CONCERNS ABOUT COD LIVER OIL

The Weston A. Price Foundation has recently received several inquiries about the possibility of rancidity in fermented cod liver oil. After conducting our own due diligence, we have concluded that these concerns are unfounded.

MARKERS OF RANCIDITY

Green Pasture, the manufacturer of fermented cod liver oil, tests every batch for the generally accepted markers of oxidation or rancidity. These tests are performed by MidWestern Laboratories, a large, respected, certified laboratory with extensive experience in this testing.

These three markers are:

* 1. peroxide value (PV) (first level oxidation)
	2. anisidine (AV) value (second level oxidation)
	3. malondialdehyde (MDA or TBARS) (third level oxidation)

|  |  |  |  |
| --- | --- | --- | --- |
| **Lot Number** | **Peroxide (meg/kg fat)** | **P-Anisdine** | **TBA-TBARS (mg/kg)** |
| C050716132LG | -- | -- | 0.49 |
| C0103111405PO | 32.1 | 22 | -- |
| C0705141404PO | 4 | 9 | 0.55 |
| CO603271404PO | -- | 11 | -- |
| C0705141405PO | 3.9 | 16 | 1.59 |
| C1905081403 | 20.7 | 6 | 0.56 |
| C22091213LG | 8.9 | 18 | 0.84 |
| C81221122GY | 9.7 | 18 | 0.43 |
| C190710132LG | 13.6 | 6 | 0.21 |
| C170710131LG | 12.9 | 6 | 0.38 |

The Certificates of Analysis for these tests are available on request.

In addition, the Weston A. Price Foundation sent a sample of Green Pasture Fermented cod liver oil to Dr. Martin Grootveld, at the Leicester School of Pharmacy, Faculty of Health and Life Sciences. Leicester. U.K. Dr. Grootveld is a Member of the Editorial Boards of Bio Analytical Techniques and International Journal of Medical and Clinical Research.  This laboratory looks for markers other than PV, AV and TBARS as signs of oxidation or rancidity. As per Dr. Grootveld’s report, his laboratory found no markers of rancidity in the fermented cod liver oil.

**COD LIVER OIL FATTY ACID ANALYSIS RESULTS (Molar % of Total Fatty Acid Content):**

Total Unsaturated: 64.05%

Total Saturated: 35.95%

Total Mono-unsaturated and Di-unsaturated: 42.39%

Total Saturated, Mono-unsaturated and Di-unsaturated: 78.34%

Total Omega-3: 21.66%

Docosahexaenenoic acid (DHA, 24:6): 6.16%

Eicosopentaenenoic acid (EPA, 22:5): 9.24%

Other Omega-3: 6.26%

Total Diacylglycerols (*sn*-1,2 and *sn*-1,3): 3.29%

*sn*-1,2-Diacylglycerols: 1.76%

*sn*-1,3-Diacylglycerols: 1.53%

**Lipid Oxidation Products (LOPs):**

**(1) Conjugated Hydroperoxydienes (CHPDs), otherwise known as ‘Lipid Peroxides’**

*cis,trans*-Conjugated hydroperoxydienes: n.d.

*trans,trans*-Conjugated hydroperoxydienes: n.d.

**(2) Aldehydes**

*trans-*2-Alkenals: n.d.

*cis,trans*-2-Alkenals: n.d.

*trans,trans*-Alka-2,4-dienals: n.d.

4-Hydroxy-*trans-*2-alkenals: n.d.

4,5-Epoxyaldehydes: n.d.

*n*-Alkanals: n.d.

Core aldehydes: n.d.

Abbreviations: n.d., none detectable.

Here is a link to the Certificate of Analysis from Dr. Grootveld: <http://www.westonaprice.org/wp-content/uploads/13GrootveldReport.pdf>

AMINE TESTS

Certain parties have also accused the fermented cod liver oil of being “putrid.” This probably comes from a misunderstanding about the nature of fermentation. When oil is removed from cod livers using high heat and chemicals—the industrial process used by most cod liver oil producers in Europe—the result is a “brown, industrial oil” that is both rancid and putrid, and requires considerable filtering and refining to clean it up and create a light yellow oil. (In this process, most of the natural vitamins are removed and are replaced with synthetic vitamins.)

A small portion of European cod liver oil is produced by extracting the livers as soon as the fish are brought up from cold, deep waters. The livers are put in pans at room temperature and the rapid change in temperature causes the release of some of the oils from the livers. This results in a natural yellow oil, with natural vitamins, called extra virgin cod liver oil. The livers must not be left too long or they begin to rot, and the oil turns brown. (Because this process is not very efficient at extracting all the oil, the livers are sent for industrial processing after the initial release of the natural yellow oil.)

This is not what happens during fermentation, a process where the whole livers are put in airtight vats with a starter and salt so that rancidity is avoided. The fermentation process causes the cells to release all the oil and natural vitamins. The resulting oil is also brown.

Those not familiar with the fermentation process may honestly assume that any oil that is brown is also “putrid” or “rancid.”

To test for whether an oil is “putrid,” scientists measure amine levels in the oil, particularly amines called putrescine and cadavarine. Green Pasture routinely tests their cod liver oil for these amines. Here are the results for various amines, in ppm, for 2014:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Amines | C1905081403 | C25042314 |  | C140801131LG | C150620133LG | C260725131LG | C240712133GY | C1905081403 | C25042314 |
| 2-phenylethylamine | 48.3 | 20 | 5.6 | nd | 12 | nd | 19 | 48.3 | 20 |
| Cadaverine | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| Histimine | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| Putrescine | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| Spermidine | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| Spermine | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| Tryptamine | 17 | 14.6 | 1.5 | nd | 6.5 | nd | 14 | 17 | 14.6 |
| Tyramine | 28 | 11.6 | 4.9 | 3 | 34 | nd | 13 | 28 | 11.6 |

These values are routinely low or non-detectible. Copies of the Certificates of Analysis are available upon request.

AMINES IN OTHER FERMENTED FOODS

It should be noted that many fermented foods contain amines, including cadaverine and putrescine, often at levels considerably higher than those found in fermented cod liver oil.

Here are typical values, in ppm, for some strong cheeses, which are often consumed in considerable amounts. Obviously humans can tolerate considerable levels of amines, including cadavarine and putrescine, in fermented foods.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Epoisses Berhaut Cheese | Limburg Cheese | Stinking Bishop Cheese | Saint Albray Cheese | St. Fellcien Cheese |
| 2-phenylethylamine | nd | 28.9 | 26.7 | nd | nd |
| Cadaverine | 2.6 | 472 | 395 | 42.7 | 45.5 |
| Histimine | 3.3 | 12 | 4.6 | 3.1 | 5.5 |
| Putrescine | 3.1 | 80.5 | 9.9 | 7.7 | 4.6 |
| Spermidine | 7.4 | 17.5 | 15.7 | nd | 7.3 |
| Spermine | 8.6 | nd | 9.1 | nd | nd |
| Tryptamine | 1.6 | 30.2 | 3.4 | nd | nd |
| Tyramine | 3.6 | 139 | 202 | 2.2 | nd |

Likewise, fermented fish sauces and other fermented fish products—consumed throughout the world--contain considerable levels of amines:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Tropics Round Scad Fish Sauce | An Lien Fish Sauce | Phan Thiet Anchovy Fish Sauce | Pantal Pickled Gouramy Fish | Mam Loc Fish Sauce |
| 2-phenylethylamine | 1.7 | 1.8 | 4.0 | 13.8 | nd |
| Cadaverine | 64.4 | 73.3 | 66.2 | 34.7 | 19.1 |
| Histimine | 55.7 | 14.7 | 34.5 | 16.2 | 11.1 |
| Putrescine | 14.4 | 19.6 | 11.8 | 8.9 | 10.6 |
| Spermidine | 12.6 | 26.9 | 11.0 | 9.4 | 17.6 |
| Spermine | 17.8 | 10.6 | 16.0 | 12.1 | 8.4 |
| Tryptamine | 7.1 | 3.6 | 14.1 | 2.8 | nd |
| Tyramine | 20.9 | 19.9 | 31.1 | 15.6 | 3.6 |

It is clear that traditional diets contained various amines considered markers of “putrification.” Therefore the small levels found in fermented cod liver oil should not be considered a problem.

CONCLUSION

The Weston A. Price Foundation has performed an appropriate due diligence investigation and has found no credible evidence of rancidity or putrefaction in the Green Pastures fermented CLO. We continue to endorse this product.

TESTING IN 2015

Our main interest lies in the levels of fat-soluble vitamins—A, D and K—in various foods. Our focus for 2015 will be testing various foods for levels of these vitamins. We will test egg yolks, cheeses, butter, lard, beef fat and liver raised in various ways (industrial, organic and pasture-fed) as well as sea foods such as fish eggs and cod liver oil. If possible we will also test fats that were prized by native peoples, such as bear fat, beaver tail fat and seal oil.