Hook, Line and Stinker!

The Truth about Fermented Cod Liver Oil

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TABLE OF CONTENTS

INTRODUCTION

SECTION I: THE “F” WORD — FERMENTATION
  Bubble Rap
  Acid Trip
  In Search of Wee Beasties
  Vat’s Up?
  Clean Up Operation
  Fermenting by another Name?
  Going Under
  Great Green Hope?
  Make It So!

SECTION II: STINKIN’ THINKIN’
  Peroxide Value
  Anisidine Value
  TOTOX Value
  TBA (Thiobarbituric Acid)
  Free Fatty Acids
  Acid Value
  Playing Cod with Consumer Health

SECTION III: IN BAD TASTE
  Foul Play
  Over a Barrel
  Spoiler Alert

SECTION IV: NETTING A, D, E AND K
  The Numbers Game
  Lab in the Headlights
  Green Pigment of the Imagination
  Testing, Testing
  Sinking to a New Low
  Not a Codsend?
  Special K
Fish E
Making a Production of It

SECTION V: SOMETHING FISHY
A Not So Golden Ratio
Mysteries of the Deep
Catch Me if You Can
Hooked!
Right to Know
Trans Fats

SECTION VI: THE PRICE WAS RIGHT
Activation, not Fermentation
Warnings to Moms
High Frustration
Synergy with Butter Oil

SECTION VII: GETTING BUTTER
OK or KO’d
The Still Mysterious X Factor
Land of Milk and Honey
The Truth?

CONCLUSIONS

ACKNOWLEDGMENTS

ABOUT THE AUTHOR
INTRODUCTION

It’s brown. It stinks. It burns people’s throats. And its taste has been described as “downright nasty.”

It’s the Green Pasture brand “fermented cod liver oil” (FCLO), a unique product said to be the one and only truly traditional cod liver oil. FCLO hit the market in 2006, and — thanks to the endorsement of Sally Fallon Morell — quickly captured the loyalty of thousands of people in the paleo, primal and Weston A. Price Foundation communities.

Believers promote it as the only true “traditional” cod liver oil, the “high vitamin” cod liver oil recommended by Dr. Weston A. Price DDS, and the very secret to the superpowers of the Vikings. It’s recommended for pregnant women, babies, and children of all ages. People facing health challenges know they should take extra in the belief that something that tastes so bad must really be good. In only nine years, FCLO has become nothing less than the “real food” community’s secret to optimal health, high energy and maximum longevity.

The Word from the Weston A. Price Foundation is that babies and children won’t grow well without it. Parents on Facebook forums share tips on how to squirt the brown liquid down the throats of protesting babies and how to scrub the inevitable brown stains off bibs and clothing. And those who cry that FCLO is too expensive for their budgets are urged to prioritize it over everything else, including the buying of organic, pastured and free-range foods. Parents whose gut instincts tell them to stop feeding it to their children find
themselves guilt-tripped with statements like “You’d find a way if your child needed to take a prescription medication, wouldn’t you?”

Those few people who’ve questioned whether oil can even be fermented, or if the smell and color might signify rancidity, find themselves shushed and shunned. Their concerns have been summarily dismissed as ignorant, unfounded, disproven by science, seriously misinformed, and the slanderous disparagement of unethical and jealous competitors. To which, a few people have dared to push back with words like “The nose KNOWS!” “What’s become of common sense?” and “Show me the science.”

In short, lines have been drawn. FCLO is either a true miracle food given to us by David Wetzel, a farmer/saint from Nebraska

Or a case of the Emperor’s New CLO.

* * * * *

Last summer, the FCLO flap caught my attention and I became curious enough to start investigating. I talked to colleagues with expertise in fats, oils, fish and fermentation, took a long look at the history and research, and talked to doctors, nutritionists and other health practitioners who had used FCLO in their practice.
I went into the project expecting to find evidence that would reconcile the adversarial “either/or” positions into a more peaceful “both/and.” I believed FCLO would be right for some individuals, wrong for others. After all, how could so many health experts be wrong?

As I reeled in the evidence, I came to believe there was something seriously wrong with FCLO. I thought the Weston A. Price Foundation should get to the bottom of it, and advised Sally Fallon Morell that we needed to test the Green Pasture Fermented Cod Liver Oil product properly and not just rely on David Wetzel’s assurances and his testing.

I expressed concerns to her and later to WAPF’s Board of Directors about probable rancidity and possible putrefaction, and said I was skeptical of data showing improbably high levels of Vitamin D2 in the product. I furthermore shared reports from clinicians who were finding severe Vitamin D deficiencies among some members who were regularly taking FCLO. As Vice President of WAPF, I felt the safety of our members and the credibility of the foundation were at stake.

In December 2014, WAPF’s Board of Directors voted against testing based on Sally Fallon Morell’s beliefs, David Wetzel’s assurances, and scientific data of limited and questionable value. I was strongly advised to relax, leave the science to people who could be “fair to Dave” and to toe the FCLO line.

Instead I went underground and set out on my own to test FCLO at some of the world’s top laboratories. Though my initial concerns had been rancidity and nutrient density, I
soon realized there might be far bigger fish to fry. FCLO might be adulterated. And it might not even come from cod!

* * * * *

In early February, I sent newly purchased, unopened bottles of unflavored FCLO off to five laboratories in the United States, Norway and the Netherlands for testing. Later, when Green Pasture’s cattle lick product became available for purchase, a sample of the liver went off for DNA testing. I sought answers to a dozen key questions:

- Is it cod?
- Is it wild or farmed?
- Is it from the arctic?
- Is it unadulterated? Nothing added?
- Have antioxidants been added?
- Does it have high levels of the fat soluble vitamins A, D and K?
- Is the Vitamin D mostly D3 or D2?
- What are the levels and ratios of EPA, DHA and other fatty acids?
- Are trans fats present?
- Is it fermented?
• Is it rancid?

• Is it putrid, with unsafe levels of tyramine, histamine, cadaverine and other biogenic amines?

In short, does FCLO have integrity? Is it as advertised? Is it whole, natural, safe and nutritious?

What is the truth about fermented cod liver oil? This is a preliminary report, with more research needed and considerable funding required. But right now it looks like consumers have been hooked on a whopper of a fish story.

* * * * *

ENDNOTES


2. “When the new fermented cod liver oil arrived, I was surprised to see that it was very thick, very dark, and had a very foul odor. I went ahead and tried one dose; it was absolutely disgusting! It burned my throat. . . .” — Sarah Smith, Nourished and Nurtured blog. http://bit.ly/1JqWZ5r

4. “After my first attempt at downing the stuff, I promptly spent the day gagging as the flavor continued to revisit my palate. Only recently have I gotten to the point where I can smell my kids’ FCLO without feeling ill.” Emily Bartlett, Holistic Squid blog. http://bit.ly/1J4eHpJ

5. “Nastiest tasting pills ever,” “yucky,” “pukey” and hundreds of other comments on the taste, odor and other sensory properties of FCLO can be found in reviews of the Green Pasture products posted at www.amazon.com. There are also many comments that it’s “not that bad,” “tolerable,” “manageable” and “worth it.”

6. “Hard as I tried, I found myself unable to tolerate the cod liver oil after a short time taking it, I found its burning sensation as I swallowed it so intensely painful I gave up on it. I figured that my body somehow couldn’t tolerate it, or wasn’t ready for it.” — David Gumpert, The Complete Patient blog. http://bit.ly/1Pzwwl1

7. Discussions about FCLO — some of which get quite heated — can be found in the comments section of various “real food” blogs, Facebook groups and Weston A. Price chapter leader forums, and especially at www.nourishingourchildren.com and in the Facebook groups Nourishing our Children and Nourished Children led by Sandrine Love Perez.


9. Author’s conversations with people at Wise Traditions, NTA, Paleo f(x), Ancestral Health, and other conferences. Also, comments written online in forums and support groups, including those noted above.

10. Posts and comments at the Facebook groups Nourishing our Children and Nourished Children as well as other online groups and forums, including a comment posted by Sandrine Love Perez.
at the Nourished Kitchen blog that says, “To say that this cod liver oil is rancid and putrid is slander. You can post this. Sally.” http://nourishedkitchen.com/benefits-of-cod-liver-oil/

11. Comments by readers at Chris Kresser’s website—http://bit.ly/1ECxjeB—including, “The whole notion of fermenting cod liver oil is misguided,” “fermented-ness is not a quality of the oil,” “fermented cod liver oil isn’t really fermented at all, it’s rotted,” and the “product is misbranded.”

12. Comments at the Nourished and Nurtured blog —http://bit.ly/1JqWZ5r— including praise for Sarah Smith: “You are a brave woman! FCLO (fermented cod liver oil) is such the rage for members of the WAPF.”


14. A particularly good example of this comes from Sandrine Love Perez at http://bit.ly/1hjqtpA. Her article concludes with the words: “Meanwhile, thank you, David and Barbara Wetzel for restoring the ancient art of fermented cod liver oil production and for providing us with this sacred food. I celebrate you, David Wetzel. I would like to give you a standing and prolonged ovation for the life you lead, for the inspiration you offer, the integrity and values you uphold, the grace and generosity of spirit you possess, and the love that you offer freely to those who are blessed to cross your path.”
SECTION I
THE “F WORD” — FERMENTATION

It’s brown and it smells, but believers in FCLO insist that it’s not rancid but “fermented,” a process said to dramatically increase its vitamin content, improve its digestibility, and miraculously protect the fragile omega 3 polyunsaturated oils found in cod liver oil from rancidity.1-3

Indeed, David Wetzel goes so far as to say that his product does not need antioxidants and only gets better with age!4,5

In fact, testing shows FCLO has not been safely preserved by fermentation — and may not have been produced by fermentation at all.

BUBBLE RAP

Lactic acid fermentation is a traditional method of food preservation used to produce foods such as sauerkraut, kvass, kimchi, kombucha, beer, wine, pickles, and sourdough breads. Lactic acid bacteria metabolize sugars and other carbohydrates in food in an anaerobic environment and produce the acidic environment that is needed to kill or inhibit the growth of pathogens and to prevent the production of bacterial toxins.
If done properly, the process not only assures food safety but preserves and increases the content of vitamins; improves digestibility; and imparts the distinctive sour, tart and mouth-puckering flavors associated with fermented foods.\textsuperscript{6-12}

The idea that cod livers could be fermented is ludicrous on the face of it. Lactic acid bacteria show a stunning capacity to degrade different carbohydrates and related compounds into the primary end product of lactic acid. But they have a very limited capacity to synthesize the amino acids of protein and none at all to synthesize fats.\textsuperscript{13}

Fermentation requires carbohydrate, which is why it is most often associated with vegetables, grains and dairy. While it is true that some cultures also ferment fish and meat, the process requires some sugar, typically supplied through acid marinades or rubs and/or the addition of carbohydrates such as rice. Processes that preserve fish and meat primarily through salt are generally called “curing.” Fish sauces such as the garum and liquamen favored by the ancient Romans are made by layering whole fish with copious amounts of salt and draining off the liquid, which is a separate product from the oil.\textsuperscript{14-16}

The fact is, cod livers are ill-suited to fermentation because they lack sufficient carbohydrate.

According to figures from the National Food Institute in Denmark, 100 grams of cod liver contain 55.1 grams total fat, 4.5 grams of protein and only one gram of carbohydrate.\textsuperscript{17} The website FitBit reports 44.2 grams fat, 9.3 g protein and 2 grams total carbohydrates.\textsuperscript{18} Figures for
pollock and other fish livers are not readily available, but probably about the same.

The Green Pasture line is that it is “fermenting” the livers rather than the oil itself and that the name “Fermented Cod Liver Oil” is just easier to say than “The Oil from Fermented Cod Livers.”19,20 The disclaimer doesn’t alter the fact that the process of “fermenting” livers has to involve oil and protein. Conceivably a little “fermentation” could occur with that one or two percent carbohydrate, but it would be a stretch to describe the overall product as “fermented.” And if anything in there ever does ferment — and that is a big if — the pH needs to be acid enough to preserve it and prevent spoilage.21

**ACID TRIP**

True lacto-fermented products are acidic with a pH under 4.6.22 The pH of FCLO as tested at two laboratories was 5.17 and 5.8. Wetzel has said on several occasions on videos and in conversation that the pH of FCLO is even higher, at 6.1 or even 6.2. So whether or not the oil was actually obtained through “fermenting” of the livers, the evidence shows that it’s not being preserved by an acidic pH.
IN SEARCH OF WEE BEASTIES

Fresh lacto-fermented products would also show a lively population of lactic acid bacteria ranging from 1 million to 50 million cfu (colony forming units) per gram of lactic acid. Lab testing, however, shows the lactic acid bacteria in FCLO at levels less than 10 cfu (colony forming units) per gram.

Furthermore, testing showed non-detectable levels of homofermentative and heterofermentative bacteria, two categories determined by the products and patterns of fermentation. The homofermentative process produces lactic acid as its sole end product while the hetero-fermentative process produces lactic acid, carbon dioxide and ethanol/acetate. Whether the product might once have contained live bacteria is unknown. Lab managers consulted said they had no way to test for that possibility.

Levels during active phases of fermentation should be anywhere from 1 million to 50 million cfu/g, but as the food supply is exhausted, the bacteria die off and their numbers drop to non-detectable levels. Changes in temperature, moisture, heat and pH of the environment can also contribute to die off.

This is true, of course, with sauerkrauts and other cultured foods as well. However, such products remain preserved because the pH is an acidic 4.6 or lower. While it’s true that some genuinely fermented products have a higher pH, they must undergo pasteurization or some other form of treatment to prevent spoilage and to ensure food safety.
Given that Green Pasture “ferments” the livers and not the oil, the very low levels of lactic acid bacteria were to be expected. Even if the oil were being fermented — or “pre-digested” as Wetzel has been wont to say — any bacteria would have quickly eaten up that one or two percent carbohydrate and died off early on. Unless, of course, Green Pasture has added other carbohydrates to keep fermentation going, a possibility that will be discussed shortly.

On a more positive note, lab testing showed no contamination of FCLO by unwanted microbes. Negative or non-detectable levels for *E. coli*, total coliforms, salmonella, staphylococcus aureus, yeast, mold, listeria, or other pathogens were found. Of course, the likelihood that any microbes could survive in any oil without moisture is slim. 26,27

**VAT’S UP?**

Producers of fermented foods typically use “starters” to ensure reliability and reproducibility, to attain the desired flavor, and to better control the rate of fermentation. Wetzel has shared videos that show rows of white containers labeled “starter” and he says Green Pasture has “developed an inoculant for our fermenting work” that has “taken much time through selection.” 28

But what’s actually in there is anyone’s guess. Is the Green Pasture starter teeming with the lactic acid bacteria needed for rapid acidification of the raw material? Does sugar serve
as a carrier for those bacteria? What about whey? How about salt? And is Green Pasture actually using its own unique and secret formula or could it be buying a readymade starter culture targeted for the food fermentation industry? If the latter, it may well contain antimicrobial substances, sugar polymers, sweeteners, aromatic compounds, vitamins, enzymes, as well as the expected lactic acid bacteria.29

Given that liver contains extremely low carbohydrate content, any attempt to keep fermentation going would require plenty of carbohydrate in the recipe. Does Green Pasture add in such carbohydrates? If so, what?

And is Green Pasture “fermenting” in air-tight vats? Photographs show a large building with a greenhouse-like glass roof and vats with top openings that appear to be tightly sealed with opaque lids. Tim Boyd, writing for the Weston A. Price Foundation’s website, confirms “air-tight vats.”30 Wetzel seems on board with this, yet also likes to talk about his “solar facility” and how his “all-natural” products benefit from exposure to the sun, moon and stars.31 Will the real process please stand up?

Not surprisingly, professionals who’ve researched fermentation and brought lactic acid fermented products to the market have been curious about his procedures. But those who’ve asked Wetzel about his signature process report inconsistent, contradictory, confusing, disrespectful, and even nonsensical answers.

Similarly, homemakers who enjoy fermenting sauerkraut, kimchi, kvass and other bubblies on their kitchen counters
have visited Wetzel’s booth at conferences to ask for tips on how to make fermented cod liver oil at home. Instead of a straight answer, Wetzel evades the questions, with answers like, “Whey? That could be a way to go.” “Salt? Sure. Add it if you’d like.” . . . “Yup, you . . . could . . . add some molasses . . .”32

The last could be a serious contender for the Green Pasture secret “fermentation” recipe because molasses is listed as an ingredient on the label of the Cattle Lick product. Given that this product is manufactured from the spent livers left over from FCLO production, ingredients used for that process that end up in the final product must be included on the label by law. The Green Pasture Cattle Lick label reads as follows:

**Ingredients:** Sun Dried Cod Liver, Fermented Cod Liver Oil, Salt from Redmond Utah, Clay, Sulfur, Magnesium, Molasses, Organic Iodine, Diatomaceous Earth, Oyster shell.

Notably, the list also includes salt, as would be expected of any form of fermentation involving brine. Whether the remaining ingredients represent added supplements or residue from the fermenting or filtering processes is unknown.

Certainly food-grade diatomaceous earth can be used for filtering and detoxifying products, but Green Pasture may add it to the Cattle Lick recipe for control of fleas, ticks, worms and other parasites, and/or to detoxify heavy metals. Indeed the diatomaceous earth (rather than the livers and oil) is one likely reason users report lustrous coats on
animals that regularly lick the product. Diatomaceous earth also helps reduce manure odor and control flies.\textsuperscript{33}

Many companies, of course, keep trade secrets, a policy at odds with the transparency and full disclosure valued by the “real food” community. Unlike Big Pharma and Big Food, most artisanal food manufacturers willingly share at least basic details of their processes with consumers who either want to know what’s in their foods or to do it themselves.

CLEAN UP OPERATION

The Green Pasture label for unflavored FCLO lists only one ingredient —“fermented cod liver oil,” which suggests he has filtered every last drop of the starter and substrate residue out of the oil. But if so, how?

All Wetzel will say is he has “developed a unique cleaning process” that does not rely on carbon filters or heat because those methods “remove flavors, odors, colors and nutrients, and also denature the fragile unsaturated fatty acids such as DHA and EPA.”\textsuperscript{34}

Whatever else that “unique cleaning process” is doing, the lab data reported in Section II suggests it’s \textit{not} protecting EPA, DHA and other fatty acids from rancidity. Indeed, the distinct flavors, odors and colors are indicative of rancidity — extreme rancidity — and that’s what the data show. As for nutrient density, lab data reported in Section IV show levels of fat-soluble vitamins that are significantly lower than are to
be expected in a cod liver oil. There’s a good reason for that, as the report on DNA testing found in Section V will show.

Notably, Green Pasture does not seem to have filed a patent application for its unique and mysterious “fermentation” process.

**FERMENTING BY ANOTHER NAME?**

If not lacto-fermented, could the liver be “fermented” in some other way? Is it perhaps “pre-digested” as Wetzel sometimes claims? Is it simply the “bacterial/ enzymatic digestion of the cell wall to release the lipids from the cellular structure” to use his words?35 If so, does it happen in dark vats the way digestion occurs in the body where “the sun doesn’t shine”? Then how about that special “solar activation” he likes to talk about?34

Is it possible that the liver is “fermented” in the way Eskimos preserve seal or whale blubber? Some FCLO fans think so, especially those who subscribe to the idea that “What doesn’t kill us, makes us stronger.” That technique involves burying foods until they begin to putrefy. Endogenous enzymes in the fat or muscle and/or exogenous enzymes from fungi do the work of breaking down the fat. Problem is, it’s playing Russian roulette with botulism. *C. botulinum* spores are common in fish and mammals from cold climates, and the state of Alaska has the highest incidence of this sometimes fatal form of food poisoning in the United States.36,37
Similarly, food historians provide many accounts of fermenting meat and fat in the earth until they become “high.” These include cod’s heads in the Faroe Islands, shark meat in Iceland, venison in Slovakia, and so forth.\textsuperscript{38}

FCLO proponents like to point to a photo of hanging shark livers posted on the Weston A. Price Foundation website.\textsuperscript{39} This old-fashioned black-and-white photo seems to give the impression that the healthy South Sea Islanders visited by Dr. Weston A. Price enjoyed optimum health because they regularly consumed an oil from “fermented” shark livers.

In fact, Dr. Price had nothing to say about this in \textit{Nutrition and Physical Degeneration} or in any of his letters or articles either, according to Joan Grinzi, Executive Director of the Price-Pottenger Nutrition Foundation.\textsuperscript{40} Grinzi says the photograph is not one of Dr. Price’s, and adds that Dr. Price referred to “fermentation” only twice in his book, and it applied to poi and wine. (For more about what Dr. Price had to say about cod liver oil, see Section VI.)

The shark liver story and photo actually come from David Wetzel. While people in the South Sea Islands probably harvested oil from hanging shark livers, the correct word for the process would not be “fermentation” but “solar rendering.” Moreover, it would have occurred over a few days at most, not over a period of months. In a warm climate, the decay — that Wetzel prefers to call “fermentation” — would have quickly turned to full-on rot.

Fresh shark oils rendered in this manner would have enjoyed short-term protection from rancidity because of the
relatively high levels of the antioxidant Vitamin E naturally found in the shark liver.\textsuperscript{41,42} In contrast, cod and most other fish livers are low in Vitamin E. This is the reason that most fish and cod liver oil manufacturers add Vitamin E or other antioxidants to their products.

**GOING UNDER**

A theory proposed by Alison Birks, MS,\textsuperscript{43,44} a nutritionist and herbalist based in Woodbury, CT, and repeated by Kim Schuette, CN, founder of Biodynamic Wellness in Solana Beach, CA, and a member of the Board of Directors of the Weston A. Price Foundation,\textsuperscript{45} holds that FCLO might be produced by “submerged fermentation.” Neither defines the actual process beyond stating that the livers are “submerged” in brine for a prolonged period and that the glycogen in the livers provides the substrate needed for fermentation.

This doesn’t sound much different from the submersion used in lactic acid fermentation, as when cabbage is kept below the brine for sauerkraut production. As for that glycogen in the livers, there’s far too little sugar in there to allow fermentation to proceed. Breakdown of the protein and fats occurs, of course, but through “all natural” putrefaction and rancidification processes that offer few possible benefits and many proven risks.

Birks’ belief that FCLO is fermented — and the corollary that fermentation can only result in beneficial substances — leads her to repeat Wetzel’s oft-heard claims of heightened
nutritional value, increased digestibility, lowered toxicity and no added synthetic antioxidants. (In fact, lab testing of FCLO shows little, if any, of this is true, as will be established in Sections III, IV and V.

True “submerged fermentation” is a high-tech industrial process that fits few of the known facts about Green Pasture’s operation. It is widely used by food, supplement and pharmaceutical companies to manufacture antibiotics, enzymes, antioxidants, citric acid, lactic acid, glycerol, hypocholesterolemic, antihypertensives, anti-tumor agents, biosurfactants, and other substances. The process involves feeding corn syrup, cane molasses, beet molasses, malt alcohol or other sugars to bacteria, fungi, and/or other microorganisms which manufacture the desired enzymes or other products. Unlike lactic acid fermentation, which is anaerobic, the submerged fermentation process is aerobic. It involves aeration through constant stirring and vigorous mixing, and is sometimes completed with injections of pure oxygen. The time table? A mere 18 to 24 hours.46-48

**GREAT GREEN HOPE?**

One last possibility is that Green Pasture could be “fermenting” with the help of algae. Although most algae thrive in the sun, they can be grown in the dark on sugars in a process known as “heterotrophic” fermentation.49 The algae convert the sugars to oil and biomass, which can be converted, in turn, into biofuels, chemicals, cosmetics and nutritional products including “healthy oils” that many
perceive as more sustainable alternatives to fish oils. Because of the growing interest in biofuel, algae farming is common in Wetzel’s state of Nebraska and a leading company based in Omaha is BioProcessAlgae.

Algae are ergosterol-containing organisms that can produce ergocalciferol (Vitamin D2) if exposed to light. This seems like it could explain the odd claim of high levels of D2 in the Green Pasture product. But even the most prolific algae would be unlikely to provide such a prodigious boost and even algae have higher levels of Vitamin D3 than D2.\textsuperscript{50,51}

In any case, as will be discussed in Section IV, only one laboratory found high levels of Vitamin D2 in FCLO and its testing methods appear dubious. Finally, algae could conceivably be enlisted to boost the long-chain DHA fatty acid levels to those found in a true North Atlantic cod liver oil, but whether Green Pasture has ever attempted that is unknown. What’s clear is the DHA (docosahexaenoic acid) levels of FCLO consistently test lower than the EPA (eicosapentaenoic acid) levels, the importance of which will be discussed in Section V.

**MAKE IT SO!**

Is there any other way fish livers could be fermented? Wetzel admits experts in the areas of food science, microbiology, nutrition and fermentation are at loss to explain how his product can be fermented, yet he insists that he knows better. FCLO, he insists, is fermented. He *knows* it’s
fermented. It *must* be fermented. Or predigested, enzymatically altered, transmuted or transmogrified by some magical process that offers a unique form of rancidity that befits a sacred food — a form no laboratory has identified but that is all benefits and no risks.

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**ENDNOTES**


4. Author’s conversations with David Wetzel at national and regional Wise Traditions conferences and at the airport in Chattanooga, Tennessee.


8. Wild Fermentation, Public Group, Facebook. http://on.fb.me/1LjgQ3M


Nourished Kitchen website. “... the livers are fermented. Most definitely fermented. The livers are fermented to extract the oils. The product could accurately be called ‘the oil of fermented cod livers’ but, that is a long sentence, and David Wetzel chose fermented cod liver oil instead.” http://bit.ly/1fp6I3t


27. Alcaligenes bacteria can contribute to a rise in free fatty acid levels in fish oils during storage. This not generally considered pathogenic. de Koning AJ. The free fatty acid content of fish oil, part V. The effect of microbial contamination on the increase in free fatty acid content of fish oils during storage at 25°C. European Journal of Lipid Science and Technology, 1999, 101, 5, 184-186.

28. email from David Wetzel, 10/14/14.


32. Author’s conversations with researchers, writers, bloggers and homemakers who have talked with David Wetzel about fermentation.

33. Nature’s Wisdom Food Grade Diatomaceous Earth http://bit.ly/1MxWbe0


35. FAQ Green Pasture website http://bit.ly/1fp6tA3


40. Author’s conversation with Joan Grinzi, Executive Director of the Price-Pottenger Nutrition Foundation, at PaleoF(x), Austin, TX, April 25, 2015. email from Joan Grinzi April 16, 2015


SECTION II: STINKIN’ THINKIN’

It’s brown, it stinks and it can burn people’s throats.

Common sense says this product’s rancid. But common sense seems to be in short supply these days, and it seems especially rare among health-conscious people who’ve come to believe that if a food tastes bad then it must be good for us, and if smells bad too, it might be even better.

According to this line of thinking, people hooked on FCLO think it must be nothing less than the power food of the ages. Then again, it might just taste nasty because it’s rotten.

Proving it is rancid, however, proved surprisingly challenging.

Laboratories used by the fish oil and vegetable oils industry are set up to test products for early stages of rancidity. They serve supplement manufacturers who have designed elaborate safeguards to protect fragile oils from rancidity due to air, light, heat or other factors.¹ Fish and fish liver oils with the long-chain fatty acids EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) have a lot of fragile oils to protect.

Yet Green Pasture purposely allows its livers to “ferment” for months. Although Wetzel keeps the details of his processing methods shrouded in myth and mystery, there’s little doubt that there is high potential for rancidity. Fragile
polyunsaturated oils, after all, do not thrive under changing “all-natural” conditions of heat, light and air, all of which could be present if Wetzel is, as he sometimes says, “solar activating” his product.²

Most likely, he is producing FCLO in opaque vats under airtight anaerobic conditions. That’s the word of Tim Boyd at the Weston A. Price Foundation³ and what many photographs suggest.⁴ In that case, he might have light and air under control, but probably not temperature. Wetzel says he does not “heat” his product and Sally Fallon Morell insists she cannot endorse any heated oils, but anyone who’s had a sun room or greenhouse knows that “solar facilities” during the summer can reach very hot levels.

Despite the risks of long-term processing and the apparent lack of controls, Green Pasture reports that it regularly orders lab testing and can prove FCLO is not rancid. Indeed, the Green Pasture website reports seemingly acceptable levels of rancidity markers such as peroxide, anisidine and TBA.⁵ Samples sent to the same lab that Wetzel regularly uses yielded similar data, suggesting that Green Pasture did not achieve non-rancid results by fraudulently submitting cleaner-than-usual samples or cod liver oil from his competitors.

Does this prove FCLO is not rancid? No. Because it’s the wrong kind of testing for a long-term “fermented” product.
THE CHALLENGE OF RANCIDITY TESTING

Evaluating rancidity in oils is like taking aim at a moving target. Tests used to evaluate rancidity provide data that will be a “hit or a miss” depending on where the oil is in its life cycle.

An oil that’s rancid before it’s even bottled is likely to test “negative” on all primary and most secondary signs of rancidity. Fatty acid levels and Acid Value, on the other hand, increase along with rancidity over the lifetime of the oil.6-9 They are by far the most reliable markers for the Green Pasture product. And they are troubling numbers indeed.

Let’s look more closely at the different lab tests and data:

PEROXIDE VALUE

Peroxide value (PV) measures the levels of lipid peroxides. PV increases during the early life of oils, and decreases in the more advanced stages. High peroxide values always indicate a rancid fat, but moderate or low values prove little or nothing. The PV value of FCLO as tested at four laboratories came in at 0.2 meq/kg, 0.53 meq/kg, 2.42 meq/kg and “non-detectable.”

These levels are extremely low — and are even lower than the results of 3.9 meq/kg and 4.0 meq/kg that Green Pasture reports on its website. The FAO (Food and Agriculture Organization of the United Nations) standard for fish oils and fish liver oils is that Peroxide Value be less than or equal
The quality standard set by the Global Organization for EPA and DHA (GOED) is 5 meq/kg and by the Council for Responsible Nutrition (CRN) is 6 meq/kg.

These low results are hardly surprising given that FCLO has been “fermenting” for months, with its peroxides long since decomposed into secondary and tertiary oxidation products. Very rancid oils have low Peroxide Values.

Most fish and fish liver oils sold in the marketplace show peroxide values that start low, increase, peak, and then decrease over the storage life of the oil. Manufacturers try to extend the “lag phase” before oxidation takes off as long as possible by lowering temperature, reducing oxygen and adding antioxidants. In contrast, FCLO has gone through its entire peroxide cycle from low to high and back to low before it is even bottled.

In a video posted on the Green Pasture website, Wetzel states that he has found extremely high peroxide values of 15 to 40 meq/kg at the peak of the peroxide bell curve but that the levels drop to 0 to 5 meq/kg by the time he bottles his product. Does this mean rancidity has disappeared and is no longer cause for concern? Many viewers might think so. But, no. Rancidity is still present but has progressed to a more advanced stage.

In all probability, FCLO is bottled at the point that it has become so rancid that it can’t get much worse. Indeed, this is the likely reason FCLO seems to have “shelf stability” compared to other oils and why antioxidants won’t help.
Extreme rancidity is also why some loyal consumers report its flavor to be “strong,” “disagreeable” or “objectionable,” yet insist it is not “rancid.” To them, rancidity is a distinct smell-and-flavor characteristic associated with a food or an oil that has recently “turned” or “gone bad” and which, if tested, would show a moderate to high Peroxide Value with a rising Anisidine Value.

ANISIDINE VALUE

Anisidine Value (p-AnV) is a marker of secondary oxidation that helps tell the history of an oil. Typically peroxide levels will rise over the first couple weeks or months as an oil starts to turn rancid, then drop off as the peroxides isomerize into aldehydes, ketones and other secondary oxidation products. At this point, anisidine values begin to climb, flavors and odors become objectionable, and consumers may experience burping. Next, anisidine levels, in turn, will decrease.14,15 Three labs testing FCLO’s anisidine level reported seemingly acceptable levels at 6.8, 13, and 3.44. On its website Green Pasture reported test results at 9 and 16.

A Norwegian lab that is a world leader in testing fish oil using 1H NMR and 13C NMR technology, tried to test for anisidine value, but failed because of a mysterious compound in the sample that “caused interference with the method.” Other testers too have run into that problem, with most concluding that interference came from the “brown pigment” or blood.16 Although blood could be part of the protein residue from
fermenting fish livers, another lab showed very low levels of iron. At less than 0.0002 percent, it’s highly unlikely that the brown color comes from blood.

The Food and Agriculture Organization of the United Nations (FAO),17 Council for Responsible Nutrition (CRN)18 and Global Organization for EPA and DHA (GOED)19 suggest fish oils and fish liver oils meet a quality standard in which Anisidine Value is less than or equal to 20. While low anisidine numbers might suggest non-rancidity for FCLO, it’s important to remember that Anisidine Value — like Peroxide Value — is a poor marker of rancidity in an oil that’s been “fermenting” for months.

TOTOX VALUE

TOTOX (TOTal OXidation) Value is a level calculated with PV and p-AnV data. The formula is $(2 \times PV) + p\text{-AnV} = \text{TOTOX}$. TOTOX is a valuable tool for evaluating commercially produced oils as it reveals a quality problem for any oil marked with both a high Peroxide Value and Anisidine Value. In general, “The lower the TOTOX, the better the quality of the oil.”20,21

The TOTOX Value for FCLO — as calculated from PV and pAnV levels data from three laboratories — came in at 7.2 meq/kg, 13 meq/kg. and 8.27 meq/kg.

On the face of it, the TOTOX values for FCLO look good. They are not only well under the FAO, CRN and GOED cut off of 26 meq/kg22-24 but under 19.5 meq/kg, which is the
higher Fish Oil Industries standard that marks the point at which an oil is likely to turn rancid. Unfortunately, TOTOX Value depends on PV and p-AnV, and so is useless for evaluating a product that’s already been “fermenting” for six months to a year.

**TBA (THIOBARBITURIC ACID)**

The TBA test was developed to detect malondialdehyde (MDA), a byproduct of polyunsaturated oil breakdown that reacts with DNA, inducing genotoxicity and chromosomal aberrations. MDA has been linked to many serious and potentially fatal health problems, including pulmonary embolism, heart disease, connective tissue disorders, and cancer.26-36

Given the well-established dangers of MDA to human health, TBA readings would seem desirable. Unfortunately, simple measurements of MDA aren’t worth much. The problem is MDA levels decrease whenever MDA reacts with proteins, DNA or phospholipids to form other toxic substances. If the TBA test occurs early in an oil’s life cycle, the aldehydes may not have yet formed, but if the test occurs late in the game, the aldehydes may have reacted with protein or other components in the sample or simply volatilized.37-39 Thus, TBA, too, tells only part of the story.

TBA Value, as reported from two labs, came in at 0.20 and 0.28. Green Pasture has reported 0.55, 0.49 and 1.59 on its website. These numbers are all low, but, as already
discussed, could be the erroneous result of malondialdehyde reacting with proteins under conditions of oxidation. On the other hand, a TBARS (Thio-Barbituric Acid Reactive Substances) test on samples from 2013 and 2014 came up with a result of 23.60 mg/kg, which is high.

In a published abstract, Standard Process Laboratory reported “MDA, an indicator of polyunsaturated fatty acid oxidation, was 10-fold higher in the fermented product” compared to the other cod liver oil samples. These results vary greatly.

Given that FCLO naturally contains some protein residue from “fermenting” livers, TBA would appear to be an unreliable way to test FCLO for rancidity.

**FREE FATTY ACIDS**

Virtually all fats and oils in the plant and animal kingdoms start out in the triglyceride form, in which three free fatty acids are attached to a glycerol backbone. As the oils start to go rancid, the fatty acids begin to break free in a process called “lipid hydrolysis.” The percentage of TAGs (triacylglycerols, the term for the most prevalent form of triglycerides) then decreases and the percentages of DAGS (diacylglycerols) and MAGs (monoacylglycerols) increase.

Oils from fresh livers will be light colored with a high triglyceride level and low free fatty acid content while oil obtained from livers which have begun to decompose will be
darker in color with a lower triglyceride and higher free fatty acid content. Light-colored oils were traditionally considered “medicinal.” Darker oils were for animal feeding and the darkest were used for paint, varnish and other industrial applications.42,43

Many stressors can increase the Free Fatty Acid content of oils, including the manufacturing process; duration and conditions of storage; and the nature of the fatty acids themselves. The last will vary from species to species — for example, pollock will differ from cod — and within a species according to the fish’s age, climate, season, environment, and other factors.44,45

According to independent marine oils expert Anthony P. Bimbo, the allowable limit of Free Fatty Acids (FFAs) for crude fish oil is in the range of 1 to 7%, but typically at 2 to 5%.46

The percentage of Free Fatty Acids in FCLO is much higher, as would be expected of a dark-colored oil. One lab reported Free Fatty Acids at 16.2% but another found an extremely high level of free fatty acids at 40.10%. Green Pasture’s own test data as posted on its website also came in high at 19.2% and 25.3%.

**ACID VALUE**

Acid Value quantifies the free fatty acids (FFAs) that have split off from the parent triglycerides though lipid hydrolysis. As oils become rancid, triglycerides break down into fatty
acids and glycerol, causing an increase in acid number. Acid Value is 1.99 times the Fatty Acid Value.47

Hence free Fatty Acids at 16.2% have an Acid Value of 32.3 mg/KOH/g. Free fatty acids at 40.10% yield an Acid Value of 79.8 mg/KOH/g. As reported on the Green Pasture’ website, Free Fatty Acid test results came in at 19.2% and 25.3% which (multiplied by 1.99) yield Acid Values of 38.2 and 50.3, respectively.

Although the Norwegian lab using 1H NMR and 13C NMR technology did not provide numbers, it reported “relatively high” levels of FFAs, DAGs (Diacylglycerols) and MAGs (monoacylglycerols), implying “a significant hydrolysis of the TAGs (triacylglycerols) originally present in the raw material.”

Acid Value should be less than or equal to 3 mg KOH/g according to FAO, CRN and GOED standards.48-50 European Pharmacopoeia Standard (EPS) is more stringent with its maximum of 0.5 mg KOH/g.51 Green Pasture’s products range from an Acid Value of 32.3 mg-KOH/g to a whopping 79.80 mg-KOH/g. In plain English, these Acid Value numbers are extremely high.

So high that they blow any claims that FCLO is a non-rancid oil right out of the water.
PLAYING COD WITH CONSUMER HEALTH

The marine oils experts I talked to all found the FFA and Acid Value numbers to be shockingly high, and several lab managers said FCLO was the most rancid fish liver oil they’d ever tested. They based their opinion on both objective lab data and subjective organoleptic impressions from of smell, taste, texture.52

Yet Wetzel insists there is no problem. He argues Free Fatty Acid level is “not an oxidative marker,” that high Free Fatty Acid levels in his product are desirable, and that textbooks that disagree with his position need to be revised. In his view, leading researchers and scientists are ignorant and either just don’t understand his unique natural product or are biased against it. Indeed, Wetzel thinks Free Fatty Acids offer consumers the benefits of “pre-digestion.”53,54 In other words, since triglycerides are going to be metabolized in the body anyway, why not provide readymade rancid products to give the body a head start?

This singular point of view disregards a massive body of research showing that rancid EPA, DHA and other polyunsaturated fats (PUFAs) in the diet can cause, contribute to and accelerate the growth of heart disease, cancer, reproductive disorders and other ills.

Free Fatty Acids are so cytotoxic to cell membranes that the body makes it a priority to build them back into the safe triglyceride form as quickly as possible.55,56 Sadly, far too many consumers of FCLO have fallen for the idea that Wetzel knows more than the world’s leading fats and oil
scientists, that the laws of science don’t apply to traditional foods, and that FCLO offers a unique, sacred and desirable form of rancidity.

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**ENDNOTES**

1. Conversations with managers and technicians at food, supplement and marine oils laboratories. Few are set up to properly test fresh or fermented fish oils because so few manufacturers produce them.

2. Do you solar activate your oils as Dr. Price did early in the 20th century? [http://bit.ly/1Jiyup7](http://bit.ly/1Jiyup7). In August 2015, subsequent to the publication of the Price-Pottenger Nutrition Foundation’s eBook *What Dr. Price Said about Cod Liver Oil*, Wetzel took down his original post and replaced it with: “Our plant is exposed the sun but this does not equate to solar activation as Dr. Price discusses. Dr. Price had a specific protocol and definition for the term solar activation and it does not occur unless uv rays are directly exposed to the products. In our plant the products are not exposed to solar uv.”


4. Photographs and videos from Wetzel and also from bloggers and others who have visited his facilities.


15. O’Brien p. 200

16. Conversations with researchers, scientists and lab technicians.

17. FAO/WHO

18. CRN
19. GOED
20. Miller.
21. FAO/WHO
22. FAO/WHO
23. CRN
24. GOED


30. Tanaga KI, Bujo H, et al. Increased circulating malondialdehyde-modified LDL levels in patients with coronary artery diseases and their association with peak sizes


40. Metzger BT, Barnes DM. Nutritional profiling of cod liver oil processed by molecular distillation, fermentation, or unrefined. *FASEB*, 2012, 26, 636. http://bit.ly/1IXs6lx This study was only published as an abstract and Standard Process declined to share the complete study or specific data.

41. O’Brien, 220-221.


46. Bimbo.

47. O’Brien, 220-221

48. FAO/WHO

49. CRN

50. GOED


52. Conversations with marine oil scientists, lab managers and others.

54. Conversations with David Wetzel at Wise Traditions regional and national conferences and at Chattanooga Airport. Email correspondence during October 2014.


SECTION III: IN BAD TASTE

Biogenic amines are compounds that arise when proteins go bad, bacteria grow wild, food spoils and flesh decomposes. Properly controlled, biogenic amines give us the distinctive odors and flavors of ripe cheeses, high meats, pungent fish sauces, strong sausages and fine wines.

Anthony Bourdain has famously written, “To me, life without veal stock, pork fat, sausage, organ meat, demi-glace, or even stinky cheese is a life not worth living.” Unfortunately, increasing numbers of people in the modern world are unable to tolerate these traditional, amine-rich foods.

The severity of the symptoms people experience depend on many factors, including the amount, type and variety of amines ingested, bio-individuality and detoxification ability. Ideally, we should be able to tolerate some biogenic amines as they have positive roles to play in hormone and neurotransmitter production and regulation, digestion, cardiovascular health, immune system modulation, and many other brain/body functions.

FOUL PLAY

The best known of the biogenic amines are tyramine, histamine, cadaverine and putrescine. Cadaverine and putrescine, as their names suggest, are associated with the foul smells of putrefying and decaying corpses. But it’s
tyramine and histamine that cause the most trouble for people.\textsuperscript{7}

Tyramine reactions can cause headaches, migraines, neurological disorders, nausea, vomiting, respiratory disorders, hypertension and other unwanted effects.

Histamine reactions can lead to a variety of symptoms, including headaches, sweating, rashes, respiratory distress and speedy heart rate. Worse, other biogenic amines — including putrescine, cadaverine, tyramine, phenylethylamine, spermine and spermidine — can potentiate toxic effects from histamine by inhibiting histamine-metabolizing enzymes in the intestine, increasing histamine uptake and liberating endogenous histamine.\textsuperscript{8,9}

Because biogenic amines can cause food poisoning and are unwanted in most processed foods, regulatory agencies require commercial food manufacturers to carefully monitor concentrations throughout the process along with other food safety measures. Their concerns are “food intoxication” and “hygiene.”\textsuperscript{10}

\section*{OVER A BARREL}

Biogenic amines are high in most fish and fish sauce products, but they are not typically found in fish oils or cod liver oils. They may be present in FCLO, however, because Green Pasture’s production method involves the “fermenting” of fish livers for many months. Wetzel likens his method to
the traditional process of fishermen tossing fish livers in a barrel, but it is important to note that the historical accounts speak of “putrefaction” of the livers that occurred in the days, weeks and months ahead.

And contrary to the Green Pasture myth, the brown oils were not considered optimal. Nearly all the historical accounts say the pale, golden and light brown cod-liver oils harvested early on the process were valued for medicinal purposes. Medium brown cod-liver oils were used in a pinch, but the dark brown oils were rarely if ever consumed. Rather they were preferred for lamp oil, paint, varnish and other industrial purposes. Indeed, dark brown cod-liver oils were so cheap that the poor painted their buildings red with a mixture of iron oxide and brown cod liver oil.

**SPOILER ALERT**

“Fermenting” cod livers — or “putrefying” them, to use the word preferred by historians— is highly likely to result in biogenic amines. As the hepatic cells in the livers break down, they not only release oil but also blood and other protein residues. Even if the glycogen in the liver or any added carbohydrates “ferment,” the oil released will start to go rancid while the protein will begin to putrefy. Without an effective filtering system, some of that decomposing protein residue — blood and biogenic amines — is likely to end up in the final product.
Green Pasture insists few biogenic amines get into FCLO. But just in case they do, Wetzel reminds us of the abundance of tyramine, histamine and other biogenic amines found in cheeses and other healthy traditional foods. Tyramine, he says “is a common amine in fish and is the common amine in cheese” and is also what gives FCLO its strong flavor. Tyramine, he says, is “typically derived through different protein digestion by Lactobacillus family of bacteria. Most in our community understand this as good and proper.”17

As discussed in Section I, Wetzel’s “fermentation” method may not be “good and proper” at all. As established in Section II, the method results in rancid oils. Yet, the Green Pasture website18 reports non-detectable (ND) levels for most of the biogenic amines tested and moderate levels for a few:

- Phenylethylamine 18 ppm, 13 ppm and 9.8 ppm.
- Tyramine 14 ppm, 5.3 ppm and 4.8 ppm.
- Spermidine 3.1 ppm, 2.9 ppm or non-detectable (ND)
- Tryptamine 4.3 ppm or ND
- Spermine 4.2 ppm or ND

Samples sent to the same lab used by Wetzel for this report showed non-detectable levels for all eight biogenic amines tested, suggesting that Green Pasture did not achieve low levels of biogenic amines by fraudulently submitting cleaner-
than-usual samples or a processed cod liver oil from his competitors.

However, in his Frequently Asked Questions section, he reveals tyramine levels for FCLO range from 5 to 50 ppm.\textsuperscript{19} Samples from 2015 showed a presence for biogenic amines, with none at high levels.

- Phenylethylamine 10.3 mg/kg
- Spermine < 1 mg/kg
- Cadaverine 2.52 mg/kg
- Histamine 2.26 mg/kg
- Putrescine <1mg/kg
- Spermidine <1 mg/kg
- Tryptamine 7.61 mg/kg
- Tyramine 8.81 mg/kg

In contrast, a lab in Scotland identified extremely high levels of tyramine, tryptamine, putrescine, phenylethylamine and cadaverine. These levels would almost certainly cause tyramine-sensitive people to react — and perhaps severely. Those on monoamine oxidase inhibitors (MAOI) medications would be at special risk.\textsuperscript{19} Notably the histamine level is extremely low.

- Tryptamine 113 mg/kg
- Phenylethylamine 168 mg/kg
• Putrescine 44.3 mg/kg
• Cadaverine 85.5 mg/kg
• Tyramine 177 mg/kg
• Histamine <10 mg/kg
• Tyramine 177 mg/kg
• Spermidine <10 mg/kg
• Spermine less than <10 mg/kg
• Phenylethylamine 10.3 mg/kg
• Spermine < 1 mg/kg
• Cadaverine 2.52 mg/kg
• Histamine 2.26 mg/kg
• Putrescine <1mg/kg
• Spermidine <1 mg/kg
• Tryptamine 7.61 mg/kg

It is a mystery why the data from the two U.S. laboratories came in at non-detectable or low to moderate while one tested high for many biogenic amines is a mystery. The fact that the lab Wetzel has regularly used offers biogenic amine testing only in the pet food category might raise eyebrows. But all the labs use the same cut off point of parts per million.

The FCLO samples submitted this spring for testing were manufactured in late 2013 or early 2014. The testing in
Scotland however, occurred back in August 2013 and involved submission of a FCLO sample from 2012.

As will be discussed in Section V, Green Pasture may have evolved its manufacturing method since 2012 to produce a cleaner product. Given that the recent samples of FCLO are far less likely to cause tyramine reactions in sensitive individuals, this might be good news. Then or now, histamine reactions seem not to be a problem.

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ENDNOTES


5. EFSA Panel on Biological Hazards (BIOHAZ), *EFSA Journal*, 2011, 9, 10, 2393


7. EFSA Panel on Biological Hazards (BIOHAZ), *EFSA Journal*, 2011;9(10):2393

8. Ladero, Calles.

9. Joint FAO/WHO

10. EFSA

11. Joint FAO/WHO


20. Hall-Flavin, Daniel K. I just started taking MAOIs for depression. Do I really need to follow a low-tyramine diet? Mayo Clinic Patient Care & Health Info. http://mayocl.in/1NeiFCv
SECTION IV: NETTING A, D, E and K

Green Pasture and the Weston A. Price Foundation (WAPF) report that the levels of Vitamins A and D in fermented cod liver oil (FCLO) are extraordinarily high — at least double the amounts found in other cod liver oils. Supposedly a single teaspoon can provide levels of Vitamin A levels at approximately 9,500 IU per teaspoon, with vitamin D levels at 1,950 IU.¹

Curiously, WAPF and Wetzel insist the Vitamin D in FCLO is mostly made up of Vitamin D2 — not the inferior D2 obtained from irradiated yeast, but a unique and sacred form of D2 first identified by them in Green Pasture fermented cod liver oil.²,³

The fact that none of the world’s leading marine oil scientists has recognized this unexpected find has not fazed their promotion of it.⁴

In fact, Green Pasture’s high fat-soluble vitamin theory makes little sense to people outside the world of FCLO. While fermentation can increase vitamin content — particularly the level of B vitamins⁵ — it’s a leap of faith to think the process could boost Vitamin A to a whopping 9,500 IU or even more. Vitamin A is set at 4,500 IU per teaspoon for a standardized cod liver oil and found at anywhere from
3000 to 6000 IU per teaspoon in a natural cod liver oil. Similarly, we find Vitamin D guaranteed at 450 to 500 IU in standardized products and typically found at 400 to 500 in a natural product.

As for most of FCLO’s Vitamin D showing up as Vitamin D2, that’s a very strange finding indeed.

**THE NUMBERS GAME**

The level of Vitamin A found in FCLO is not too shabby at all. It is typical of any natural cod liver oil, but well under the 9,500 IU promised on the Weston A. Price website and the rounded-off 10,000 IU figure that is frequently lobbed around the internet. Testing for Vitamin A, a top US lab reported 73,200 IU per 100 grams, which comes to 3,147.6 IU per tsp.

The labs furthermore report that most of the Vitamin D is in the expected D3 form, with minuscule levels of D2. The total Vitamin D, however, is strikingly low — well under what would be expected of a natural cod liver oil. The figures for Vitamin D3 came in at 17.6 IU per gram (75.7 IU per tsp) and Vitamin D2 at less than 0.04 IU per gram (under 0.172 IU per tsp).

That same lab found nearly non-existent levels of D2. In contrast, the Green Pasture website records data on more than 60 samples tested between 2008 and 2013. Not all the reports separate out the D3 and D2, but whenever both are
reported, the D2 levels dwarf the D3. A few examples of lows and highs from 2013 are listed below (with a rough calculation from milliliters to grams at 0.9 grams per milliliter and 4.3 grams per teaspoon).

For the year 2013, Green Pasture reported the lowest and highest levels of Vitamin A at:

- March 29, 2013: 35 IU/mL retinol and 310 IU/mL palmitate (135.5 and 1199.7 IU per tsp)
- April 9, 2013: 220 IU/mL retinol and 3250 IU/mL palmitate (851.4 and 12,577.5 IU per tsp)

In 2012 Green Pasture reported the low and high Vitamin for D2 (plus the accompanying D3) as:

- May 18, 2012: 810 IUs/ML D2 with 100 IU/mL D3 (3134.7 IU of D2 and 387 IU D3 per tsp)
- June 28, 2011: 2971 IUs/mL D2 with 53 IUs/mL D3 (11,497.8 IU of D2 and 2055 IU D3 per teaspoon)

Wetzel attributes so much variation to his product being “all natural” and the vagaries of the fermentation process.6,7

Skeptics say the data make no sense.

LAB IN THE HEADLIGHTS

The incongruous data cited by Green Pasture and the Weston A. Price Foundation come from one small laboratory, UBE Analytical Laboratories of Fullerton, California, which
uses HPLC (High Performance Liquid Chromatography), a technique that involves ultra-violet light detection. UBE’s Lab Manager Danny Pang prides himself on unique testing methods, the specifics of which he has declined to disclose, and which have produced results that no one else seems to have replicated.\(^8\) While Pang may yet prove to be a genius who has gone boldly where no lab has gone before, the likelier explanation is inappropriate testing methods and/or erroneous analysis.

W. Craig Byrdwell, Research Chemist at the USDA Food Composition and Methods Development Lab in Beltsville, MD, and author of numerous publications in peer-reviewed journals, explains: “If the method is UV detection, it is very easy to be fooled. There are numerous other lipid-soluble components that overlap with the retention times of both Vitamin D2 and Vitamin D3.”\(^9\)

As Byrdwell explains in the August 2008 issue of the *American Journal of Clinical Nutrition*, “Historically, the measurement of vitamin D concentrations in foods has presented an enormous analytic challenge. Vitamin D is a complex, highly reactive and lipophilic molecule. Extracting vitamin D from food materials with all the other lipid components complicates an already difficult separation process and makes detecting vitamin D by ultraviolet molecular absorption highly problematic.”\(^10\)

Unlike UBE Analytical Laboratories, credible and consistent results from major laboratories specializing in marine oil testing show minuscule amounts of Vitamin D2 in all cod liver oils tested including FCLO.
Michael F. Holick, PhD, MD, professor of medicine, physiology, and biophysics at Boston University Medical Center and the world’s leading Vitamin D researcher, said in 2013 that he had never found D2 in cod liver oil.\textsuperscript{11}

Furthermore, many laboratories including the Institute of Aquaculture, Stirling University in Scotland, have tested fish livers and many unrefined/unprocessed fish liver oils over many years without ever finding more than minimal amounts of D2.\textsuperscript{12}

Could all these experts be wrong? Wetzel and Fallon-Morell think so, saying that the D2 has gone missing because the labs lack UBE’s unique technology. As for the researchers, Wetzel blames their failure to “seek and find” the elusive D2 on lack of curiosity, limited intelligence, lackluster initiative, investment in the status quo and “kick backs” from the Vitamin D3 supplement industry.\textsuperscript{13}

Is there any way D2 could be present at high levels in a fish liver oil? It sounds like a possibility worth exploring. Pro-Vitamin D, D2 and D3, after all, can all be found in the plankton that fish eat.\textsuperscript{14,15} That may be so, but D2 in the food doesn’t guarantee D2 in the fish. Is this because Vitamin D3 is the form most bioavailable to fish? Do fish preferentially incorporate D3 into their cells, tissues and organs and excrete most of the D2? Can fish convert D2 into D3? Whatever the case, the evidence to date is that D2 is not getting into fish liver oils.
Could the “fermentation” process produce D2?

Yes, if Green Pasture is growing ergosterol-containing organisms such as algae in a sea-water brine and employing UV light to convert the ergosterol to ergocalciferol (Vitamin D2). The fact that some algae can be cultured anaerobically and create their own ecosystems suggests fermentation might be possible. The algae’s work would then have to be followed up with light activation, which could be the “solar activation” Wetzel claims to be part of his secret processing method. While this is an intriguing possibility, it’s questionable whether the algae could significantly boost the vitamin D2 levels in his oil. Even more importantly, this does not explain the extremely low D3 levels reported by UBE Analytical Laboratories.

Could the algae or other micro-organisms convert the Vitamin D3 always found in fish liver into D2? Again, it’s possible, but the process would have to involve adding an extra methyl group and a double bond. Let’s just say “it’s complicated” and my research team turned up no organism on the planet that comes equipped to convert D3 into D2.

Without further evidence, the idea that D3 could convert to D2 naturally in a “fermenting” liver appears improbable, if not impossible.
TESTING, TESTING

It’s far more likely that the putative D2 is — as Dr. Byrdwell’s research suggests — an artifact of UBE’s testing methods and not naturally present in the oil itself.

In fact UBE’s testing methods have yielded improbably high levels of total Vitamin D in many other products. At the 2009 Wise Traditions conference in Schaumberg, IL, Sally Fallon Morell announced that UBE had found “astronomical values” for Vitamins A, D and K in pastured butter, lard, bear fat, caviar and other products. Although she acknowledged the figures were “off the charts,” she said she had “confidence in these numbers.”19

Let’s compare two of those UBE numbers — on lard and roe to what’s found in standard nutritional databases.

- UBE found 74,560 IU of Vitamin D in 100 grams of pastured lard (3,206 IU per teaspoon). That is nearly 300 times the 250 IU per 100 grams (10.8 IU per teaspoon) reported by Italian researchers in lard from pigs that see sunlight and pasture.20 In contrast, the USDA has reported Vitamin D level for lard from factory-farmed pigs at a lowly 100 IU per 100 grams (4.3 IU per teaspoon).

- Similarly, UBE found 116,480 IU of Vitamin D in 100 grams of roe (500.9 IU per tsp), a figure that is over the top compared to the 232 IU per 100 grams (9.9
IU per teaspoon) reported in standard nutrition data bases.

Shortly after the 2009 conference, I alerted Fallon-Morell to the absurdity of these data from UBE Laboratories and later discussed them with Chris Masterjohn PhD, who said at the time that they would “only make sense in a parallel universe.” More recently, he said he might be able to accept the figures if he only knew more about Danny Pang’s methods. But Pang’s not saying much about the unique and secret methods employed at UBE to Masterjohn or apparently anyone else.21

Fallon-Morell now acknowledges “we’re not so sure about these figures,” but she would like to validate them.22 Until then, the high Vitamin A and D fermented cod liver oil data from UBE remain up on both the Weston A. Price Foundation and Green Pasture websites.

SINKING TO A NEW LOW

High levels of Vitamins A and D can be toxic so it makes little sense that the extraordinary levels reported for the Green Pasture product would even be desirable. In fact, the average levels of A and D found in most cod, skate or other liver oils would more than suffice for attainment of optimal health. FCLO, however, tested surprisingly low in Vitamin D3 at 1,760 IU per 100g or 78.07 IU per tsp and 4,770 IU per 100g or 211.60 IU per tsp.
The low levels of Vitamin D3 found in FCLO are not entirely surprising. Over the past several years, a number of doctors and other health care professionals have reported severe vitamin D deficiencies among some patients who have been taking daily doses of FCLO for months and even years.

As measured by the 25(OH)D blood test, many FCLO consumers show levels under the cut-off point of 30 ng/mL, with some even dipping into the severe deficiency zone of under 10 ng/ML. Many theories about the cause of this have been bandied about on internet forums, ranging from defective and damaged receptor sites to exceptionally high personal needs. No amount of FCLO seems to help these people, yet Vitamin D3 supplements have moved their numbers into a healthy range.23

Only rarely has anyone asked the obvious question of whether the Green Pasture product is actually rich in Vitamin D. Sadly, many of these people experiencing Vitamin D deficiencies have been pregnant and lactating mothers, growing children and people with serious health challenges who’ve relied on FCLO’s promises for their Vitamin D needs.

Could FCLO’s high hydrolytic rancidity be adversely affecting its Vitamin D levels? Rancidity can definitely compromise the quality and quantity of many vitamins. Yet Vitamin D has traditionally seemed the exception to the rule — a trooper that can survive early stage rancidity and still do a body good.

Indeed, that’s the likely reason clinicians during Dr. Weston A. Price’s lifetime reported benefits for malnourished
individuals despite the rancidity found in most of the cod liver oils sold during that era. Whether Vitamin D can survive severe late stage rancidity is the unanswered question. Certainly FCLO’s high degree of rancidity and low level of Vitamin D suggest that as a strong possibility.

**NOT A CODSEND?**

Could the problem be that FCLO might not come from cod? It’s a good question, although most fish livers provide more than adequate levels of Vitamin D.

The textbook *Bailey’s Industrial Oil and Fat Product* reports the Vitamin D levels of some common fish liver oils as follows:

- Cod Liver 60-120 IU/g (258-516 IU/tsp)
- Saithe liver 80-200 IU/g (344 to 860 IU/tsp)
- Ling Liver 100-200 IU/g (430-860 IU/tsp)
- Haddock liver 50-100 IU/g (215-430 IU/tsp)
- Porbeagle liver 50-100 IU/g (215-430 IU/tsp)
- Dogfish liver 10-30 IU/g (43-129 IU/tsp)
- Halibut liver 1000-2000 IU/g (4300-8600 IU/tsp)\(^{24}\)
As these figures suggest, it’s normal for the levels of Vitamin D in fish liver oil to vary, and the ratio of Vitamin A to D tends to vary quite a bit as well. Dogfish liver is high in Vitamin A but low in D; skate is low in A but high in D, halibut is extremely high in both. In addition to species differences, levels and ratios are affected by feeding habits, age and size of the fish, season and climate.25,26

As previously noted, Vitamin D levels have tested as extremely low in FCLO. Of the seven oils tested for the Eagle Fisheries report, only dogfish liver was extremely low in Vitamin D. Could Green Pasture be using dogfish livers? Dogfish is a member of the shark family that is cheap, available and mostly caught as by-catch off the west coast and Alaska. Compared to FCLO, dogfish liver oil is also adequately high in Vitamin A (1000 to 2000 IU/g or 4300-8600 IU/tsp). Its fatty acid profile is also passably close.

Dogfish oil also has a long history of being substituted for cod liver oil. In a letter published in the journal Industrial and Engineering Chemistry, dated March 16, 1925, a chemist named A. Chaston Chapman wrote, “Dogfish liver oil has been examined physiologically” and “as a source of the fat-soluble, growth-promoting accessory substance, it was equal to medicinal cod liver oil.”27

Equal or not, many unscrupulous, profit-minded manufacturers back then either diluted cod liver oil with cheap dogfish oil or substituted it completely to maximize profits. Dogfish oil came into its own during World War II when Norway fell to the Nazis and cod liver oil became
unavailable. The U.S. military then started promoting Vitamin A-rich dogfish oil to improve the night vision of soldiers facing Japanese soldiers in night combat. Although the military developed a market for dogfish oil, sales fizzled after the war when synthetic supplements entered the marketplace. So, yes, dogfish oil could be a contender. Is Green Pasture actually using it? No. For the correct answer and results of DNA testing, see Section V.

Could FCLO’s vitamin D levels match up with Alaskan pollock? Levels of Vitamin D in pollock oil run the gamut from extremely low to high, depending upon whether or not it is spawning season and other factors. Of the four pollock samples tested at Biomed, Inc. in Seattle for the 1998 Eagle Fisheries report, the lowest came in at less than 40 IU per gram for a liver taken during spawning season. (Because 40 IU was the cutoff for the testing, the amount of Vitamin D found in a teaspoon could be anywhere from 177 IU on down to zero.) The other three samples were 110 IU per gram (488 IU/tsp), 180 IU per gram (798 IU/tsp), and 1204 IU per gram (5341 IU/tsp).

Could the sample of FCLO we tested have come from pollock caught during the spawning season? The numbers are close enough yet Eagle Fisheries reported the very highest levels of Vitamin A in the spawning-season sample. At 930 IU per gram, it is considerably higher than the 732 IU per gram found in FCLO. However, data from additional samples might well show a wider range. What does DNA testing of the Green Pasture liver show? Hold tight for the answer in Section V.
SPECIAL K

Sally Fallon Morell says, “We know fermented cod liver oil has some Vitamin K in it” and Wetzel claims he’s found stupendous amounts of it. “Fermentation,” he says, “increases the total quinone count by 700 to 1600 percent compared to readings prior to the fermentation process.” Wetzel admits he has “not identified the specific quinones” but “suspects” Vitamin K2 and Coenzyme Q10 will be “important components within the quinone nutrients.”

Quinones and their derivatives are the active molecules needed for many biological processes including photosynthesis and aerobic respiration. Phylloquinone is Vitamin K1 synthesized by plants and found in highest amounts in leafy vegetables because it is directly involved in photosynthesis. Fish, animals and bacteria can convert K1 into Vitamin K2 or menaquinone, which includes valuable MK-4 and MK-7. Coenzyme Q10 is a fat-soluble, vitamin-like quinone commonly known as ubiquinone.

The Green Pasture website reports quinones at levels of 5.65 to 17.06 mg/mL for the years 2012 and 2013, and at levels as high as 34.15 in 2011. Whether these refer to Vitamin K or a mix of Vitamin K and other quinones is anyone’s guess. They are definitely high numbers, well over the amounts found in Vitamin K rich foods like natto and goose liver paté. If converted to mcgs, the unit used in most Vitamin K2 tables, the figures would look even more impressive. But if the data comes from UBE Laboratories,
then the figures are probably as artificially high as those for Vitamin A and D.

For reliable Vitamin K testing, I sent a sample of FCLO to the world’s leading Vitamin K research center, which tested it in duplicate. The results came back showing extremely low levels:

- Menaquinone-4 — 13.83 and 11.73 ng/g
- Menaquinone-5 — 0 and 0
- Phylloquinone (K1) — 1.01 and 1.02 ng/g
- Menaquinone-6 — 3.23 and 3.27 ng/g
- Menaquinone-7 — 0 and 0
- Menaquinone-8 — 1.12 and 1.16 ng/g
- Menaquinone-9 — 1.26 and 1.19 ng/g
- Menaquinone-10 — 0 and 0

That puts the total Vitamin K2 at 19.44 ng/g and 17.35 ng/g (0.01944 and 0.01735 mcg/g or 1.94 mcg/100g and 1.74 mcg/100g). Far from being high, the Vitamin K level of FCLO is just about zero.

Far better levels have been found in other brands of cod liver oil, including one brand that showed impressive K2 levels at 181.12 ng/g and 200.60 ng/g (0.18112 and 0.2006 mcg/g or 18.11 or 20.96 mcg/100 grams. The same brand had high Vitamin K1 levels as well, at 304.84 to 329.09 ng/g (0.30484 to 0.32909 mcg/g or 30.48 to 32.9 mcg/g. Compared to other
quality brands, those levels are so improbably high that they seem spiked. Other brands came in at 1.83 and 1.68 ng/g; 8.90 and 9.92 ng/g; and 20.32 and 16.61 ng/g.\textsuperscript{37}

By comparison, there’s 1104 mcg/100g in natto, 369.0 mcg/100g in goose liver paté, 76.3 mg/100g in hard cheeses, 56.5 mg/100g in soft cheeses, and 32.1 mg/100g in egg yolk.\textsuperscript{38}

In plain English, you’d have to swig a heck of lot of FCLO to come even close to the Vitamin K found in a serving of natto, paté or cheese.

Then how about that CoQ-10 that Wetzel promises? Lab testing showed it just about undetectable at less than 0.005 percent.

So could the high levels of quinones showing up on Green Pasture’s tests be coming from something else, perhaps from antibiotics? Yes, if Wetzel were “fermenting” farmed fish. To test this possibility, we tested for 14 fluoroquinolones and quinolones. The good news is the high quinones his lab is reporting aren’t coming from antibiotics.

It would thus appear that the high levels might be the work of UBE Laboratories.

**FISH-E**

Fish livers tend to be low in Vitamin E. So it was not surprising to find low levels in FCLO at 10.1 mg/100 grams, of which all — or nearly all — is alpha tocopherol. Beta,
gamma and delta tocopherol all tested at levels less than 0.1 mg/100 g.

The preponderance of the alpha tocopherol form might lead people to conclude that Green Pasture adds synthetic alpha tocopherol as an antioxidant. Most fish and fish liver oil manufacturers do that. But that conclusion would probably be wrong. The fact is alpha tocopherol levels are so high in fish that they dwarf levels of the other tocopherols. And the total amount of Vitamin E found in the product seems about right. 39-41

MAKING A PRODUCTION OF IT

Processing, refining, heat and chemical treatment can all have a negative impact on the nutrient content of liver oils. Although Wetzel disparages such “industrial” methods, the evidence is mounting that his ways may not be as “safe and natural” as he claims. What we know for sure is that Vitamins A, D and K are testing at levels well under what people have been encouraged to expect.

* * * * *


3. Author’s discussions about D2 in cod liver oil with Sally Fallon Morell, Chris Masterohn and others over the past several years.

4. Author’s conversations with researchers, scientists and lab technicians. Michael Holick, the world’s leading Vitamin D researcher, for example, wrote in an email dated March 11, 2013 “We have never found ergocalciferol in salmon or cod liver oil.”


8. Author’s conversations and emails with Sally Fallon Morell and Chris Masterjohn.

9. Email from Craig Byrdwell, August 14, 2014.

11. Email from Michael Holick, March 11, 2013. “We have never found ergocalciferol in salmon or cod liver oil.”

12. Conversations with researchers, scientists and lab technicians.

13. Conversations and emails about D2 in cod liver oil with Sally Fallon Morell and David Wetzel from September through December 2014.


21. emails from Fallon Morell and Masterjohn, October 15 and 19, 2014. Of UBE’s figures for lard, Masterjohn also wrote, “That these values for lard can be so at odds with biological tests of antirachitic activity raises a red flag to me. It doesn't mean the UBE values are wrong. But with the level of secrecy that UBE employs, accepting the values means taking them as an article of faith, and with such red flags, I am not willing to make that leap of faith.”


23. Conversations with doctors, nutritionists and other health care practitioners at Wise Traditions, PaleoF(x), Ancestral Health, NTA and other conferences.


37. Vitamin K data on four brands of cod liver oils shared by Maastricht University Vita K R&D Group. Brand names were not shared. August 20, 2015.

38. Rhéaume-Bleue.


41. Conversations with marine oil experts.
SECTION V: SOMETHING FISHY

Fish oil is extracted from the flesh of tuna, herring, cod and other deep-sea oily fish species. It’s valued for the omega-3 fatty acids EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) but considered a poor source of vitamins A and D.

Fish liver oil comes from the liver of the fish, not the flesh. Compared to fish oil, it is lower in EPA and DHA but far richer in Vitamins A and D. The ratio of EPA to DHA varies from species to species and is a useful tool for identifying the species of fish.¹

In the case of arctic cod liver, the EPA is always lower than the DHA, and the ratio is typically in the range of 6 to 10 or 9 to 14. The exact ratio will vary depending on age, size, food and habitat, but if it’s off by much, it’s not arctic cod.²

The EPA to DHA ratio of the Green Pasture Fermented Cod Liver Oil does not even come close.

  • 17.4 to 10.0

A NOT SO GOLDEN RATIO

EPA and DHA figures from 20 samples taken from the years 2008 to 2014 are posted on the Green Pasture website.³ Typical ratios are:

  • 12.0 to 5.8
- 15.7 to 8.4
- 16.5 to 9.9

Of all 20 sets on the Green Pasture website, only two showed an EPA lower than the DHA, and those were barely so at 11.3 to 11.4 and 9.4 to 9.6. Although the table identifies those two samples as FCLO, they closely match the EPA to DHA data for some of Wetzel’s skate oil samples, suggesting a sample mixup or website typo. Whether or not this explains it, the ratios are closer — but not close enough — to true cod liver oil.

Results similar to Wetzel’s tests came in from one US lab which reported an EPA to DHA ratio of 13.5 to 6.48. Similarly, a lab in the UK reported in 2013 an EPA to DHA ratio at 16.21 to 7.44.

An unexpected finding came from Martin Grootveld of De Montfort University in Leicester, who analyzed a sample sent to the Weston A. Price Foundation. His tests showed an EPA to DHA ratio of 9.24 to 6:16, which is not a ratio likely to be found with cod liver oil.

Whether Prof. Grootveld did not notice this or chose not to be the bearer of bad news is unknown, but his letter to Fallon Morell makes no mention of the finding. His letter also misidentifies EPA (eicosapentaenoic Acid) as a 22:5 fatty acid and DHA (docosahexaenoic Acid) as a 24:6 fatty acid. The correct nomenclature for EPA is 20:5, and for DHA 22:6. (In chemistry shorthand, two numbers separated by a colon provide the chain length and number of double bonds.)
None of these numbers add up to arctic cod.

**MYSTERIES OF THE DEEP**

To be fair, Wetzel, has never advertised his “arctic cod” as from the North Atlantic though he’s not exactly disabused consumers of the notion either. His flavor name “Oslo Orange” certainly reinforces the impression of a Norwegian cod liver oil. In contrast his skate liver oil is advertised as “fished from the pristine waters of Alaska’s Aleutian Islands.”

In fact, Wetzel has consistently evaded questions about the source of the livers for his FCLO product, sometimes whispering that his source is a mysterious unnamed Russian and other times declaring he obtains all his livers from unnamed suppliers supposedly accredited by the Marine Stewardship Council. Either way consumers have no information that could help them evaluate the authenticity and sustainability of his product. His use of the Marine Stewardship Council (MSC) name — with their implied stamp of approval — seems unauthorized. The MSC eco-label indicates the product is traceable through the supply chain back to the certified fishery to assure consumers it’s a truly sustainable seafood product and not mislabeled as such. Boat-to-bottle transparency, of course, is impossible if a company is luring consumers with cod but delivering something else.

There are many species of cod in the world that Wetzel could be using, some of which have higher levels of EPA
than DHA. Peruvian cod is a good example, and many unethical cod liver-oil producers substitute it for arctic cod in premium-priced products. Indeed, this happens so often that the cod liver oil industry has been wracked by the same kind of scandals found in the olive oil industry.\textsuperscript{9}

Another strong contender is Alaskan pollock. Also known as walleye pollock, it’s a member of the cod family though most people would say it’s a stretch to call it cod. A 1998 report from Eagle Fisheries entitled \textit{U.S. Market Prospects for Alaskan Pollock Liver Oil}\textsuperscript{10} reports EPA to DHA ratios on five samples as follows:

- 8.6 to 5.8
- 8.9 to 6.0
- 9.9 to 6.8
- 9.3 to 6.7
- 18.0 to 5.4

If the last ratio seems to be either an error or an outlier, it’s not. With pollock there is always a “tremendous seasonal variation in omega 3 content,” and it’s typical for livers taken during the spawning season to show an extremely high EPA to DHA ratio.\textsuperscript{11} The wide range looks suspiciously similar to the data gathered on FCLO’s EPA and DHA.
CATCH ME IF YOU CAN

“The label said red snapper. The lab said baloney” was the title of a recent *Consumer Reports* expose on widespread fraud in the seafood industry. Because most consumers want what they pay for — and people with allergies may stake their lives on it — authenticity and sustainability have become major issues in the fish and seafood industries. As a result, laboratories are coming up with ever more sophisticated methods to verify identity, expose adulteration and even pin-point the habitat.

DNA technology can now accurately distinguish all common fish and seafood as well as most exotic species. Additionally, it can identify species of fresh, canned and frozen fish in readymade products so long as they are present at levels greater than ten percent. Unfortunately, DNA procedures do not work well with oils.

Could Nuclear Magnetic Resonance (NMR) spectroscopy do the job? Sintef in Norway has been building a worldwide reputation for authenticity testing using state-of-the-art technology. Unfortunately, expensive testing only revealed FCLO to be “similar to cod, wild and not farmed.”

The lab could not identify FCLO conclusively because of high hydrolytic rancidity and interference from the “brown pigment.” Color — such as the red of Krill Oil or the brown of FCLO — can confound results determined through any testing involving the color spectrum. On the plus side, this lab provided additional confirmation of rancidity.
Clearly, DNA testing would be needed.

Would it be necessary to beg, borrow or steal one of Wetzel’s livers? That prospect seemed daunting, but it turns out he sells them. Not as fresh or frozen livers to be fried up or turned into paté, but as sun-dried livers in the Green Pasture Cattle Lick Product. According to Green Pasture’s website, the “cod livers” in the Cattle Lick product are left over from the manufacture of FCLO.

HOOKED!

The DNA testing lab pulled no punches. The liver is “100 percent Alaskan pollock.”

RIGHT TO KNOW

Alaskan pollock is not just another word for cod. It’s a favorite of Big Food, which turns it into fish sticks, fried fish, surimi and other fishy substances found in processed, packaged and fast foods. Alaskan pollock livers are primarily sold for use in pet food, and pollock liver oil is commonly substituted in “cod liver oils” coming out of China and other countries. A popular saying is “you get what you pay for,” but Green Pasture products are sold at premium prices to health-conscious consumers who think they are purchasing
“cod liver oil” and who have trusted Green Pasture for “truth in labeling.”

Will Wetzel argue that Alaskan pollock is a member of the cod family and say the mislabeling is just a little white lie with no consequences for consumers? Probably.

And he would not be entirely wrong. Scientists recently changed the scientific name of walleye pollock from *Theragra chalcogramma* to *Gadus chalcogrammus* after an extensive investigation of species and evolutionary relationships.21

This fact doesn’t absolve Green Pasture from mislabeling charges, however. Labeling their pollock liver oil as “cod liver oil” seems deceptive to consumers and may violate FDA and FTC regulations. It is definitely not in accordance with the Codex General Standard for the Labeling of Pre-packaged Foods, which attempts consumer protection with specific and separate labeling requirements for cod and pollock.22

What’s more, most consumers think they have a “right to know,” and few will to be pleased to learn they’ve been paying top dollars for a cheap product that has a very different nutritional profile from true North Atlantic cod. The fact that this “fermented” pollock liver oil is also testing as rancid, putrid and with low-to-average levels of vitamins A, D and K will cheer people even less.

Could a quality pollock-liver oil serve health-conscious consumers? Absolutely. But there are good reasons why the commercial fish industry has not developed a market for pollock liver oil products. For starters, pollock has a serious
image problem. People have either never heard of it or know it as the cheap, generic fish found in fried fish and fake crab products. The deal breaker for makers of standardized supplements, however, is pollock oil’s wildly fluctuating fatty acid and vitamin content. Sellers of “all-natural” products, though, can choose to milk those same “ups and downs” as the work of Mother Nature herself.

On the plus side, Alaskan pollock can be sustainably fished. It’s not an endangered species and it comes from comparatively uncontaminated waters (before Fukushima, at least.) That’s one possible reason FCLO tested as low in pesticides, heavy metals (except arsenic) and other toxins. In contrast, most true arctic cod liver oils require extensive processing to reduce toxicity. Cod has also been overfished and is becoming an endangered species.

**TRANS FATS**

And that’s not all, folks! The livers may be 100 percent Alaskan pollock, but FCLO itself appears to be diluted with something else. What that is, is the mystery, though the evidence points to a heat-damaged vegetable oil containing trans fats.

Lab testing of FCLO showed 3.22 percent trans fats, of which a leading Norwegian authority on fish oils, says:

*No authentic raw or mildly processed cod liver oil will contain trans fats. There should also be none present if the cod liver oil is mildly refined. The presence of*
trans C18:3 indicates that another oil has been added to this oil. This other oil must obviously be in sufficient quantities to detect the presence of these trans fats.\textsuperscript{24}

Here’s why: Of the total 3.22 percent trans fats, The lab identified 2.40 percent as an 18.3 trans fat. This would derive from an 18.3 cis alpha linolenic fat, which would be typically found in pollock oil at levels ranging from 0.4 to 0.7. However, the level of 18.3 cis found in FCLO by labs in the US and the UK came in at 0.448 and 0.59, respectively. Both are on par with the level typically found in pollock oil.

The only way to achieve the level of 2.40 percent of 18.3 trans fat would be to add a thermally damaged vegetable oil. If the trans fats occurred because of heat damage to the fish liver oil itself, the levels would be no higher than the level of 18:1 cis alpha linolenic fat present in pollock oil.

FCLO also contains 18.1 trans fat at the level of 0.781 percent. Pollock oil contains 18.1 cis, which is a form of oleic acid, at 15.4 to 26.5 percent. The US and UK reports showed 18.1 cis in FCLO at the levels of 27.6 percent and 21.46 percent respectively.

Finally, FCLO contains an 18.2 trans fat at the level of 0.184 percent. This would be derived from an 18.2 cis linoleic acid, which is typically found in pollock oil at levels ranging from 0.7 to 1.0. The labs report the cis form at 1.12 percent and 0.94 percent respectively.
If all of this talk about *trans*, *cis* and so on sounds overly confusing and complicated, one thing is abundantly clear: neither a vegetable oil nor *trans* fats should be in FCLO.

Could these *trans* fats come from any other source than a thermally damaged vegetable oil? Apparently not. But an unanswered question remains: Is Green Pasture diluting the fish liver oil with vegetable oil or “fermenting” a readymade pollock/vegetable oil combination? If the latter, he would be taking the cost-cutting step of buying bottled pollock liver oils that — perhaps unbeknownst to him — have been diluted with vegetable oil. Readymade refined pollock oils would have several other added virtues as well: low biogenic amines as well as low heavy metals and other contaminants. This is a possible explanation for why the more recent products tested seem “cleaner” than the earlier sample tested in Scotland.

If so, Green Pasture would be following the path of the many commercial fish oil and fish-liver oil manufacturers of supplements who either add refined vegetable oils to their products or co-refine marine oils together with vegetable oils. Those manufacturers put vegetable oil in there for increased profits and/or added antioxidant protection. Is Wetzel doing this too? Is there any other reason vegetable oils and *trans* fats would be in there?

Could the *trans* fats in FCLO be none other than the healthy CLA (Conjugated Linoleic Acid) that has beneficial effects for weight management, immune function, cancer, diabetes, and atherosclerosis? No. CLA comes from cows and other ruminant animals, not cod or pollock. CLA is also identified
as C9 t10, t11 or t12, none of which showed up in FCLO’s fatty acid profiles. CLA is also not found in the fatty acid data included in the Eagle Fisheries report on pollock.21

Then could the \textit{trans} fat in FCLO be some kind of unique and special form of CLA found in fish, a fatty acid no marine oil expert has yet identified and no lab has ever reported? Sure, though that would seem to be yet another case of the Emperor’s New CLO.

If the “fermenting” vegetable oil theory seems preposterous based on Wetzel’s ongoing sales of Cattle Lick and fertilizer products made from spent livers, consider this: The FCLO myth requires he continue to buy and ferment some livers for appearances sake and to continue to give carefully orchestrated “grand tours” to the top bloggers and other “real food” royalty who have endorsed his product, encouraged its sales, and fostered the FCLO myth.

So what is Green Pasture actually up to? Further investigation is needed.

\textasteriskcenter*
ENDNOTES


11. Ibid.


23. emails from a leading Norwegian marine oils expert, May 17 and July 6, 2015.


What did Dr. Weston A. Price have to say about fermented cod liver oil?

In a word, **NOTHING.**

There’s not one word about fermented cod liver oil in the 500-plus pages of *Nutrition and Physical Degeneration*. And it’s not mentioned in Dr. Price’s letters, journal articles, lecture notes or papers either. “It’s taken us over a year to thoroughly search the archives,” says Joan Grinzi, Executive Director of the Price-Pottenger Nutrition Foundation, but “we can now state that Dr. Price never mentioned fermented cod liver oil.”¹

Yet, for nearly a decade now, many people in the Weston A. Price Foundation, paleo and “real food” communities have promoted David Wetzel’s Green Pasture Fermented Cod Liver Oil as the only true “traditional” cod liver oil and as the “high vitamin cod liver oil” recommended by Dr. Price.² However, even if the Green Pasture “cod liver” oil were from cod — and even if it could be proven to be a safe product — it would not be the cod liver oil recommended by Dr. Weston A. Price.

In brief, here’s why:
Wetzel compares his “fermented” product to an “activated cod liver oil” recommended by Dr. Price, but the truth is the products are not even remotely the same.

Dr. Price talked about an “activated cod liver oil” that had been exposed briefly to sunlight, but warned that “over activation” made an “injurious product.” He never recommended the oil be “fermented” for months at a time, and indeed warned that rancidity would become a problem if cod liver oil were “activated” for more than a few minutes.

Dr. Price furthermore warned people to take the cod liver oil in “small quantities” or “very small doses.” In contrast, many people regularly take the Green Pasture “fermented” cod liver oil at doses of a teaspoon or more every day without fail. Many take even higher doses when under physical or mental stress.

Finally, Wetzel’s claims that his methods are “traditional” and that “brown” cod liver oils have been used medicinally for millennia seem to represent a misreading of historical facts. Instead, pale, golden and light brown cod liver oils were valued for human consumption, and brown oils were used for lamp oils, paint and other industrial applications.

ACTIVATION, NOT FERMENTATION

Dr. Price recommended “activating” cod liver oil by putting a bit of fresh raw cod liver oil — no more than one eighth of an inch deep — in a dish and letting it sit in the noonday sun for
three to five minutes in the summer and from five to fifteen minutes in the winter.11

That’s minutes, not hours, not days, not weeks, and certainly not months. Price advised that the product should be stirred while being exposed and explained that “exposure for longer periods, say an hour or two, will produce a change in the oil so that very undesirable symptoms such as headache may develop.”12

Wetzel’s method is different — very different. Although explanations of his unique “fermenting” process vary, the version that most closely resembles Dr. Price’s “activation” method came from Wetzel himself. For many months, the Green Pasture website stated: “We solar activate all our products as Dr. Weston A. Price did. Solar activation is simply exposing the product to the sun. Our plant is a solar plant and we ensure that all our oils are exposed the the sun, moon and stars.”13,14

This might seem like a bright idea, but Dr. Price’s method took just a few minutes whereas Wetzel’s takes much longer. Descriptions of the Green Pasture method - as found on his website, from lectures and from conversations with consumers — give timetables of anywhere from months to a year. However long it takes, the evidence presented in Section I suggests it is probably not fermented and its pH is too alkaline to preserve a lacto-fermented product.

Dr. Price’s method also involved stirring, whereas Wetzel says his product is not stirred. And though Wetzel has repeatedly claimed his “natural methods” use “no heat” and
“no high temperatures,” visitors to his solar facility report the temperatures can reach extremely high temperatures, especially in the summer.

In contrast, Dr. Price sounded many warnings about “the abuse and possible serious injury that would be occasioned from exposing food overlong to ultraviolet light, whether from the sun or from an artificial generator, because of the production of substances distinctly deleterious to health.”15 He also wrote fish oils that have been exposed to the air may develop toxic substances.16 As reported in Sections II and III of this report, “toxic substances” from rancidity and putrefaction are exactly what lab testing shows in Wetzel’s product.

It’s also a myth that Dr. Price found healthy people in primitive cultures eating lots of fermented foods. The truth is he mentioned fermentation only twice in Nutrition and Physical Degeneration — when he talked about poi with the Polynesians and wine with the Swiss. According to Joan Grinzi of PPNF, Dr. Price rarely mentioned fermentation in his other writings either.17

**WARNINGS TO MOMS**

Over the years Price offered many warnings to health-conscious moms:

“I have frequently had mothers bring this question to me as a serious nutritional problem with their children. They had desired to do all they possibly could for their children and, in
their efforts, had tried to follow the directions on the bottle or as otherwise provided, which often meant large doses of cod liver oil. They have reported to me the difficulty they had in combating the rebellion of their children against the use of cod liver oil, which may have been in part a reaction of self-preservation. Many of the children were reported to regurgitate the oil when it was forced down. Since it has been demonstrated that only the oil that is utilized contributes to the well-being of the human being or animal, it can readily be anticipated that compulsion to take such a toxic product could be very injurious.”

Yet many “real food” moms — taking direction from Sally Fallon Morell — think they are following the advice of Dr. Price when they force their kids to take the Green Pasture product. In contrast, Dr. Price instructed: “Just as soon as your child gets so he hates it, stop using it because when he or she does, it is a pretty sure sign that it is doing more harm than good.” In his writings, he most often recommended cod liver oil for severely malnourished children, saying the benefits for them would outweigh the risks. Although he did not clarify why, the most likely reason is some Vitamin D remains intact even in a rancid cod liver product. Unfortunately, Wetzel’s product seems to be neither a cod liver oil nor high in Vitamin D, as discussed in Sections IV and V.

In short, Dr. Price was abundantly clear that the “disagreeableness” of cod liver oil was not a superficial matter of taste preference but rather a serious warning of rancidity and toxicity. In contrast, fans of FCLO think that its
brown, smelly “disagreeableness” is proof of high potency and efficacy. Dr. Price was not alone in his concerns, and cited other researchers from the 1920s and 1930s who had “called attention to the importance of considering the toxic substances in cod liver oils as possible explanation for differences in results obtained by different workers in vitamin studies.” He regretted the limitations of the research studies and chose to emphasize some “dangers that are not usually recognized or properly emphasized in the literature” The adverse effects he found included physical and mental health problems, most notably depression and “serious structural damage” to the heart and kidneys by overdose.

He always recommended small doses because he had “continually found evidence indicating that cod liver oil contains products that are very seriously toxic to humans and other land animals and can do much harm when given in large doses, even only as large as frequently advocated.”

HIGH FRUSTRATION

Despite the risks, Dr. Price considered “activated” cod liver oil to be one of the “best sources of stored-up activator known at present.” But he felt frustrated that testing showed inconsistent vitamin content not only in different brands of cod liver oils but in the same brand. As a
clinician, he needed to know the dose that would provide maximum help for malnourished, sick and injured patients with minimal toxic side effects. He warned against “regular drugstore cod liver oil” which he found to be very low in vitamin content.28

Dr. Price wanted to correct the assumption that cod liver oil is an adequate source of the fat-soluble vitamins, which is said “is not true for human beings, animals or birds.”29 In short, he did not consider cod liver oil to be a satisfactory source of fat-soluble activators in ordinary diets.

SYNERGY WITH BUTTER OIL

Dr. Price recommended cod liver oil be taken along with a high vitamin butter oil which contains “Activator X” because he thought the butter oil would increase the benefits and reduce the risks.30 Why exactly he thought butter oil could reduce the risk is unclear, but he wrote of “an apparent influence of the activators from butter in neutralizing toxic effects produced by cod liver oil.”31

Can the Green Pasture Brand X Factor Gold High Vitamin Butter Oil do that? Can it magically transform FCLO’s rancidity, putrefaction and other problems so that those risk factors will disappear? Is it a high-quality product that would have received Dr. Price’s stamp of approval? Some answers are coming right up.
To read more about what Dr. Weston A. Price said about cod liver oil, visit the Price-Pottenger Nutrition Foundation’s website — ppnf.org —and download their free eBook What Dr. Price Said about Cod Liver Oil. PPNF is the place to find accurate information about Weston A. Price, DDS, and other nutrition pioneers.

ENDNOTES

1. Author’s conversation with Joan Grinzi, Executive Director of the Price-Pottenger Nutrition Foundation at Paleo f(x), Austin, TX, April 25, 2015.

2. Dr. Price’s name is consistently associated with Green Pasture products on the Green Pasture website, product labels, retail sites; at the Weston A. Price Foundation conferences, Facebook pages and chapter leader forums; and by many real food bloggers.

3. PPNF Archive #: W108 Page #: 685 (7) Archive Title/Info: Reprinted from Industrial and Engineering Chemistry, Vol. 18, No. 7, page 679, July, 1926 The Relation of Light to Life and Health Some Biochemical and Clinical Aspects By Weston A. Price Dental Research Laboratory, Cleveland, Ohio. Read before the Chemistry Session at the Second Chemical Equipment and Process Engineering Exposition, Cleveland,
Ohio, May 10 to 15, 1926. “Over-activation of cod-liver oil makes an injurious product. One to 5 minutes in the bright summer sun and 5 to 15 in the winter are ample. Ten drops in a capsule is an average dose taken with 5 grains of calcium lactate. It is better to use raw oil than over expose. Never activate with quartz mercury lamp without filter.”


5. Price, Weston A. *Nutrition and Physical Degeneration* (Price-Pottenger Nutrition Foundation, 8th edition, 2014) p. 267. “My investigations have shown that when a high vitamin natural cod liver oil is used in conjunction with a high-vitamin butter oil the mixture is much more efficient than either alone. This makes it possible to use very small doses. Except in the late stages of pregnancy I do not prescribe more than half a teaspoonful with each of three meals a day. This procedure appears to obviate completely the undesirable effects.

6. PPNF Archive #: W172Page #: 431 (16) Archive Title/Info: Eskimo and Indian Field Studies in Alaska and Canada. By Weston A. Price, D.D.S., M.S., F.A.C.D. Cleveland, Ohio. Reprinted from *The Journal of the American Dental Association* Vol. XXI-II, Pages 417-437, March, 1936 “This butter oil is mixed with equal quantities of a specially high vitamin natural cod liver oil. The quantity given is a teaspoonful of this mixture at the time of eating the special meal, which consists of natural foods for providing minerals in liberal quantity and in suitable chemical form.”
7. PPNF Archive #: W218 Page #: 28 (28) Archive Title/Info: The Relation of Vitamins to Health and Disease (This lecture was made by Dr. Weston A. Price before the Cleveland Sorosis, on Thursday Afternoon, December 20th, 1928.) “If you are sick - indeed if you are not sick - I would advise everyone here this afternoon to take at least twenty drops or thirty drops, a third of a teaspoonful of raw cod liver oil from November until April. You will get both vitamin A and D in that way. Now you will not be able to activate it to determine whether it will keep the diffusibility of your blood right. Perhaps you will not be able to put it in capsule form. I cannot take time for that more than to stress for you that you can get the vitamins in that simple way.”

8. PPNF Archive #: W259 Page #: Unpaginated (3) Archive Title/Info: Transcript of a letter believed to have been written about 1934 - DDF. Weston A. Price, D.D.S., M.S. Dental Research Laboratories, 8926 Euclid Avenue, Cleveland, Ohio. “One of your greatest difficulties will be to provide the children and yourselves with sufficient of the fat-soluble activators and vitamins. We being mammals, have bodies prepared to get these from milk and its butter fat, which is not in skimmed milk. There is not much left for the children when the cream has been taken from the milk for the parents' coffee. Where possible, have June butter stored for winter use. Cod-liver oil can be given in moderate doses without injury and to great advantage. Seldom however, should the child be given more than a teaspoonful a day for extended periods, because of toxic effects that often develop. It is better to take the cod-liver oil with the meal rather than before or after, as it aids in the utilization of the minerals in the food.”

9. Price, Nutrition and Physical Degeneration, pp. 492-493 “Seldom however, should the child be given more than a teaspoonful a day for extended periods, because of toxic effects that often develop. It is better to take the cod-liver oil
with the meal rather than before or after, as it aids in the utilization of the minerals in the food.”


11. PPNF Archive #: W110 Page #: 17-18 (18-19) Archive Title/Info: Chemical Metabolism Studies The Raising of Serum Calcium by Topical Applications of Raw and Activated Cod Liver Oil Disturbances Associated with the Active Dental Caries of Childhood and Pregnancy. Weston A. Price, D.D.S. Cleveland. Reprinted from the American Journal of Diseases of Children, January, 1927, Vol. 33, pp.78-95. Copyright 1927. “Cod liver oil is activated by placing it in an open dinner plate, in a layer not over one eighth of an inch deep, and exposed to the bright noonday sunshine for from three to five minutes in the summer, and from five to fifteen minutes in the winter. It should be stirred while being exposed. Exposure for longer periods, say an hour or two, will produce a change in the oil so that very undesirable symptoms such as headache may develop.”

12. Ibid.

13. Do you solar activate your oils as Dr. Price did early in the 20th century? http://www.greenpasture.org/public/FAQ/ In August 2015, subsequent to the publication of the Price-Pottenger Nutrition Foundation’s eBook What Dr. Price Said about Cod Liver Oil Wetzel took down his original post and replaced it with: “Our plant is exposed the sun but this does not equate to solar activation as Dr. Price discusses. Dr. Price had a specific protocol and definition for the term solar activation and it does not occur unless uv rays are directly exposed to the products. In our plant the products are not exposed to solar uv.”
http://www.benaturallyprepared.com/collections/green-pasture
“All of Green Pastures products are solar activated just as Dr. Weston A Price did. Solar activation is simply exposing the product to the sun. Their plant is a solar plant and they ensure that all of their oils are exposed the the sun, moon and stars.”

PPNF Archive #: W107 Page #: 26 (26) Archive Title/Info: Newer Knowledge of Calcium Metabolism in Health and Disease, with Special Consideration of Calcification and Decalcification Processes Including Focal Infection Phenomena. By Weston A. Price, D.D.S., M.S., F.A.C.D. Cleveland, Ohio. Reprinted from The Journal of the American Dental Association, December, 1926. “In this connection, it is important to raise a note of warning for those who would advise or in any way be responsible for the abuse and possible serious injury that would be occasioned from exposing food overlong to ultraviolet light, whether from the sun or from an artificial generator, because of the production of substances distinctly deleterious to health. I have learned much from experimenting on myself, and one of the early safeguards that came from that source was secured as the result of severe headaches produced by taking cod-liver oil that had been exposed to ultraviolet rays from a mercury quartz vapor lamp for one half hour, even though the dosage was only a few drops.”

Price, Nutrition and Physical Degeneration, p. 267. “The available evidence indicates that fish oils that have been exposed to the air may develop toxic substances.”

Conversation with Joan Grinzi, Executive Director of the Price-Pottenger Nutrition Foundation, at Paleo f(x), Austin, TX, April 25, 2015.

PPNF Archive #: W133 Page #: 1358 (21) Archive Title/Info: Control of Dental Caries and Some Associated Degenerative Processes Through Reinforcement of the Diet with Special

19. PPNF Archive #: W125 Page #: 37 (38) Archive Title/Info: *The Association Bulletin*. International Association of Milk Dealers, No. 10, Jan. 29, 1931, 228 N. La Salle St., Chicago. Some Means of Improving Human Life by Increasing the Vitamin Content of Milk and Its Products. By Weston A. Price, D.D.S., M.S., F.A.C.D. Cleveland, Ohio. Read before the International Association of Milk Dealers at Cleveland, Ohio, October 22, 1930 “QUESTION: What substitutions can be used for the capsules? DR. PRICE: ‘The substitute for the capsules would perhaps be to go to the drugstore and buy cod liver oil, and just as soon as your child gets so he hates it, stop using it because when he or she does, it is a pretty sure sign that it is doing more harm than good.’”

20. Posts and comments from parents on health and nutrition blogs and Facebook groups. Author’s conversations with people at Wise Traditions, Paleo f(x), Ancestral Health, NTA, and other conferences.

21. PPNF Archive #: W133 Page #: 1358 (21) Archive Title/Info: Control of Dental Caries and Some Associated Degenerative Processes through Reinforcement of the Diet with Special Activators. By Weston A. Price, D.D.S., M.S., F.A.C.D.Cleveland, Ohio. Reprinted from *The Journal of the American Dental Association*, Vol. XIX, Pgs. 1339-1369, August, 1932. “This shows the extreme toxicity of this substance. Little seems to have been reported on the toxic substances in cod liver oil. Recently, Norris and Church have called attention to the importance of considering the toxic substances in cod liver oils as possible explanation for differences in results obtained by different workers in vitamin studies.”

23. Price, *Nutrition and Physical Degeneration*, p. 267. “It is important that I emphasize here some dangers that are not usually recognized or properly emphasized in the literature. When fish oils including cod liver oils are given in too large doses to some patients they experience quite definite symptoms of depression. The available evidence indicates that fish oils that have been exposed to the air may develop toxic substances. My work and that of others with experimental animals has demonstrated that paralysis can be produced readily by over-dosing. Serious structural damage can be done to hearts and kidneys. I have reported this in considerable detail.”

24. PPNF Archive #: W126 Page #: 611-612 (8-9) Archive Title/Info: Reprinted from *American Journal of Public Health* and *The Nation’s Health* Vol. XXI, No. 6, June 1931. View of Health and Disease Based on a Rise and Fall in the Levels of Life with Cycles in Vitamin Tides. Weston A. Price D.D.S. Published by the American Public Health Association, 450 Seventh Avenue, New York, N.Y. “In my clinical and technical investigations of the activators for inducing mineral metabolism, I have continually found evidence indicating that cod liver oil contains products that are very seriously toxic to humans and other land animals and can do much harm when given in large doses, even only as large as frequently advocated.”

25. PPNF Archive #: W112 Page #: 6 (6) Archive Title/Info: *Calcium, Its Activation, Utilization and Metabolism*. By Weston A. Price, D.D.S., M.S., F.A.C.D. Reprinted from *The Journal of the American Dental Association*, April, 1928. “Since the best sources of stored-up activator known at present is cod-liver oil, it has become important to consider carefully its advantages and disadvantages.”

26. PPNF Archive #: 228Page #: 13 (14) Archive Title/Info: *Light from the Activators on the Phenomena of Life*. Weston A.
Price, D.D.S. “During the past decade I have been studying the relative values of the different cod liver oils for supplying the needs as activators. During the past eight years this has included a study of the bio-logic qualities both by animal feeding and by chemical analysis. It has been apparent continually that there is a marked difference in the efficiency of different samples of oil. As a part of the study to determine the reason for these variations I have had oils sent for testing from many places both for comparing districts and succeeding months of the same year for the same place and for different years. Others who have made investigations have reported a higher level of vitamins in the Newfound-land oil than for oils from most other places. In this regard a report of the Empire Marketing Board of Great Britain entitled “The Relative Values of Cod Liver Oils From Various Sources” by Drummond and Hilditch published by His Majesty’s Stationery Office, London, England strongly favors Newfoundland oils. Inasmuch as cod liver oils are only made during the summer months in Newfoundland territory with the exception of a few places in which winter fish are used it has not been possible for me to make curves for the entire year for the vitamin level of the cod liver oils as I have for milk products.”

27. PPNF Archive #: 212. Page #: Unpaginated (27) Archive Title/Info: New Fundamentals for the Prevention of Dental Disease, with Special Consideration of Calcification and Decalcification Processes Read Before The New Jersey State Dental Society, Asbury Park, New Jersey, April 19, 1928. By Weston A. Price, D.D.S., M.S., F.A.C.D.Cleveland, Ohio. “Any and all of these procedures have possibilities for both great good and great harm. It is therefore very important that the dangers of over treatment should be emphasized. Reduce to its simplest and safest form, it would seem that the administration of small doses, say from 1/8 gram to 1 1⁄2 g, of a mixture of raw cod liver oil and a cod liver oil that has been activated for 5 minutes in the sunshine, then placed in capsules and used
before chemical change has been al- lowed to take place, will
be the procedure of choice for the members of the dental
profession, for use for increasing the defense. This problem is
still complicated by the fact that there’s still a great difference
in different samples of cod liver oil.

28. PPNF Archive #: W123 Page #: 1219 (31) Archive Title/Info:
New Light on the Con- trol of Dental Caries and the
Degenerative Diseases. By Weston A. Price, D.D.S., M.S.,
F.A.C.D.Cleveland, Ohio Read before the Section on
Histology, Physiology, Pathology, Bacteriology and Chemistry
(Research) at the Seventy-Second Annual Session of the
American Dental Association, Denver, Colo., July 22, 1930.
DISCUSSION R. M. Smith, Iowa Falls, Iowa: You spoke of
cod-liver oil that one gets at drugstores as being very low in
vitamin content? Dr. Price: It is high enough in vita- min D to
pass government requirements, but it is not nearly so high as I
require for my use. If I had time to use the slides, I could show
what serious injurious effects are experienced from giving
large doses of cod-liver oil.

generally been assumed that cod liver oil is an adequate
source of the fat-soluble vitamins, but that this is not true for
human beings, animals or birds is readily illustrated by the
following experiment in which turkeys were used that were
afflicted with weak legs.”

investigations have shown that when a high vitamin natural
cod liver oil is used in conjunction with a high-vita- min butter
oil the mixture is much more efficient than either alone. This
makes it possible to use very small doses. Except in the late
stages of pregnancy I do not prescribe more than half a
teaspoonful with each of three meals a day. This procedure
appears to obviate completely the undesirable effects.
In Figure 9 will be seen an apparent influence of the activators from butter in neutralizing toxic effects produced by cod liver oil. The clinical result from using these two products in the combination in which I now use them has afforded an abundance of important date, which will be discussed presently.
Dr. Weston Price revered his butter oil. The question is, would he recognize the Green Pasture X-Factor product that is being sold using his good name?

And, if he did, would he think it has enough of the “right stuff” to overcome the rancidity, putrefaction, adulteration and low fat-soluble vitamin content that testing shows are found in the Green Pasture fermented cod liver oil product?

Because any butter, even a cheap one, will show adequate levels of Vitamins A and D, I focused on testing Vitamin K. Chris Masterjohn, after all, in his 2008 article “On the Elusive Trail of Activator X: A Sixty-Two-Year-Old Mystery Solved” made a case for Vitamin K2 being the mysterious “X Factor” identified by Dr. Price.

Masterjohn’s article came out more than seven years ago. Yet no one seems to have been curious enough to have tested butter oil or ghee for its reputed high Vitamin K2 content to actually prove Masterojohn’s theory.

As part of this investigation, I wanted to know if the Green Pasture X Factor Butter Oil would show superior levels of Vitamin K2. Or whether the amounts would only be en par with the 15 mcg/100 grams found in regular butter? Finally, how would the Green Pasture-brand compare to quality butter oils or ghees?
OK or KO’d?

As tested at the leading Vitamin K research facility in the world, Green Pasture X-Factor Butter Oil showed very good levels of Vitamin K2. Not nearly as high as Vitamin K2 superstars like natto and goose liver pate, but impressive nonetheless.

- 393.84 ng/g (0.39384 mcg/g or 39.4 mcg/100 grams)
- 431.11 ng/g (0.43111 mcg/g or 43.1 mcg/100 grams)

A second brand of butter oil — also advertised as from pastured cows — was tested at the same lab and showed decent levels of Vitamin K2 though at lower levels than the Green Pasture brand.

- 250.65 ng/g (0.25065 mcg/g or 25.07 mcg/100g)
- 259.89 ng/g (0.25989 mcg/g or 25.99 mcg/100g)

Four other samples of butter oil tested showed levels in the range of 196.37 to 263.70 ng/mg (0.19637 to 0.2637 mcg/g or 19.64 to 26.37 mcg/100g)

A high-quality, grass-fed ghee showed levels of Vitamin K2 that were nearly as high as the Green Pasture X Factor Gold product:

- 335.70 ng/g (0.33570 mcg/g or 33.57 mcg/100 grams)
- 324.36 ng/g (0.32436 mcg/g or 32.44 mcg/100 grams)
Two other samples of ghee that were tested showed levels in the same range with a high of 367.45 ng/g (0.36745 mcg/g or 36.74 mcg/100 g) and low of 268.37 ng/g (0.26837 mcg/g or 26.84 mcg/100g).³

All these ghees tested significantly higher than ordinary butter, which typically has Vitamin K2 content of 15.0 mcg/100 grams. All three showed levels comparable to egg yolk, which typically offers a Vitamin K2 content of 32.1 mcg/100g. By comparison, the Vitamin K2 superstars are natto (1103.4 mcg/100g), goose liver paté (369.0 mcg/100g), hard cheeses (76.3 mcg/100g) and soft cheeses (56.5 mcg/100g).⁴⁻⁶

In her book *Vitamin K2 and the Calcium Paradox*, Kate Rhéaume-Bleue discusses two products that she says should be “chock-full of Vitamin K2” — the Green Pasture X-Factor Gold Butter Oil and Pure Indian Foods 100% Organic, Grass-fed Ghee. She writes she was “blown away by the flavor” of the “absolutely delicious” ghee, but wondered if the butter oil possessed any special attributes that could justify its higher cost.

*Since the butter oil is seven times the price per ounce of grass-fed ghee, I did endeavor to determine exactly what distinguishes it. Except for the reference to an unstated species of grass on the butter oil label, the label descriptions of the two products seem the same. I interviewed the owner of Green Pasture Products and my specific questions were met with vague answers. If you can afford this product, you can afford grass-fed ghee and,*
According to my research, you’ll be getting pretty much the same thing.7

As it turns out, Rhéaume-Bleue was right — the grass-fed butter oils and ghees tested with roughly comparable levels of Vitamin K2. This raises the question of how plain butter from pastured cows would test. Would it test higher than regular butter, and conceivably reach the levels of K2 in the butter oils and ghees?

It turns out that some butters do test high in Vitamin K2, and at levels far over the supermarket butter average of 15 mg/g found in Dutch products. Indeed, researchers at Maastricht University Vita K and D Research Center have found results as high as 239.66 ng/g (0.23966 mcg/g or 23.97 mcg/100g) and with multiple samples in the 20.0 mcg/100 g range.8

THE STILL MYSTERIOUS X FACTOR

This strongly suggests that Vitamin K2 might not be Dr. Price’s elusive “X Factor.” Dr. Price was specific that it was butter oil — and not just butter — that had healing power and a potent synergizing effect on cod-liver oil. Clearly, it’s time to test a variety of butters, butter oils and ghees not only for Vitamin K but for other potentizing factors.

Until then it looks like Vitamin K2 is not Dr. Price’s mysterious “X Factor” after all.
LAND OF MILK AND HONEY

If not Vitamin K, might other factors distinguish the Green Pasture X-Factor Gold Butter Oil from its competition?

The Green Pasture myth holds that its butter oil is an “exquisite golden oil” extracted from the “milk of cows that graze on select grasses of the Northern Great Plains.” The words vary from one retail site to another, but the message is unmistakeable. This is a premium, all-American product made from the creamy milk of Shorthorn and Devon cows that graze exclusively on:

- “The fertile soils and green grasses of the Midwest”
- “Rapidly growing specialized forage ensuring optimal levels of Activator X”
- “The irrigated grass of the Northern Great Plains”
- “Specially selected, rapidly growing grass.”
- “The green grasses of the northern Great Plains.”

THE TRUTH?

Green Pasture once obtained its butter from trusted, local farmers and probably started out with butter from Wetzel’s own herd of cows. But for several years now the company has imported its butter in large canisters from Argentina.

While it could conceivably be “spring butter” from pastured cows, it’s not certified organic and hardly fresh by the time
it’s traveled north to Nebraska. Whether it’s coming from herds of happy milking Shorthorn and Devon cows who feast on rapidly growing grass is anyone’s guess.

What’s known for sure is some visitors to Green Pasture have reported seeing canisters of butter that sit around unrefigerated for weeks, heating up in the sun, and possibly going rancid. This may explain why so many butter oil connoisseurs have commented that the Green Pasture product has gone downhill over the past several years and is often marked by objectionable “off flavors” and an “odd texture.”

Predictably, Wetzel frames the sensory perceptions differently. “Our High Vitamin Butter Oil will have a culture or fermented like flavor. Because we do not use industrial means, each lot can have different tastes, odors etc. . .”

Taste, smell and texture are subjective impressions. For an objective evaluation of rancidity, a bottle of Green Pasture’s butter oil was sent for lab testing.

According to the Codex Milk Fat Products Standards, the Peroxide Value for a butter oil should be no higher than 0.6 meq/kg. Tested at the level of 3.6 meq/kg, the Green Pasture butter oil has already “turned” and is showing significant primary-stage rancidity. Codex Standards also specify a maximum Free Fatty Acids Value of 0.4. Multiplying by 1.99 yields a maximum acceptable Acid Value of 0.796 mg KOH/g. At 3.0 mg-KOH/g, the Green Pasture product tested at well above that.
The bottom line is, the sample was rancid. While that may not prove true of every batch, it’s definitely a case of “buyer beware.”

Can anything good be said about the product? Yes. Testing showed non-detectable GMOs and antibiotic residue. Both would have shown up in butter from factory-farmed cows fed corn and soy and treated with antibiotics. So the butter purchased by Green Pasture could very well be coming from grass-fed cows, as the excellent Vitamin K2 levels would also suggest.

More testing is needed. Until then, there seem to be three strikes against the Green Pasture X-Factor Gold Butter Oil. The evidence indicates that the good Vitamin K2 levels are matched by grass-fed ghees that cost substantially less. It comes from Argentina and so is not the all-American product demanded by truth in advertising.

And, most important of all, Dr. Weston A. Price would never, ever have endorsed a product that tested rancid.

* * * * *

ENDNOTES

2. Vitamin K data on butter oil products shared by Maastricht University Vita K R&D Group. Brand names were not shared. August 20, 2015.

3. Vitamin K data on ghee products shared by Maastricht University Vita K R&D Group. Brand names were not shared. August 20, 2015.


8. Vitamin K data on butter shared by Maastricht University Vita K R&D Group. The high levels suggest pastured butters, but brand names were not shared. August 20, 2015.


14. Conversation with Joey Jones of Prospect Farm, Texas. Jones is a former neighbor of David Wetzel who supplied local butter to Green Pasture.

15. Author’s conversation with Ron Schmid of Dr. Ron’s, a longtime reseller of the Green Pasture products. “At least a
couple years ago, Dave told me he was getting at least some of his butter from Argentina.”

16. Conversations with consumers at Wise Traditions and other conferences.


18. Codex Standard for Milkfat Products CODEX Stan 280-1973 Codex does not offer a cutoff value for Anisidine Value so I was not able to evaluate the p-AnV of 4.1 reported by Lab #8.
CONCLUSIONS

Do you feel betrayed? Let down by the very health experts you trusted? Worried that you may have harmed your loved ones? Upset that you allowed “expert” opinion to override your own good common sense? Angry that you overpaid for a product that evidence indicates was not as labeled?

Then it’s time to take back your power.

First, talk to friends and family who are taking Green Pasture products. Send them to drkaayladaniel.com to get their own free copy of this report.

Then take care not to be duped again. Here’s three tips:

• Know where your food is coming from. Boat to bottle. Farm to fork.

• Know how your food is grown and made. No secrets. No evasions.

• Be skeptical of health claims. If it seems too good to be true, it probably is. And being “all natural” doesn’t change that.

Finally, if you think you have health challenges related to FCLO consumption, share your story with friends, colleagues . . . and me. Contact me at wholenutritionist@earthlink.net.

* * * * *
ACKNOWLEDGMENTS

This was a top secret project. I am grateful to many people who helped with this investigation, most of whom spoke to me on the condition that I keep their names private. These included top university professors, scientists, researchers, lab managers, doctors and other health care practitioners.

In order to do the necessary laboratory testing of the Green Pasture Fermented Cod Liver oil and X-Factor Gold Butter Oil, I was required to sign legal agreements with each of the analytical laboratories not to use their names or publish their original reports.

Many thanks to the Price-Pottenger Nutrition Foundation, which opened its archives to me. Former aerospace engineer Sarah Smith, of the Nourished and Nurtured blog, provided thoughtful feedback and valuable editorial assistance. I particularly want to thank Dr. Ron Schmid ND for his generosity and integrity. He and several other loyal members of the Weston A. Price Foundation helped fund my laboratory testing. All of them trusted me to get to the truth, and fully accepted my condition that I would allow no control over the content and would publish the results of the investigation no matter what.

Finally, I would never have had the courage to complete this project without the inspiring example of my friend and mentor the late Mary G. Enig, PhD.

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Dr. Kaayla Daniel tells the truth that’s too hot to handle.” She received the Integrity in Science Award from the Weston A. Price Foundation in 2005, the Health Freedom Fighter Award from Freedom Law School in 2009, and the BadAss Award from the Paleo-Primal-Price (now Hunt Gather Grow) Foundation in 2015.

She is coauthor of *Nourishing Broth: An Old-Fashioned Remedy for the Modern World* (2014) and the author of *The Whole Soy Story: The Dark Side of America’s Favorite Health Food* (2005). She has been a guest on *The Dr. Oz Show*, *PBS Healing Quest*, *NPR’s People’s Pharmacy*, *ABC’s View from the Bay*, and *Discovery Channel’s Medical Hotseat*, and has shared the stage with Dr. Mark Hyman, JJ Virgin, Gary Taubes, Charles Poliquin, Dr. Joseph Mercola, Joel Salatin, Dr. Terry Wahls, and other prominent health experts.

Dr. Daniel has spoken at numerous professional conferences, including Ancestral Health, Paleo f(x) BoulderFest, Wise Traditions, National Association of Nutritional Professionals (NANP), Nutritional Therapy Association (NTA) and Biosignature. She received her PhD from the Union Institute and University in 2005.