[8,10,13,18,19,22,42] The pancreas product Nick and I used was tested, again orally, in a mouse model of pancreatic cancer with positive results.[43] All this says to me that orally administered pancreatic enzymes and precursors *are* absorbed.

Experiments on this subject have shown conflicting results.[44-46] A 2004 article has been touted to prove that orally administered pancreatic enzymes are not systemically absorbed.[47] In this study, pigs that had their pancreas removed were given pancreatic enzymes with their food, and no changes in blood levels of enzymes were seen. Since the product was administered with food, it may have been used up in digestion with little to none left for systemic absorption, or the food could have slowed absorption and made increases in blood levels shallow and not easy to recognize. Kelley, Nick, and I all stressed that patients should take their pancreas doses on an empty stomach.

A 2020 article discussing PAR signaling in the gut suggests that proteases may interact with PARs in the intestinal tract cells to facilitate absorption of large molecules such as proteases, and that PARs impact gut permeability regulation.[48] While reading this particular article, I had an image of proteases using the PARs to knock on the door of the gut lining, and then being allowed inside.

Are enzyme or proenzyme products stable when they encounter stomach acid or duodenal juices? One experiment showed that 70% of trypsin activity remains after storage in duodenal juice at room temperature for four days.[49] In 1965, Heizer and colleagues looked at the stability of trypsin in gastric juice.[50] The product was fairly stable at a pH of 4 but was degraded if the pH went below that, especially if pepsin, an enzyme secreted by the stomach, was present. Kelley, Nick, and I all directed patients to take their pancreas product away from meals, thus potentially limiting the amount of acid in the stomach, the amount of pepsin secreted, and the time spent in the stomach.

Both Wobe-Mugos and the enzymes Kelley used were enterically coated, protecting the contents from stomach acid and pepsin. However, other experts have pointed out that enteric coatings do not always dissolve properly and can sometimes cause intestinal problems in and of

A Patient's Story: Giving Hope to People with Cancer

It is now 21 years since a tumor measuring 3.2 cm was found in the head of my pancreas. I was shocked, especially because it had been discovered as the result of a routine checkup. I had told my doctor that I was having diarrhea after eating, and she ordered a CAT scan of my abdomen and found the tumor. Two months later, a biopsy confirmed that I had pancreatic cancer.

After meeting with two surgeons, I realized that I was facing a life-threatening disease. Both wanted me to have a Whipple procedure, which removes the head of the pancreas along with part of the duodenum, the gallbladder, and the bile duct. If I survived the surgery, chemo and radiation would follow. They told me that without the surgery, my life expectancy would be three to six months.

I was determined not to have the surgery, so I read and investigated everything I could find on cancer, including some prominent books on alternative medicine. I learned enough to begin a vitamin and herb regimen, and I asked for prayers from family and church leaders. I also spoke with a gentleman named William Donald Kelley, a dentist who had had pancreatic cancer and cured himself and numerous patients with pancreatic enzymes.

Then, a doctor told me about a research trial being conducted on Dr. Gonzalez and Dr. Isaacs's enzyme therapy. I submitted the required medical documentation and went to New York on my own, only to be told by an administrator that I was not eligible for the trial because I could have surgery. I said, "You're dooming me to die because I don't want surgery and I'm not going to have it."

Dr. Isaacs showed compassion and offered me her services, outside of the study, if I could pay for the pills and other items needed to follow the protocol. I jumped at the chance. I did my enemas and my juicing, and took about 150 pills a day—the enzymes as well as various vitamins and minerals. It was time consuming, but it wasn't that hard. And, although people usually don't believe this, I never felt sick.

After I went onto the protocol, I stopped running to the bathroom and I got my energy back—although I really hadn't lost that much energy. I felt good. I went to Mexico with my husband for two weeks, and then I went on a trip with each of my children. I kept faithfully on my regimen; the only thing I didn't do on the trips was the enemas.

I stayed on the program for 13 or 14 years, and I am still taking my enzymes. The last time I had the tumor checked, six years ago, it was still there, although it had shrunk a bit and it had not metastasized. My blood tests continue to come back absolutely fantastic, especially for an 80-year-old.

Over the years, I have been in good health and have spoken to groups, given classes about alternative medicine, and appeared on radio and TV talk shows to give cancer patients hope. I have also started writing a book that I hope will be an inspiration to all who are diagnosed with cancer.

—Sarah Ann Cooper

themselves.[51] Nick and I used a pancreas product without an enteric coating and were happy with the clinical results.

CANCER AND THE TROPHOBLAST

There is some modern support for Beard's concept that "vagrant" trophoblast cells are present in tissues throughout the body as a reservoir for cell renewal but can develop into a cancer. A similar principle in recent theories about cancer involves the cancer stem cell.[52]

Normal stem cells are self-renewing cells that can morph into various mature cell types, allowing for development in the embryo or replacement of aging or damaged cells in the adult. Cancer stem cells are responsible for cancer initiation as well as its growth and spread. Similar markers are found on the surfaces of cancer stem cells, adult stem cells, and human embryonic stem cells.[53]

A Patient's Story: Experiencing a Renewed Sense of Energy

I was 58 years old in May 2014 when I noticed blood in my stool one evening. I went for a colonoscopy, and then my doctor advised me to see a surgeon, who confirmed stage 3 colon cancer with a few lymph nodes involved. The surgeon recommended that I immediately have surgery, which I did, and then wanted me to undergo chemotherapy.

My wife and I have always been somewhat nonconventional, and we weren't advocates of chemotherapy. We created our own nutritional cocktail, and we took that and monitored my cancer antigen levels instead. After a while, my levels seemed to be rising, which forced us to go to an oncologist to discuss the situation. Out of apprehension, we agreed to chemotherapy. I went through that for six months, and it was probably the worst experience I've ever had—constant nausea, pain, and ultimately a severe case of neuropathy.

Soon after the course of chemotherapy ended, I had a CT scan that showed a recurrence of the cancer, in my liver. But we were very blessed because, one day, while we were at home, a television program came on about Dr. Gonzalez. This program described a nontraditional program for dealing with cancer that had a proven record of effectiveness. We got online and learned that Dr. Gonzalez had recently passed away, but his colleague, Dr. Isaacs, was still in the business of saving lives.

We immediately contacted her and went through a rigorous screening process. Before Dr. Isaacs would admit me into the program, she said I had to get surgery on my liver, which I did in 2016. I was then admitted and prescribed a comprehensive, enzyme-based nutrition program.

However, we soon found out that the surgeon had made a mistake and left some cancer behind. We went to another doctor, who did the surgery flawlessly but recommended more chemotherapy, telling my wife I had six months to live if I did not do it. I had already decided I was not going to do chemotherapy again. Then, another doctor noticed a couple of nodules on my lung and recommended immediate surgery, which I declined.

By that time, I had grown very confident in Dr. Isaacs's protocol. I continued following it and, in subsequent CT scans, those nodules got progressively smaller. The last several scans have been absolutely clean, and I take them twice a year. I never told my oncologist what we were doing, but he lauded my improvement as somewhat miraculous, saying that he had seen nothing like it before.

I was very diligent in following the protocol. It is very demanding—200 pills a day, enemas, and all kinds of things—but it was worth it. Having the right support structure is absolutely critical, and I was lucky to have my wife help me with preparing the pills and doing all the other necessary things. Ultimately, we were able to do this very effectively in spite of the demands that we both had in our lives. The outcome has just been extraordinary.

I'm still on the protocol today, and it is giving me a renewed sense of energy. I'm an avid runner, and even when I was on chemotherapy, I was running. But with the pills—nutrients and other supplements, as well as enzymes—it's amazing. I'm 65, and I'm still running 12 or 13 miles a week.

The program has also had a lot of unintended benefits. It has brought us closer together as a family and helped us to trust our decisions. But I would say the biggest thing is that it has given me more time with my family. I have a ten-year-old son, and it has enabled me to be in his life. My dad wasn't around for me, and it has given me the opportunity to change that cycle.—*Name Withheld*

Beard also claimed that in normal prenatal development, the aggressive trophoblast changed into the mature placenta when the baby began making pancreatic enzymes, in the first trimester. Others have confirmed that the fetus makes pancreatic enzymes months before delivery, and well before the baby would see food.[40,54] Trophoblast cells also have PARs. One intriguing article reports that the relative amounts of different PARs on the surfaces of trophoblast cells change over the course of the first trimester, during the time when, Beard suggested, fetal pancreatic enzymes would influence the behavior of trophoblast cells.[29,30,55,56]

The molecular mechanisms used by cancer cells and by the trophoblast to invade tissue and create a blood supply are the same.[57,58] Recent review articles discuss this and mention the possibility that study of the trophoblast could inform efforts to address cancer.[59,60]

HOW DO I USE PANCREATIC ENZYMES IN MY PRACTICE?

Between Nick's monograph about Kelley's work, the case reports Nick was writing at the time of his death (since posthumously published in two volumes), and those I have published since, there are more than 200 case reports available about patients successfully treated with this method.[10,18,20-22] Our standards for what constitutes a good case report are high, so there are many more patients who have had good outcomes but are not included.[61,62] Many different types of cancers are documented among these case reports, including common ones, such as breast and colon, as well as less common ones, such as rare sarcomas. Nick and I offered a free screening process prior to setting up appointments, so that we could assess whether a patient's particular situation was a good fit for our treatment program. I have continued this.

I also see patients with other conditions and find that our pancreas product taken away from meals can be helpful for patients with autoimmune disorders. In addition, I recommend that all patients take a few capsules of pancreatic enzymes with their meals to aid digestion.

WHAT CAN YOU DO WITH THIS?

More than a century ago, Beard stated that pancreatic proteolytic enzymes could have a therapeutic effect on cancer. Case reports in the medical literature, including some about patients I have treated, have kept this possibility alive.

I believe, based on Beard's work and my own, that pancreatic enzymes do more than digest food; they are part of the surveillance system for cancer. If you have any digestive distress such as gas or bloating, or even if you don't, a few capsules of digestive enzymes taken with meals can help you utilize your food better and also free up some of your body's own enzymes to look for abnormal cells in your system. Of course, you should also consult with a physician about any symptoms or problems you are having. 🕮

Editor's note: The three patient stories that accompany this article are based on personal interviews conducted by the* Price-Pottenger Journal. *These narratives are not a guarantee of similar outcomes.

ABOUT THE AUTHOR

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Medicinal Mushrooms: Going Viral

by Anna Sitkoff, ND

Mushrooms have been used as both food and medicine since antiquity. One of my favorite poems, discovered in an ancient Egyptian temple, illustrates this history: "Without leaves, without buds, without flowers, yet they form fruit. As a food, as a tonic, as a medicine: the entire creation is precious." At a time when viral epidemics are inevitable and the current COVID-19 pandemic has presented in most of the world, antiviral therapies are possibly being investigated now more than ever before. This paper explores the use of medicinal mushrooms as antivirals in both in vivo (human and animal) and in vitro (petri dish) experiments and how these experiments may inform us on the utilization of these fungi as antiviral therapies.

Medicinal mushrooms are known as biological response modifiers. This physiologic modification is largely a result of the interaction of various mushroom constituents, primarily polysaccharides, with the immune system. Therefore, to understand the role that medicinal mushrooms play as antiviral agents, it is imperative to understand the happenings of the immune system in response to a viral pathogen and the interplay between mushrooms, their constituents, and this system. Unlike pharmaceutical antivirals, the actions of medicinal mushrooms are not straightforward, and there is no absolute rule that mushrooms stimulate or depress immunity. Mushrooms contain many constituents and are dynamic in their interplay with the human body.

Turkey tail, courtesy of Anna Sitkoff, ND

OVERVIEW OF ANTIVIRAL IMMUNITY

The initial immune response to a new pathogen is facilitated by the innate immune system (*innate* meaning "inborn" or "natural"). This is our first response to non-self organisms and requires no other stimulation than the pathogen itself. It is the response that is ready to go at all moments in the day and persistently protects the human body from infection. It is easy to imagine that an altered or defective innate immune response can have a detrimental effect on the ability to fight disease.

The innate immune response to a virus is multidimensional. There is a massive amount of cell-to-cell communication, and different chemicals (called *cytokines*) are released to make this communication possible. Once an epithelial cell (cells that make up the surface of different body tissues, such as skin, lungs, etc.) is infected with a virus, type 1 interferon (IFN-α, a cytokine) is released and has three major

functions: to induce resistance to viral replication in all cells, to increase expression of ligands for receptors on natural killer (NK) cells, and to activate NK cells to kill virus-infected cells. NK cells are lymphocytes (small white blood cells found primarily in the lymphatic system) that defend against viral infections and tumor cells via cytokine stimulation and direct killing of infected cells. NK cells provide such a vital role in antiviral immunity that people deficient in NK cells suffer from persistent viral infections. These functions of NK cells are important in regard to understanding medicinal mushrooms and their role in antiviral immunity.

Imagine the immune response to a newly inhaled viral particle. This virus enters the healthy person's lungs and invades the lung epithelium. Once an epithelial cell is infected, it releases IFN-α, which turns circulating NK cells into cytotoxic effector NK cells (NK cells primed to seek out and kill virally infected cells). The cytotoxic effector NK cells promptly start the process of seeking out infected cells and the innate immune response commences. At the same time, there are resident macrophages in the respiratory epithelium and throughout the body. These macrophages ("big eaters") are also major players in the innate immune response. Their role is to consume these virus particles and produce chemicals (cytokines and chemokines) that attract and engage more NK cells and also T cells. An important cytokine engaged in this process is interleukin-12 (IL-12), which stimulates NK cells to become *non-cytotoxic* effector NK cells. Unlike *cytotoxic* effector NK cells, these effector NK cells stimulate an inflammatory response via type 2 interferon (IFN-γ) at the site of infection. This inflammatory cascade consists of IL-1, IL-6, TNF-α, and IL-12, and is essential for viral eradication. It is only when this response is out of control that it becomes problematic and detrimental to the host.[1-4] If this initial response is not primed for viral combat, viral particles continue to proliferate and infect more healthy cells. It is in this phase that medicinal mushrooms can have a great impact to prevent viral infections from taking over the host.

Mushrooms contain many constituents and are dynamic in their interplay with the human body.

COVID-19 provides an excellent example of these two main immune responses.[5] The first stage of infection is the less severe incubation phase. The previously mentioned immune response is imperative to eliminate the virus and keep disease from progressing to later, more severe stages. It is in the incubation stage that immune-stimulating therapies are most

Cytokine	Source	Role
IFN-α	Virus-infected epithelium	Circulating NK cells –>cytotoxic effector NK cells
IL-12	Macrophages post virus consumption	NK cells –> effector NK cells
IFN- γ	Effector NK cells	Macrophages –> inflammatory cytokines (TNF-α, IL-2, IL-1, IL-6)
TNF- α	Macrophages	Induce blood vessels to become more permeable, enabling effector cells to enter infected tissue
IL-1	Macrophages	Induce blood vessels to become more permeable, enabling effector cells to enter infected tissue
IL-6	Macrophages	Induce fat and muscle cells to metabolize, make heat, and raise temperature of infected tissue
IL-12	Macrophages	Recruit and activate NK cells –> secrete more cytokines that strengthen macrophage response to infection
IL-10	Toxic substances secreted by macrophages–> T_H2	Suppress macrophage activation
IL-4	Toxic substances secreted by macrophages–> T_H2	Suppress macrophage activation

indicated. In more severe stages, the protective immune response is impaired and the virus will spread and destroy healthy cells. Because damaged cells induce inflammation, immune stimulation is less indicated and it is more favorable to treat with anti-inflammatory therapies. It is at this stage of disease, characterized by severe lung inflammation, that life-threatening respiratory disorders occur and the feared cytokine storm is initiated. The cytokine storm is an influx of inflammatory cytokines. It is an overdramatic immune response that is harmful to the host and can often lead to acute respiratory distress syndrome. The inflammatory cytokines that are so important for stage one of the disease (IL-1, IL-6, TNF-α, and IL-12) are now abundant, destructive, and out of control.[6,7]

The two-phase division of the immune response is very important. The first immune response is protective, and it is a response that can be altered through diet and lifestyle: our base response when initially combating infection. As mentioned previously, this is the phase where medicinal mushrooms are most indicated. They are primers of the first response to viral particles.

ANTIVIRAL IMMUNITY IN HEALTHY ADULTS

The most informative studies exploring the interaction of medicinal mushrooms and the immune response are those done on healthy human adults. In these studies, it is ideal to see cytokine and NK cell levels before and after mushroom intake in healthy people to get a good idea of how exactly the mushrooms are priming our innate response. There are not many studies of this kind, but there are a few.

Healthy Korean men who took 1.5 g/day of powdered extract of *Cordyceps militaris* brown rice culture for four weeks had their blood analyzed before and after treatment. Levels of NK cells, IFN-y, and IL-12 were examined in blood samples before and four weeks after therapy began. There was a significant increase in NK cells and IFN-γ and no difference in IL-12.[8] *Cordyceps sinensis* mycelium extract, in combination with the endoparasitic fungus that commonly exists with *C. sinensis*, *Paecilomyces hepialid,* also had immune-stimulating activity in healthy adults. In this study, people were given 1.43 g/day and after eight weeks the cytotoxic activity of NK cells was significantly higher than at baseline (before therapy).[9] Wild fruiting bodies of Cordyceps species are incredibly expensive and are therefore rarely, if ever, used in research. However, it is likely that cultivated fruiting bodies have similar medicinal qualities.[10-12]

Shiitake is a good example of the dynamic effects that some mushrooms have on the immune system.

Shiitake © Adobe Stock | unicusx

In another study, 52 healthy males and females aged 21-41 consumed either 5 g or 10 g of *Lentinus edodes* (shiitake mushroom) daily for four weeks. Eating the shiitake for four weeks led to increased proliferation of NK cells and IgA, decreased C-reactive protein (CRP; a marker of inflammation), and an increase in IL-4, Il-10, TNF-α, and IL-1. Serving size had no impact on cytokine levels, except that two servings of shiitake increased serum IL-4.[13] Shiitake is a good example of the dynamic effects that some mushrooms have on the immune system. Shiitake increased both inflammatory cytokines (IL-1 and TNF-α) and anti-inflammatory cytokines (IL-10 and IL-4) simultaneously, illustrating the use of the term *immunomodulatory*; it is neither a pure stimulator nor a depressor of the immune system. This may mean that immune-modulating mushrooms are safe and effective to take during both phases of the viral immune response, and, in fact, may have inhibitory effects during the cytokine storm of acute respiratory distress syndrome.

Grifola frondosa (maitake) also exhibits this modulating activity. *G. frondosa* fruiting body extract produced both immune stimulatory IL-2, TNF-α, and IFN-γ, and suppressive IL-10 in breast cancer survivors taking 5-7 g/kg per day of mushroom extract for three weeks.[14]

The combination formula of *Trametes versicolor* (turkey tail) and *Salvia miltiorrhiza* (red sage root, or Dan Shen) given at 50 mg/kg and 20 mg/kg respectively for four months showed significant immunomodulatory effects in healthy adults. There was a significant increase in PBMC (peripheral blood mononuclear cells—NK, B, and T cells) gene expression of IL-2 receptors, as well as an increase in T helper cells and the ratio of T helper cells to cytotoxic T cells. There was also a significant increase in IFN-γ.[15] There is little information in Western herbal and mycological medicine about the use of plant and mushroom combination formulas. Dan Shen is known to "move the qi of the blood" and in combination with the immune-stimulating activity of turkey tail, has promise as a very useful combination for immune therapy.

Maitake © Adobe Stock | Georg Lehnerer

Not all fungi are created equally as immune modulators. When the β-glucan isolate Lentinex, from *L. edodes* mycelium, was administered to healthy adults, there was no difference seen in NK cells and inflammatory cytokines between treatment and control groups.[16] This is juxtaposed with the previous shiitake study where the subjects consumed whole mushrooms and *did* have immune-stimulatory effects. Contrary to what has been suggested by in vitro research,[17,18] a mushroom that showed no benefit in vivo was *Agaricus blazeii*. Healthy elderly women consumed 300 mg of *A. blazeii* fruiting body extract three times daily for 60 days, and there was no change in levels of IFN-γ, IL-6, and TNF-α after

Mushroom	Cytokine response	Immune response (simplified)	Phase of viral response most applicable
Grifola frondosa (Maitake)	IL-10 IL-2, TNF-α, IFN- γ	Anti-inflammatory Pro-inflammatory	Possibly severe phase Prevention/incubation phase
Lentinus edodes (Shiitake)	IL-4, IL-10 TNF-α, IL-1	Anti-inflammatory Pro-inflammatory	Possibly severe phase Prevention/incubation phase
Cordyceps spp.	IFN-γ	Pro-inflammatory	Prevention/incubation
Trametes versicolor (Turkey tail) with *Salvia miltiorrhiza* (Red sage)	IL-2, IFN-γ	Pro-inflammatory	Prevention/incubation

administration.[19] Perhaps the dose was too low in this study; further research is needed.

MUSHROOMS AS IMMUNE MODULATORS

The increases seen in IL-10 and IL-4 after maitake, shiitake, and cordyceps mycelium intake are important as they relate to T_H2 (T helper 2) immune responses. T_H2 responses are anti-parasitic and anti-allergic, but through the lens of viral immunity and inflammation, are anti-inflammatory. In fact, IL-10 is considered an anti-inflammatory master regulator.[20-23] IL-10 is essential for defending the host from tissue destruction during acute phases of immune responses, though it is not as desirable in the initial phase of infection, where a higher T_H1 (inflammatory) response is required. At this stage, IL-10 can downregulate antigen presentation in macrophages and dendritic cells and can lead to chronic infection.[24] During the later stages of infection, however, IL-10 levels can determine host survival and higher concentrations of IL-10 have been associated with better outcomes in patients with acute respiratory distress syndrome.[25]

Advantageous respiratory effects of pleuran are also observed in adult athletes.

This is immune modulation. As depicted, mushrooms are neither solely inflammatory nor anti-inflammatory, and so should be utilized as such. The safety of medicinal mushroom use at different phases of the immune response is debatable. It is most likely that if mushrooms and mushroom extracts are consumed as preventative medicine, and the immune response is primed, the host won't succumb to infection in the first place. There is some concern that if IL-10 is too high during the initial phase, the infection will become chronic, but since the mushrooms are simultaneously stimulating inflammatory cytokines, this isn't likely.

	T_H1	T_H2
Associated cytokines	IL-2, IL-12, IFN-γ, TNF-α	IL-4, IL-10, IL-5, IL-6, IL-13, IL-9

MUSHROOM-DERIVED β-GLUCANS AND THE IMMUNE RESPONSE

The most studied immune-stimulating constituents derived from medicinal mushrooms are 1,3/1,6-β-glucans. β-glucans, or polysaccharides, are present in all mushrooms as they are an integral component of the mushroom cell wall. Macrophages in the gut have specific receptors for β-glucans, most significantly Dectin-1, complement receptor 3 (CR3), and toll-like receptor 2 (TLR-2).[26,27] When β-glucans bind to these receptors, an immune response is initiated. Because of this, in most studies, polysaccharides have been deemed the "active" constituents in regard to immune activation. Therefore, isolation and administration of these compounds are most commonly seen in the literature.

PLEURAN, A POLYSACCHARIDE DERIVED FROM OYSTER MUSHROOMS

There are a number of human trials exploring the use of pleuran, a polysaccharide extracted from *Pleurotus ostreatus* (oyster mushroom), as a therapeutic agent in respiratory infections. As respiratory infections are most commonly of viral origin,[28] it seems appropriate to discuss this research here. In a double-blinded, placebo-controlled, randomized multicentric study, 175 children treated with pleuran experienced a significant reduction in the frequency of recurrent respiratory tract infections.[29] These findings agreed with a Spanish study investigating 166 children aged one to ten years who were also treated with pleuran for recurrent respiratory infection.[30]

Advantageous respiratory effects of pleuran are also observed in adult athletes. A study of 50 athletes treated with pleuran over a three-month period found a significant reduction in the frequency of upper respiratory tract infections compared to athletes treated with placebo. Blood samples of the athletes showed significantly higher levels of circulating NK cells in the pleuran group as compared to the placebo group.[31]

Oyster mushrooms contain almost 33% polysaccharides,[32] so we can deduce from these studies that consuming whole oyster mushrooms and/or oyster mushroom aqueous extracts could

be beneficial for the prevention of respiratory infections.

IMMUNE-STIMULATING POLYSACCHARIDES IN LATE-STAGE CANCER PATIENTS

The polysaccharides isolated from *Ganoderma lucidum*, also known as "Ganopoly," were administered at 1800 mg three times daily in late-stage cancer patients, and there was a significant increase in NK cells, IL-1, IL-6, and IFN-γ after administration.[33] Another isolate, polysaccharide krestin (PSK), is a protein-bound polysaccharide derived and isolated from *Trametes versicolor.* In a phase one clinical trial, breast cancer patients consumed 6 or 9 g of PSK for six weeks, leading to an increase in CD8 T cells and NK cells.[34] Another isolated polysaccharide, Maitake D-fraction (derived from the fruiting body of *G. frondosa*), was administered to patients aged 46-84 with stage 2-4 cancers at doses between 40 and 150 mg twice daily. IL-2 and NK cell activity was detected through peripheral blood draw and both were significantly increased after administration.[35] The research on isolated, mushroom-derived polysaccharides was intended to prove anti-cancer activity, but because of the close similarities of anti-cancer and antiviral immunity,[36] it also suggests that polysaccharides support antiviral immunity in late-stage cancer patients.

IN VIVO HEALTHY ANIMAL TRIALS

Polysaccharides from *G. lucidum*, *L. edodes,* and *G. frondosa* administered to healthy mice significantly increase macrophage phagocytosis (engulfing and digestion of microbes and other cellular threats) and NK cell activity.[37] Other studies have demonstrated similar immune-enhancing effects on healthy mice with *G. frondosa* and *L. edodes* extracts increasing IL-12, IL-6, and IFN-γ. In this study, the combination of the *G. frondosa* and *L. edodes* extracts have a stronger effect than either extract alone.[38] Maitake D-fraction increases IL-12 and IFN-γ in healthy mice along with significantly decreasing IL-4 and IL-10.[39] *C. militaris* extract also increases IL-12 and TNF-α cell activity in H1N1 (swine flu)-infected mice.[40]

IN VIVO ANIMAL CANCER MODELS

A number of in vivo animal trials explore different mushroom extracts with similar immune effects. Many of these animal studies are cancer models, so they will be mentioned briefly. Agaricus hot water extracts increase IFN-γ, IL-6, and IL-1.[41,42] Reishi polysaccharide and triterpene extracts increase inflammatory NFkB, TNF-α, IL-1β, IL-2, and IFN-γ.[43-45] Maitake extract increases IL-12, IFN-γ, TNF-α, and

Oyster mushroom © Adobe Stock | Jaroslav Machacek

IL-1,[46,47] and PSK increases IL-12.[48] Ganoderma polysaccharides increase NK cells and cytotoxic T cells, IL-1, IL-6, and IL-1.[49,50]

Because these are cancer models, it is not completely clear if the same effects would take place in healthy animal models, though we can deduce from other experiments using healthy volunteers and healthy animals that it is likely that similar immune effects would occur.

IN VITRO ANTIVIRAL ACTIVITY

There are a number of fungal constituents that have antiviral activity in vitro, including polysaccharides, indole alkaloids, terpenoids, polyketides, and lignan derivatives. *Agaricus subfruescens* and *Grifola frondosa* act directly on viral particles, β-glucan protein from *A. subfruescens* inhibits viral adsorption into the cell, polysaccharides from *A. subfruescens* and polysaccharopeptide from *T. versicolor* inhibit viral replication, and triterpenes from *Ganoderma spp* directly kill virus proteins.[51]

The fruiting body ethanol-water extract of *T. versicolor* extract increases the T_H1-related cytokines IL-2, IL-12, IL-18, and IFN-γ.[52,53] As most of the research done on *T. versicolor* is with an isolated constituent, PSK, it is significant that these studies, which used whole fruiting body extract, demonstrate immune-stimulating qualities.

Reishi © Adobe Stock | Photo Gallery

Maitake fruiting body extract does not show direct antiviral activity against influenza A but does exhibit antiviral activity through macrophage activation and an increase in TNF-α production.[54]

L. edodes mycelium directly inhibits influenza virus growth at early phases of infection, possibly during the entry process of viral particles to host cells. The in vivo administration stimulated an increase in innate immunity as well, suggesting that shiitake mycelium has antiviral effects through both inhibition of initial viral replication and immune stimulation.[55]

A little known mushroom, *Cryptoporus volvatus*, the cryptic globe fungus, has shown antiviral activity through multiple mechanisms. Aqueous extracts of the fruiting body inhibit porcine respiratory syndrome virus infection by repressing viral entry, viral RNA expression, possibly viral protein synthesis, cell-to-cell spread, and the release of virus particles from the host cell. *C. volvatus* also inhibits influenza virus replication in vitro and in vivo.[56-58]

The aqueous extract of *Phellinus igniarius*, or fire sponge, shows virucidal activity against influenza A and B viruses, including 2009 pandemic H1N1, human H3N2, avian H9N2, and oseltamivir-resistant H1N1 viruses. The study concludes that this extract may interfere with one or more early events in the viral replication cycle, including viral attachment to the target cell.[59]

In vitro research is what propels in vivo research forward, but it is important to take this information with a grain of salt and understand this is what *may* happen in the human body, and not necessarily what *will* happen.

ANTI-NEURAMINIDASE ACTIVITY

A highly valued antiviral action in pharmaceuticals is neuraminidase inhibition. This is the mechanism of the commonly known antivirals Tamiflu and Relenza. The enzyme neuraminidase is found on the surface of influenza viruses and allows viruses to be released from the host cell so they can then infect other, healthy human cells. Neuraminidase inhibitors have been shown to improve

the outcome of patients with leukemia and influenza.[60] Medicinal mushrooms and their constituents have exhibited neuraminidase inhibitory activity in vitro and in vivo. Ganoderic acids, triterpenes found in Ganoderma species, have broad-spectrum inhibition against influenza neuraminidases, specifically H5N1 and H1N1.[61,62] Both the fruiting body and mycelial extracts of *Phellinus spp.* have neuraminidase inhibiting actions as well.[63-65] While there is still more research needed in this area, it is possible that Reishi and Phellinus species could be beneficial in treating viruses that utilize neuraminidase.

Cordyceps militaris © Adobe Stock | lebrac

This paper focuses on mushrooms as antiviral therapies for enveloped, influenza-like viruses, but there is in vitro evidence to suggest medicinal mushrooms have antiviral activity towards many different viruses.[66,67] *Ganoderma lucidum* has shown to be active against enterovirus,[68] human papillomavirus (HPV),[69,70] herpes simplex virus (HSV),[71-74] hepatitis B (HBV),[75] and Epstein-Barr virus (EBV).[76] *Cordyceps militaris* has anti-hepatitis C (HCV) activity.[77] *Trametes versicolor* is active against human immunodeficiency virus (HIV).[78,79] *Grifola frondosa* is active against HSV-1[80] and HBV.[81] *Inonotus obliquus* has anti-HSV,[82,83] anti-HCV,[84] and anti-HIV[85] activity, and *Lentinula edodes* has anti-HBV[86] and anti-HSV[87] activity. Although not explored in this paper, these antiviral actions are interesting and worth considering for further dissection in future research.

Having a basic understanding of our complex immune system is important in understanding the role that mushrooms play as antivirals. As we have seen, mushrooms are immune modulators and can stimulate inflammatory and anti-inflammatory responses simultaneously. Mushrooms are most likely to be useful as preventative medicine before infection occurs, though if there is an initial infection, cordyceps, maitake, shiitake, turkey tail, and oyster mushroom may prevent infection from becoming more severe. If infection does become severe, the mushrooms that also stimulate IL-10—maitake, cordyceps, and shiitake—could be beneficial. In the wake of the current viral pandemic, these mushrooms should be further explored and utilized as medicine. Further research is essential in elucidating their potential effects. 🕮

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The references for this article are available both on the author's blog and at our website, price-pottenger.org.

ABOUT THE AUTHOR

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Favorite Holiday Recipes

Selected by Price-Pottenger

CHICKEN LIVER AND APPLE MOUSSE

by Kristen Mitteness, DC

½-1 pound chicken livers
1 sweet onion
1 tart apple
½ cup coconut milk
Coconut oil or lard for sautéing
Salt, pepper, cinnamon, and nutmeg

Directions

1. Chop the onion and sauté it in a pan with the oil or lard over medium heat.
2. While it's cooking, chop the apple.
3. Once the onion is cooked nearly to your liking (I like mine nicely browned), add the apple, chicken livers, and spices. Continue cooking until the livers are almost cooked through, with just a bit of pink inside.
4. Put it in a food processor with the coconut milk and blend until smooth. This won't take too long. Make sure it has enough salt, which will help bring out some sweetness in the apples.
5. I typically put half in the freezer for later and half in the refrigerator. I will also eat it fresh with apple slices, but it does become more palatable after sitting in the refrigerator for a bit.

Reprinted from drkristenchiro.com/recipes.

MAPLE PECAN CRUSTED SALMON

by Ryan Kennedy, CCN, CFMP, CTN

Serves 3

3 six-ounce wild-caught salmon fillets
2 tablespoons Lakanto monk fruit-sweetened maple syrup
2 tablespoons Dijon mustard
½ cup crushed pecans
Seasonings: ½ teaspoon each of paprika, salt, and pepper
1 head broccoli
2 tablespoons grassfed butter
Salt and pepper to taste

Directions

1. Preheat oven to 320° F and place fresh salmon on a baking sheet lined with parchment paper.
2. Combine sweetener, mustard, and seasonings in a small mixing bowl.
3. Brush thickly on salmon fillets.
4. Sprinkle crushed pecans over salmon.
5. Cut broccoli into bite-sized pieces and add to baking sheet.
6. Top broccoli with small chunks of butter, and salt and pepper.
7. Bake for 12-16 minutes.

Reprinted from Beyond Nutrition*; ryankennedyhealth.com/book.*

SWEET POTATO CUSTARD

by Pat Connolly and Associates of Price-Pottenger

Makes 6 half-cup servings

3 small sweet potatoes
3 egg yolks
¼ cup filtered or spring water, boiling
1 tablespoon unflavored gelatin
1 teaspoon pumpkin pie spice mix
½ cup organic whipped cream

Directions

1. Steam sweet potatoes and blend or mash to produce about 2 cups of pulp.
2. Pour boiling water into blender, run on low speed, and add gelatin. Gradually add egg yolks, pumpkin pie spice, and sweet potato pulp while continuing to blend into puree.
3. Chill. It will form a firm custard.
4. Serve in sherbet glasses. Top with whipped cream.

Adapted from The Candida Albicans Yeast-Free Cookbook, *2nd ed. (McGraw-Hill).*

CRANBERRY SAUCE WTH APPLES AND GINGER

by Sarah R. Smith

Makes 3 cups

10 ounces cranberries (I use frozen)
2 medium apples, cored and chopped (Rome, Pink Lady, Fuji, or Granny Smith work well)
1½ teaspoons minced fresh ginger *or* ½ teaspoon dried ginger
¼ teaspoon orange extract (optional)
Dash of Celtic sea salt
⅓ cup mild-flavored honey
One small squeeze of lemon or lime juice

Directions

1. Combine all ingredients except lemon/lime juice in a medium pot. If your apples are thick-skinned, you might prefer to peel them for this recipe.
2. Cook over medium-low heat for about 25-35 minutes, stirring occasionally, until the cranberries start to break down and the liquid has mostly evaporated.
3. Add the lemon/lime juice. Using a potato masher (or the back of a spoon), lightly mash the cranberries, and cook a bit longer. Cool and serve!

Reprinted from nourishedandnurturedlife.com.

ROASTED MARROW AND BABY BEETS WITH RED KALE

by Taylor Allen

Serves 4-6

6 small beets (3 golden and 3 red)
1 bunch red kale, roughly chopped
4 pasture-raised beef marrow bones
4 tablespoons ghee, melted
2 tablespoons feta cheese from grassfed cows
Salt and pepper

Directions

1. Preheat the oven to 400° F.
2. Remove the stems and wash the beets thoroughly. Place the beets in a baking dish and pour melted ghee over them, rotating and coating them completely.
3. Place marrow bones on a parchment-lined baking sheet and sprinkle with salt and pepper.
4. Cook (both the bones and beets) in the oven for one hour.
5. Remove the beets from the oven and let cool slightly. When they are cool enough to handle, remove from the pan and gently rub off the skin. Slice the beets, place on a plate, and reserve for later.
6. Use a knife to gently nudge out the marrow into a skillet with any tallow or jus that was rendered in the baking sheet from roasting the bones. Add the kale to the skillet and cook over medium heat until greens are completely wilted.
7. Add the beets to the kale/marrow mixture and toss lightly. Add salt and pepper to taste and transfer to a serving dish, using two spoons to drain excess fat. Sprinkle with feta cheese and serve warm.

BRAISED TURKEY DRUMSTICKS WITH SAGE AND DATES

by Annie Dru, CCE

2-3 turkey drumsticks
6 garlic cloves
Handful of fresh sage leaves
6 large dates, chopped
Celtic sea salt, to taste
Pepper, to taste
Splash of bourbon
2 cups poultry stock
2 tablespoons crème fraîche

Directions

1. Mince garlic and sage (reserving some whole leaves), combine with salt and pepper, and stuff underneath the turkey skin.
2. Brown drumsticks in a cast-iron skillet in a 400° F oven for 30 to 40 minutes. Sprinkle whole sage leaves and chopped dates over the top, cover with parchment and then foil, and braise at 300° F for another hour.
3. Remove drumsticks, sage, and dates from braising skillet and set aside to rest in a foil tent.
4. Heat skillet on high on the stovetop, and deglaze with bourbon, lifting browned bits off the bottom with a wooden spatula.
5. Add poultry stock to skillet and reduce over high heat, stirring constantly, until thick and velvety consistency is achieved. Reduce heat, add crème fraîche, and stir until a smooth gravy results.
6. Return dates, sage, and pulled turkey to skillet with gravy.

Suggestion: Serve the meat and gravy over spiralized zucchini noodles caramelized in brown butter ghee.

SLOW COOKER PULLED PORK WITH APPLES

by Kristen Mitteness, DC

2- to 3-pound pork shoulder
1 large onion, chopped
1 green apple, chopped
4 cloves of garlic, chopped
¼ cup apple cider vinegar
2 cups bone broth
2 tablespoons salt
1 tablespoon pepper

Directions

Place it all in your slow cooker and set it on low for 10-12 hours. If the pork is fully thawed, 10 hours will be more than enough. If your pork is still a bit frozen, it will take a little longer. Note: Sometimes pork shoulders are wrapped in string. Make sure you cut it off!

Reprinted from drkristenchiro.com/recipes.

EINKORN BANANA NUT BREAD

by Sarah R. Smith

Makes one loaf

4 large (or 5 small) very ripe bananas, to make about 2 cups of mashed bananas
2 large eggs, preferably from pastured hens
6 tablespoons butter, plus more for greasing the baking dish
½ cup milk kefir (or substitute buttermilk)
1 teaspoon vanilla extract, preferably organic
2 cups all-purpose Einkorn wheat flour
1 teaspoon baking soda
½ teaspoon finely ground Celtic sea salt
¾ cup chopped pecans (or substitute your favorite type of raw or roasted nuts)

Directions

1. Preheat the oven to 350° F.
2. Chop the nuts. If you're using raw nuts, toast them in a small skillet over medium-low heat for about 10-15 minutes, stirring occasionally. This will enhance the flavor of the nuts.
3. Generously grease a 9x5 loaf pan with softened butter.
4. Melt 6 tablespoons of butter in a small saucepan over low heat. Set aside and allow to cool a bit.
5. Combine the flour, baking soda, and salt in a medium bowl. Whisk until well mixed.
6. Mash the bananas in a large bowl.
7. Add the kefir, vanilla, and eggs, and mix well with a hand or stand mixer.
8. Add the melted butter.
9. Mix the dry ingredients into the wet ingredients. Because the Einkorn flour contains gluten, make sure not to overmix or the bread will be tough. Mix just enough to combine the wet and dry ingredients, erring on the side of less mixing.
10. Fold in the chopped nuts with a large spoon or silicone spatula.
11. Pour the bread mixture into the loaf pan. Use a spoon or spatula to smooth out the top.

12. Bake the bread for about 52-58 minutes. It will be done when it is nicely browned and set in the middle (you can lightly touch it or check to see if a toothpick comes out clean).
13. Let cool for a few minutes, and then use a spatula or knife to go around the edges of the loaf. Cool until the loaf pan can be handled, then invert the pan to release the bread. Allow to cool completely before slicing.
14. Leftovers can be stored in the refrigerator or freezer.

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RYAN'S PEANUT BUTTER CUPS

by Ryan Kennedy, CCN, CFMP, CTN

Serves 4-6

1½ cups no-sugar-added baking chocolate chips
¾ cup peanut butter (or nut butter of choice)
½ cup plus 2 tablespoons unsweetened shredded coconut
1 tablespoon grassfed butter
1 tablespoon yacon syrup
Sea salt and macadamia nuts for topping (optional)

Directions

1. Combine peanut butter, grassfed butter, and sweetener in a glass (or stainless steel) bowl over a pot of simmering water, stirring until smooth.
2. Mix in shredded coconut.
3. In a separate glass bowl over the pot of water, melt chocolate, stirring gently.
4. Put a thin layer of chocolate in a nontoxic silicone mini cupcake tray, followed by a layer of peanut butter mixture and then another layer of chocolate.
5. Top with salt and macadamia nuts, if desired.
6. Freeze. Store in glass airtight container in freezer.

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IN THE NEWS: ANTIVIRAL RESEARCH UPDATE

VITAMIN D AND HOSPITALIZATION RISK FOR COVID-19

A case-control study published in the November issue of *The Journal of Clinical Endocrinology & Metabolism* found that a deficiency in vitamin D was associated with a higher risk of hospitalization for COVID-19. Participants were recruited from both the community and inpatient populations of two hospitals in the United Kingdom in this large-cohort observational study.

In total, 80,670 subjects were involved in the study, making it one of the largest to date linking vitamin D with COVID-19 disease severity. The participants were divided into primary and validation cohorts, depending upon which lab processed their vitamin D test. Out of the 80,670 subjects, 1,808 were admitted to a hospital with COVID-19.

In the primary cohort, the median vitamin D level in non-hospitalized participants with COVID-19 was 50.0 nmol/L compared to 35.0 nmol/L in those who were hospitalized. In the validation cohort, the median vitamin D level was 47.1 nmol/L in non-hospitalized participants versus 33.0 nmol/L in hospitalized patients. Considering both cohorts, the risk of a severe SARS-CoV-2 infection requiring hospital admission was between 2.33 and 2.4 times greater in those with a serum vitamin D level of less than 50.0 nmol/L, after adjusting for age, gender, and season. No association was found between low vitamin D levels and inpatient hospital mortality.

Vitamin D deficiency has been highlighted as a risk factor for viral respiratory illnesses due to its potent immunomodulatory functions. Vitamin D is anti-inflammatory and assists in upregulating the expression of multiple antimicrobial peptides. As the authors of the study concluded, "Urgent action is required to address the high prevalence of vitamin D deficiency that increases COVID-19-related morbidity."

SOURCE: Jude EB, Ling SF, Allcock R, et al. Vitamin D deficiency is associated with higher hospitalisation risk from COVID-19: a retrospective case-control study. *The Journal of Clinical Endocrinology & Metabolism*, 2021; 106(11), e4708-e4715. DOI: 10.1210/clinem/dgab439.

WORMWOOD AS AN ANTIVIRAL

Sweet wormwood *(Artemisia annua L.)*, a medicinal plant native to the temperate regions of Southeast Asia, has recently demonstrated efficacy against RNA viruses. In a study published in the peer-reviewed *Journal of Ethnopharmacology*, Nair et al. tested the in vitro ability of sweet wormwood leaf extracts to inhibit the replication of SARS-CoV-2 and its United Kingdom and South African variants (B1.1.7 and B1.351). Extracts were taken from seven cultivated varieties sourced from four continents. The extract concentrations needed to inhibit replication of the virus by 50% were calculated, and tea infusions were prepared to test the extracts. Human lung cancer and African green monkey kidney cells were infected with the USA SARS-CoV-2 isolate as well as the United Kingdom and South African variants for the in vitro assessment.

Artemisinin, a compound isolated from the sweet wormwood plant, was previously shown to block SARS-CoV-1 in 2005, and has been successfully employed as an antimalarial drug since the 1970s. In fact, a 2012 review found artemisinin-based therapies to be the most effective antimalarial agent available. The Chinese herbalism use of *Artemisia annua* for malaria and other fever-related ailments goes back at least 2,000 years.

Calculating on the basis of total flavonoid content, Nair et al. saw that the concentrations at which the extracts were able to prevent the virus from replicating by 50% ranged from 0.01 to 0.14 mcg/ml. Interestingly, data from the experiment suggested that artemisinin was not the principal ingredient responsible for suppressing the virus, as the extracts with the highest artemisinin and total flavonoid content required larger doses to block it.

SOURCES: Nair MS, Huang Y, Fidock DA, et al. Artemisia annua L. extracts inhibit the in vitro replication of SARS-CoV-2 and two of its variants. *Journal of Ethnopharmacology*, 2021; 274, 114016. DOI: 10.1016/j.jep.2021.114016.

Fairhurst RM, Nayyar GM, Breman JG, et al. Artemisinin-resistant malaria: research challenges, opportunities, and public health implications. *The American Journal of Tropical Medicine and Hygiene*, 2012; 87(2):231-241. DOI: 10.4269/ajtmh.2012.12-0025.

COLOSTRUM FOR RESPIRATORY TRACT INFECTIONS

Galdino et al. recently reviewed the immune-boosting properties of bovine colostrum and its potential for combating COVID-19, in a paper published in *Food and Agricultural Immunology*, an open access journal. Colostrum is the nutrient-rich fluid secreted by the mammary glands of female mammals during the first few days following birth. Colostrum contains high amounts of growth factors, enzymes, hormones, macronutrients (protein, fat, and carbohydrate), vitamins and minerals, and antibodies for nourishing the newborn and assisting the development of its immune system. The tissue-building and immune factors present in colostrum aid in appropriately sealing for the first time the immature intestinal wall of neonates. Adult supplementation with colostrum has benefited autoimmune conditions through the same mechanism—decreasing excessive permeability of the gut wall.

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Mammalian colostrum also contains probiotics and prebiotics that further the establishment of the infant's intestinal microbiota. Many of the probiotic species carried by human colostrum are of the *Lactobacillus* and *Bifidobacterium* genera, while the prebiotics present are in the form of oligosaccharides (strings of simple sugar units). The health of the gut microbiota plays a major role in immune function and has been linked to disease severity in patients with COVID-19.

Stem cells and microRNAs can be found in colostrum, too—the stem cells supplying precursors for all three of the germ layers, and the microRNAs helping to program and guide immune development as regulators of gene expression.

The protective immunoglobulins and lactoferrin (an antimicrobial protein) found in colostrum have previously demonstrated activity against a range of bacteria, fungi, viruses, and parasites. These pathogens include *E. coli*, *Salmonella typhimurium*, *Candida albicans*, HIV-1, and *Giardia lamblia*. Specific to respiratory tract infections, bovine colostrum has helped thwart infection by influenza virus, human rhinovirus, respiratory syncytial virus, and coronavirus varieties.

Athletes and other physically active individuals have also benefited from using colostrum, gaining enhanced immune defenses and improved exercise performance. Additionally, colostrum consumption has been associated with a reduction in asthma and respiratory allergy symptoms.

Because of colostrum's anti-inflammatory and antimicrobial properties, as well as its ability to strengthen both the innate and adaptive immune systems, multiple research groups are scrutinizing it as a prophylactic and treatment option for COVID-19. Lactoferrin may be capable of inhibiting the binding of SARS-CoV-2 to host cells, and in an observational study, liposomal bovine lactoferrin improved the symptom profile in all of 75 patients diagnosed with COVID-19.

Further studies are needed, but Galdino et al. concluded: "Current evidence indicates that colostrum and its components may contribute as a non-pharmacological alternative for the clinical management of COVID-19."

Editor's note: Selected sources for this research update are listed below. For a fully referenced version of this article, see our website, price-pottenger.org.

SOURCES: Batista da Silva Galdino A, do Nascimento Rangel AH, Buttar HS, et al. Bovine colostrum: benefits for the human respiratory system and potential contributions for clinical management of COVID-19. ***Food and Agricultural Immunology,*** **2021; 32(1):143-162. doi: 10.1080/09540105.2021.1892594.**

Alsayed A, Al-Doori A, Al-Dulaimi A, et al. Influences of bovine colostrum on nasal swab microbiome and viral upper respiratory tract infections—a case report. ***Respiratory Medicine Case Reports*****, 2020; 31, 101189. DOI: 10.1016/j.rmcr.2020.101189.**

Serrano G, Kochergina I, Albors A, et al. Liposomal lactoferrin as potential preventative and cure for COVID-19. ***International Journal of Research in Health Sciences*****, 2020; 8(1):8-15. DOI: 10.5530/ijrhs.8.1.3.**

PECANS MAY REDUCE THE RISK OF CARDIOVASCULAR DISEASE

Researchers from the University of Georgia have found that consuming pecans can help improve multiple risk factors for cardiovascular disease. In a randomized controlled trial published in *The Journal of Nutrition*, participants who incorporated pecans into their diet saw a significant reduction in total cholesterol, LDL cholesterol, total cholesterol/HDL cholesterol ratio, and apolipoprotein B (a component of LDL that reflects LDL particle size).

Fifty-two adults at risk for heart disease were recruited for the study. Their ages ranged from 30 to 75, and they were divided into two experimental groups and a control group. The first experimental group consumed roughly 470 calories worth of pecans each day as part of their regular diet. The second experimental group substituted the same amount of pecans for isocaloric foods from their habitual diet. The control group made no changes to their diet and did not consume any pecans.

After a period of eight weeks, changes in blood lipids and blood glucose were measured. Among the two experimental groups, an average decrease of about 5% was observed in total cholesterol, with an average drop of over 8% in LDL cholesterol. Triglycerides were lowered in the first group, while postprandial glucose fell in the second.

One of the researchers noted that whether participants added pecans to the diet or substituted them for other foods, similar responses in total cholesterol and LDL cholesterol were seen. Due to the small sample size in this study, further research is needed to validate the findings.

SOURCES: Pecan-enriched diet shown to reduce cholesterol. University of Georgia, August 23, 2021. news.uga.edu/pecan-enriched-diet-reduces-cholesterol.

Guarneiri LL, Paton CM, Cooper JA. Pecan-enriched diets alter cholesterol profiles and triglycerides in adults at risk for cardiovascular disease in a randomized, controlled trial. *The Journal of Nutrition*, 2021; 151(10):3091-3101. DOI: 10.1093/jn/nxab248.

POOR SLEEP HEALTH LINKED TO HEART DISEASE INCIDENCE

On November 9, results from a UK Biobank cohort study examining the link between time of sleep onset and cardiovascular disease incidence were published in *European Heart Journal–Digital Health*, a journal of the European Society of Cardiology. In one of the most extensive studies on sleep timing to date, participants who routinely fell asleep between 10:00 and 11:00 p.m. showed the lowest risk for subsequent development of heart disease.

Data from 88,026 subjects recruited between 2013 and 2015 were analyzed. Ages for the sample group ranged from 43 to 79, with 57.9% being female and 41.6% being male. Enrollees agreed to wear an accelerometer on the wrist for a period of seven days to track time of sleep onset and sleep duration. These individuals were then followed for an average of 5.7 years.

Of the participants, 3.58% developed cardiovascular disease (CVD) during the follow-up period. After adjusting for sleep duration, sleep irregularity, and established CVD risk factors, those with a bedtime of midnight or later saw a 25% greater likelihood of being diagnosed with CVD. In the bedtime categories of 11:00 p.m. to midnight and before 10:00 p.m., the increased risk percentages were 12% and 24%, respectively, surprisingly showing that falling asleep before 10:00 p.m. was nearly as problematic as falling asleep after midnight. A sensitivity analysis revealed the association between bedtime and CVD risk to be stronger in females versus males.

Sleep timing has been an understudied risk factor for CVD, and the results of this study support the importance of good sleep hygiene and respecting the body's circadian rhythms for the maintenance of heart health.

SOURCE: Nikbakhtian S, Reed AB, Obika BD, et al. Accelerometer-derived sleep onset timing and cardiovascular disease incidence: A UK Biobank Cohort Study. *European Heart Journal–Digital Health*, 2021; ztab088. DOI: 10.1093/ehjdh/ztab088.

IN THE NEWS

POLYPHENOL-RICH FOODS CAN HELP SEAL A LEAKY GUT

The journal *Clinical Nutrition* recently published a new analysis of the MaPLE trial (Microbiome mAnipulation through Polyphenols for managing Leakiness in the Elderly), which ran from 2016 to 2019. This randomized controlled trial investigated the effects of an eight-week, polyphenol-rich diet on the gut microbiota and permeability of the intestinal wall. Stool samples were analyzed to assess changes to the microbial population while the protein zonulin was employed as the marker for gut leakiness.

Fifty-one elderly individuals participated in the study, and the diet consisted of three daily portions of polyphenol-rich foods, including blood oranges, pomegranate juice, green tea, apples, dark chocolate, and berries. A previous report on the trial found that, compared to the control diet, the diet rich in polyphenols significantly increased the numbers of SCFA (short-chain fatty acid)-producing bacteria and decreased excessive permeability of the gut wall. The most recent analysis observed a correlation between food-derived metabolites in the blood and an improvement in the inflammatory environment of the gut as a result of the dietary intervention.

SCFAs nourish the epithelium of the small and large intestines and play a large role in regulating the immune system. In addition, increased permeability of the gut barrier is concretely regarded as a major contributor to the development of autoimmunity. This is primarily due to a leaky gut allowing for systemic inflammation to be ignited by way of bacterial toxins and other invaders gaining access to the bloodstream.

Intestinal permeability is modulated in large part by the bacteria constituting the gut microbiome. As the authors of the paper concluded, upping the intake of fruits, vegetables, and other plant foods may help to counteract a leaky gut and attenuate the severity of a present autoimmune condition.

SOURCE: Peron G, Gargari G, Merono T, et al. Crosstalk among intestinal barrier, gut microbiota and serum metabolome after a polyphenol-rich diet in older subjects with "leaky gut": The MaPLE trial. ***Clinical Nutrition,*** **2021; 40(10): 5288-5297. DOI: 10.1016/j.clnu.2021.08.027.**

PESTICIDE USE AND KIDNEY FUNCTION

A University of Queensland study recently examined the association between exposure to pesticides and kidney dysfunction, including chronic kidney disease and acute kidney injury. Using pooled data from the National Health and Nutrition Examination Survey, the researchers found that exposure to the pesticide malathion increased the risk of low kidney function.

Over 41,000 participants contributed data to the cohort study, and calculations of the estimated glomerular filtration rate were used to classify their degree of kidney function. Pesticide exposure was measured via metabolite concentrations in urine samples. Several pesticides (including malathion) were analyzed and compared against the heavy metal cadmium, which is known to be toxic to the kidneys.

After adjusting for variables such as age, gender, and ethnicity, the authors observed that those who were exposed to malathion had a 26% higher risk of kidney dysfunction. A sensitivity analysis that excluded individuals with high blood pressure or diabetes revealed an even higher risk of 32%.

Malathion is an insecticide used largely to control mosquitoes and fruit flies. It can also be found in topical medications for the treatment of head lice. Malathion is the most commonly applied organophosphate pesticide in the United States, and multiple animal and human studies have connected it to nephrotoxicity.

SOURCES: Pesticide linked to chronic kidney disease. University of Queensland, October 14, 2021. uq.edu.au/news/article/2021/10/pesticide-linked-chronic-kidney-disease.

Wan ET, Darssan D, Karatela S, et al. Association of pesticides and kidney function among adults in the US population 2001-2010. ***International Journal of Environmental Research and Public Health*****, 2021; 18(19), 10429. DOI: 10.3390/ijerph181910249.**

In the News was researched and written by Price-Pottenger science writer Denton Coleman.

Therapeutic Effect of Lamb Fat in the Dietary

by Francis M. Pottenger, Jr., MD

(Originally published in 1957)

Animal fats in the dietary provide man with a source of fatty acids that can be utilized with relatively little damage to the highly active unsaturated components natural to the species. The physiological effect of a fat or an oil depends on its chemical composition. The nutritional value of animal fats varies from species to species, and the general characteristics of a fat are peculiar to a given species. However, the sex of the animal, whether altered or unaltered, the age of the animal when altered, and the age at the time of slaughter, along with the feeding methods used in rearing the animal, including the use of chemicals in the feeds, can change the chemical characteristics of the fat.

The fat of beef contains less unsaturated fatty acid than does the fat of the lamb or pork. These meats, when properly prepared, are more effective in the treatment of conditions requiring low melting point fats than beef. Improper processing, particularly overcooking, chemically alters fat so that toxic properties may be present.

The unsaturated fatty acids of low melting point, particularly those of lamb, are most effective in the treatment of one of the commonest forms of fat disorders, simple dry skin. The higher melting point fats with less unsaturated fatty acid content are more useful as fuel to the body, and the characteristic of the subcutaneous fat of the human being can be changed by the type of fat he consumes.

• • •

Fats in the diet serve four major purposes. First, they supply energy for locomotion and the maintenance of bodily temperature. Second, they supply the body with depot reserves that secondarily insulate against mechanical injury, heat, and cold. Third, they provide a source of elements for a complex metabolic process. Fourth, they act as agents for the transfer of nutritional accessories.

The so-called neutral fats are glycerol esters of fatty acids. They are composed of a molecule of glycerine attached to three fatty acid radicals. Glycerine is freed from the fatty acid radical in the process of digestion by hydrolysis. On assimilation into the body, glycerine is oxidized, releasing energy in a manner similar to the utilization of carbohydrate. It is changed into phosphoglycerol. The fatty acid radicals, likewise, are oxidized with a further release of energy.

Long chain fatty acids are broken down, step by step, to the so-called C-2 fragments or acetic acid radicals. Octanoic acid, for example, is first reduced to a molecule of hexonic acid plus an acetic radical. The hexonic acid is reduced to butyric acid plus an acetic acid radical, and the butyric is reduced to two molecules of acetic acid by oxidation. The breakdown of this 8-carbon atom of fatty acids gives four acetic acid [radicals] or C-2 fragments, which in turn can be changed into two molecules of aceto-acetic acid.

Some of the fat that is consumed in excess of body requirements is deposited in the so-called fat depots. These fat supplies serve the purpose of protecting the body from mechanical injury, of insulating against heat and cold, and of acting as a source of energy in case the intake of fat in the food falls below the normal nutritional requirements. These stores are constantly changing with the metabolic picture of the individual. They provide 1000 calories per kilo when released as energy.

The acetic acid [radicals] or C-2 fragments enter into many complex chemical processes within the body, providing the building stone for the elaboration of cholesterol, acetylated amines, and many complex metabolites necessary for bodily functions. The assumed mechanism for the utilization of these fragments in the production of more highly complex radicals is known as the Krebs cycle.

The further function of dietary fats is to act as carriers for absorbed substances that are found accompanying natural fats. These substances of animal origin consist of the four fat-soluble vitamins—A, D, E, and K; certain of the animal steroids, such as the ovarian, testicular, and cortical adrenal hormones; and compound lipids, such as the phospholipids, sphingomyelins, and others. These lipids are usually metabolized in a manner similar to the simple lipids.

The simple fats differ greatly in their chemical composition and their physical properties. Physically, the fats are divided into the fats and fatty oils, depending upon whether or not they melt at 20° C. This is determined, in part, by the number of carbon atoms in the chain of the fatty acid and whether or not the chain contains double bonded carbon atom linkages. The so-called saturated fatty acids above six carbon atom chains are solid. On the other hand, the unsaturated fatty acids, including those with as many as 22 carbon atoms, are still liquid.

Depot fats vary greatly in their chemical composition, depending on the carbohydrate and fatty acid content of the ingested food. Likewise, the chemical composition of depot fats of an animal vary with the location in the body, such as in the highly active depot fat of the peri-renal tissue when compared with the fat of the buttocks. In spite of those changes that can be brought about, there appear to be certain physical characteristics of the depot fats of an animal of a given species that are specific. The fat of a hog can vary from a fatty oil, when rendered as lard, to a firm, clear white substance, depending on its feed. One would not confuse these widely variable tissues of the hog with those of the steer, which tends to store a much higher melting point fat with a greater quantity of saturated fatty acids.

The unsaturated fatty acids of low melting point, particularly those of lamb, are most effective in the treatment of one of the commonest forms of fat disorders, simple dry skin.

These differences would be particularly evident when comparing two animals of different species on similar types of ration. Besides the effects on the composition of the fatty acids of depot fats stored in the tissue of animals, due to their rations and species, we have differences in chemical composition due to the sex of the animal. This controls not only the location of the depot deposit but to a lesser degree composition of the fat. Age, too, has a marked effect on the character of the fat. The female of the species tends to have a slightly softer fat than a male of the same age. In certain phases of the reproductive cycle, the female tends to store much more fat than at other phases. The infant, too, has a fat of considerably different composition from the mature. The castrate differs from the normally sexed. The state of

nutrition is determined in part by the metabolic activity of the animal. The highly active physical animal stores less fat and utilizes its fat stores in starvation. The fat of the highly active tends to be firmer and contain less water than that in the less active. All fats contain some water. The lower the metabolic level of the individual, the more water is stored. This is well understood by the animal husbandryman who frequently places his animals on starvation rations before putting them on his fattening diet. Farmers have likewise learned that the use of certain drugs, along with inactivity and high carbohydrate feeding, will reduce metabolism and aid him in fattening the animal. Such practices frequently produce an animal with tissues that are softer but frequently less tasty than those of an animal with better metabolism.…

Besides the alteration in the composition of fats above mentioned, the care with which these food elements are stored and preserved is of great importance. Saturated fatty acids are relatively stable compounds. It is for this reason that hydrogenization of fatty oils and other fats is so widely practiced in order to preserve them. Unsaturated fatty acids, especially those with two or more double bonds, are highly unstable and their breakdown to free acid—odoriferous aldehydes, organic peroxides, ketones, and other volatile substances—is responsible for much of the decomposition of foodstuffs. Likewise, the oxidation of the double bonded fatty acids to form ozonides and polymers renders the substance less digestible. Some of the compounds resulting from the breakdown of fatty acids may be not only distasteful but actually poisonous to man. The process of rancidity can be greatly hastened by heat and other methods of handling foods. In some fats, there are important antioxidants among which are the tocopherols or substances with vitamin E activity. The alpha-tocopherol, in particular, possesses this property. Although it is present in all meat to some degree, there are certain vegetable fats and oils that appear to be much richer in this type of material than others.

Hansen[1]… fully discussed the importance of unsaturated fatty acids and their effects, especially when administered in the form of pork fat to the eczematous child. It will be found that pork tends to concentrate unsaturated fatty acids to a degree greater than many animals. Inasmuch as cutaneous lesions in experimental animals have been shown to be due to the lack of the unsaturated fatty acids, and not the saturated, pork appeared to be an excellent source of these materials. The author's approach to the problem of the eczematoid and dermal conditions in general was stimulated by a slightly different point of view. Lamb fat offered several advantages, both theoretical and practical, over the use of pork. Lamb is a meat that can be consumed rare and for that matter is consumed raw by people in many parts of the world. Raw meats contain factors that are destroyed in the usual preparation of meats,[2] especially if they are well done. The possibility of infection from pork precluded its use as rare meat. Secondly, the sheep is naturally a fat animal, bred for the purpose of producing meat, wool, and fat. It excretes in its wool a fatty substance containing esters, cholesterol, vitamins, and hormones, as well as steroids that go to make up lanolin. Inasmuch as the primary source of this highly curative wool fat must come from ani-

mal metabolism, it is reasonable to suspect that the fat depot of this animal might be expected to contain some of these substances in reserve supply.… It is, likewise, found that freshly cut meat has considerable advantage over meat cut one or more days in advance, inasmuch as oxidation takes place on the surface of the meat and actually changes the flavor for as much as an eighth of an inch with pieces that have been cut not over 24 hours. Freshness is important.

Evidence of fat deficiency in the American public has become of great concern to the physiologist, as has been so expressed in recent textbooks dealing with the subject. Beauty experts have written on the problem extensively, especially the problem of dry skin. In my own practice, we analyzed one hundred consecutive examinations representing fifty men and fifty women. Twenty-five of the fifty men had evidence of dry skin. Thirty-seven of the fifty women showed similar evidence. Simple dry skin is an index of fat dyscrasia.[3] Although in the adult, more women appear to have dry skin than men, in our practice, the male child has greater evidence than the female.

It is, likewise, found that freshly cut meat has considerable advantage over meat cut one or more days in advance, inasmuch as oxidation takes place on the surface of the meat.

Fat deficiency in the mammalian species is not corrected by fats composed of saturated fatty acids. It is only those unsaturated fatty acids of two or more double bonds that prevent the development of this condition, and the double bond fatty acids of four or more are more effective in a curative manner. The rare lamb chop has proven an excellent food source of unsaturated fatty acids and can bring about changes noticeable in the skin of patients who have been on a low fat consumption in as short a period of time as 48 hours. This change can be detected by a softening of the skin; and as the patient continues to consume the rare lamb chop, the velvety return to the normal skin can be gradually noted. Follicular keratoses that are so common on the legs and buttocks of many fat-starved individuals gradually disappear. When a lamb chop is prescribed, it is understood that all of the fat is to be eaten. Although many people feel that they cannot consume fats, there are few, indeed, who are truly unable to handle this form of fat. When digestive difficulties are present, they are usually due to insufficient gastric, pancreatic, or liver function. A substitution of suitable digestants can usually suffice to enable the patient to handle his meat unless natural prejudice or serious disease of the biliary tract or stomach precludes its use. The average patient, although his complaints may be multiple, who does not suffer from serious organic disturbance other than the dry skin, responds well. One can see the change in the hair as quickly as in the skin. It has been common to find boys with unruly hair who have been plastering it down with greases or other cosmetic preparations, within less than a week's time show sufficient return of natural oil to their scalp so that the texture of the hair becomes soft and the subject can be properly groomed.

These results are not obtained if the patient removes the fat from his lamb chop [or] if he does not consume it rare. The average one-inch chop should be cooked no longer than two minutes on a side at 450° F. Nor are the results obtained well from the use of rare beef fat. The usual fats, pasteurized butter[4] and oleomargarine, frequently reported as being consumed in relatively large amounts, do not possess the factors necessary to correct this condition in spite of the fact that the tables of composition of many oleos and butter show the presence of unsaturated acids.

Many people in their desire to follow the fashion of the day have lost especially important depot fat pads which are of special significance, namely, the sucking pads in the cheeks, the fat pads around the lips, and the fat pads in the palms and plantar fascia that serve to protect the metacarpal and metatarsal bones from mechanical injury. The loss of gluteal fat pads, particularly in older people, is a serious problem. The return of these important fat depots is much slower than the cutaneous manifestations

mentioned above. Although depot fats may be returned to the subcutaneous tissue relatively quickly, the return of these protective fat pads is much slower and difficult of attainment.

Frequently, particularly women are unable to grasp objects firmly because of lack of these pads on the fingers or the palms of their hands. Frequently painful feet are associated with the loss of these pads and difficulty in walking may actually be experienced. Loss of protective pads over the tuberosities of the ischia renders sitting very uncomfortable for many Americans, not merely the aged. Once these pressure pads are lost, it frequently requires from one to three years in the younger individual to replace them. If, on the other hand, the individual has entered into the declining years beyond his fifties, once these protective pads have been resorbed, adequate fat intake over a long period may be insufficient to return these individuals to comfort. The elderly patient who has lost his fat pad may be made more uncomfortable by a fat-restricting diet than any fundamental condition which has made the clinician feel the necessity for such restriction.

The loss of gluteal fat pads, particularly in older people, is a serious problem.

SUMMARY

The great fear of the production of hypercholesterolemia through the use of fats does not appear to be justified when the rare lamb chop is used for the major source of fat. The author has previously reported[5] that a high-fat diet of animal origin did not alter the cholesterol level when used in conjunction with lecithin, a lipotropic agent, but actually diminished the cholesterol level. Inasmuch as a high lamb fat diet has not been attended with any evidence of damage, and cholesterols have not increased but have diminished in conjunction with a lipotropic agent, this source of animal fat appears to be of great value in the treatment of simple dry skin and other fat dyscrasias.

The rare lamb chop with all its fat provides an excellent source of unsaturated fatty acids that appear to be curative for the usual dry skin that is seen in such a high percentage of individuals today. It seems to be an excellent source for returning fat pads to the younger individual. It may not be successful in returning fat pads to the older person, although it may materially improve his general nutrition. 🕮

Ed. note: Excerpted from an article that appeared in the Spring 1957 issue of *Journal of Applied Nutrition* (Vol. 10, No. 2) and was reprinted in the Fall 2002 issue of *Health and Healing Wisdom Journal*, predecessor of the *Price-Pottenger Journal of Health and Healing*. *This is one of the many articles by Dr. Pottenger that can be found in the Price-Pottenger research archives.*

ABOUT THE AUTHOR

Francis M. Pottenger, Jr., MD, (1901-1967) dedicated his professional life to understanding the role of nutrition in the prevention of chronic illness and physical degeneration. He was best known for his ten-year feeding study examining the effects of feeding cooked and heat-processed vs. raw foods to cats, the findings of which were chronicled in the book Pottenger's Cats *(available from Price-Pottenger). Dr. Pottenger served as president of the Los Angeles County Medical Association, American Therapeutic Society, and American Academy of Applied Nutrition. In 1940, he founded the Francis M. Pottenger, Jr., Hospital in Monrovia, California, for the treatment of respiratory diseases.*

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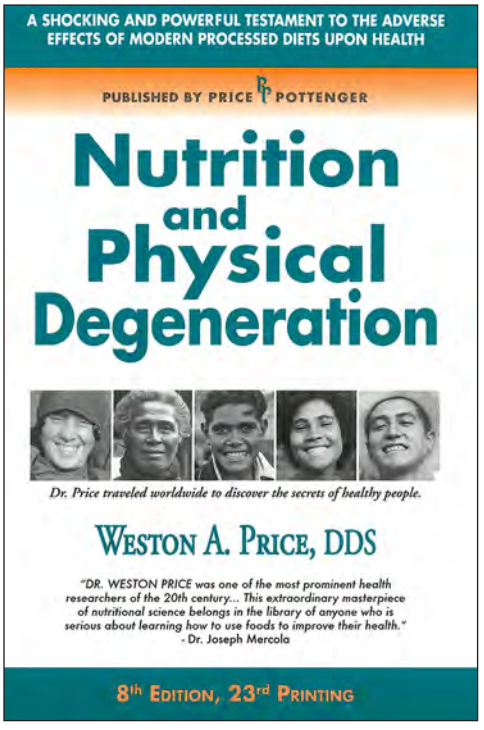

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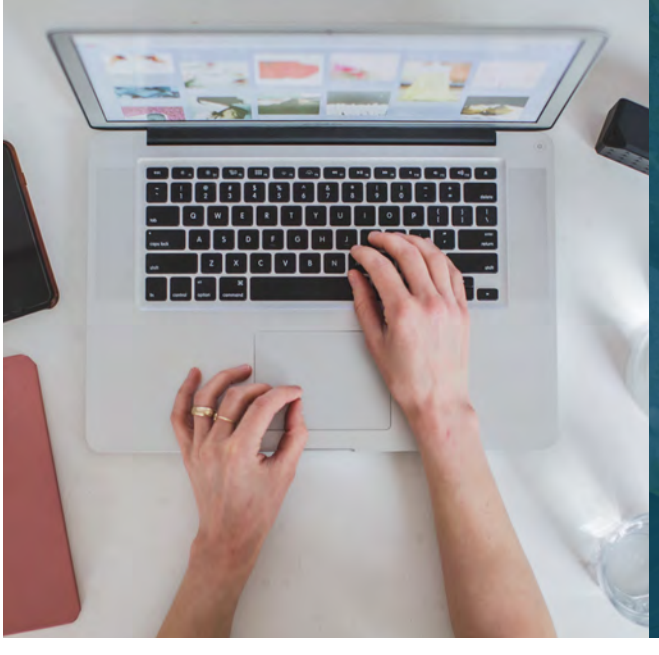

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