

# Perspective

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## ION™ Profile & GI Effects™ Profile in Underweight Patient with Joint Pain, Diarrhea & Constipation

*ION™ Profiles Can Often Reveal Layered Effects of a Particular Nutrient Deficiency or Biochemical Abnormality - This Affords the Clinician Greater Confidence & Specificity in Their Therapy*

41 year old male SR, presented to his clinician with major complaints of joint and muscle pain coinciding with severe gut symptoms in the form of diarrhea, constipation and belching. The patient's other major concerns include low weight, anxiety and irritability. The results of the patient's **ION™ Profile** show some significant perturbations in nutrient elements, plasma fatty acids and the **Organix™ Profile**. With regard to the patient's **Gastrointestinal Function Profile**, the major findings are a dysbiosis in predominant bacteria and the presence of significant amounts of yeast. Each result is reviewed below.

### Nutrient Elements



Severe deficiencies for potassium and magnesium suggest the involvement of factors other than simple lack of intake. Poor absorption due to intestinal dysbiosis could be an additional contributing factor. Low potassium levels will sometimes be mirrored by cardiac arrhythmias, however, no such symptoms are reported. Likewise, the patient does not report any classical cardiovascular or neuromuscular symptomatology associated with magnesium deficiency.

### Vitamin D & Magnesium Absorption

The low magnesium level is concerning given the patient is taking supplemental magnesium. This further reinforces possible limitations with the patient's absorption of magnesium. There is some evidence that vitamin D can increase absorption of magnesium. The patient reports vitamin D supplementation, however, vitamin D levels are still suboptimal as seen below. The patient may require some high-dose vitamin D to restore healthy levels. This in turn may assist with magnesium absorption.



### Zinc / Copper Ratio

Low zinc combined with high copper is cause for concern, given they share the same mechanism of intestinal absorption. The patient was diagnosed a few years ago with steatorrhea, which among other things can cause raised copper levels since copper is excreted via bile.



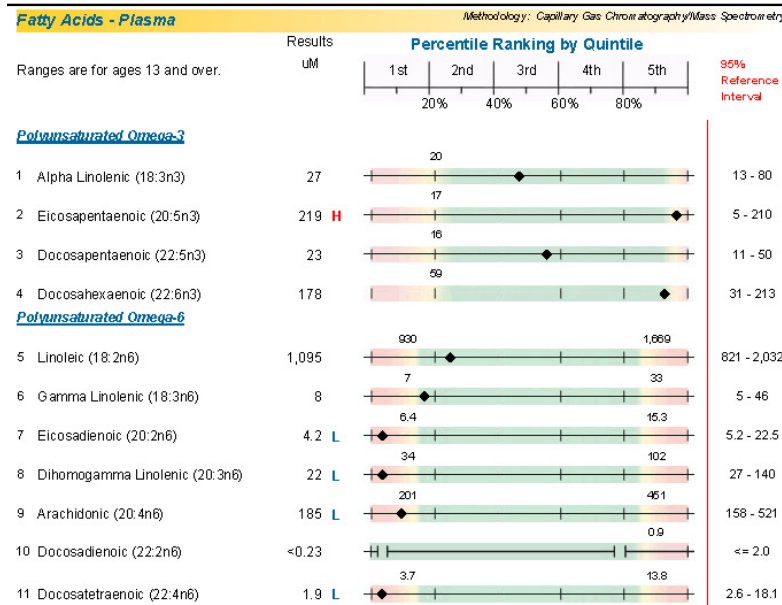
### Selenium & Thyroid Function

Low selenium levels can affect thyroid function and a multitude of physiologic systems through its central role as a cofactor for glutathione peroxidase. Selenium supplementation will be important to restore healthy levels, however, it is unlikely that the low level has a major bearing on the patient's symptoms.



### Plasma Fatty Acids

The other significant finding to emerge from the patient's *ION™ Profile* is a chronic deficiency of omega-6 fatty acids as seen below.

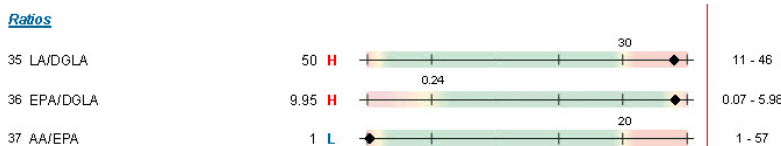


### Omega-6 Deficiency & Joint Pain

Chronic low levels of omega-6 fatty acids are important in the context of the patient's complaints of joint pain. A number of studies have reported a benefit from supplementation with gamma linolenic acid in rheumatoid arthritis. While there has traditionally been a focus on supplementation with omega-3 fatty acids and their associated health benefits, it is important to remember the vital role that the omega-6 fatty acids play.

### Omega-6 Fatty Acids, Inflammation & Zinc Deficiency

Omega-6 fatty acids serve as precursors to both series 1 & 2 prostanoids and leukotrienes. Dihomo-gamma-linolenic acid, or DGLA as it is more commonly referred to, is the primary precursor to the series 1 prostanoids and leukotrienes, which have an anti-inflammatory action. Arachidonic acid by contrast serves as the precursor to the series 2 prostanoids and leukotrienes, which have a pro-inflammatory action. Above, you can see the patient has a particularly low level of DGLA, even lower than the 95% reference interval. In contrast, arachidonic acid is low as well, but still well within the 95% reference interval. So it is reasonable to assume that this patient may benefit from aggressive GLA supplementation to assist with DGLA formation and its subsequent anti-inflammatory effects for the patient's joint pain. The desaturase enzyme responsible for the conversion of linoleic acid (LA) to DGLA has a specific requirement for zinc. For this reason, the LA to DGLA ratio is often used as a functional measure of zinc deficiency. As seen below, the patient has a very high value for LA/DGLA, which further reinforces the zinc deficiency detected on the patient's red blood cell element profile.



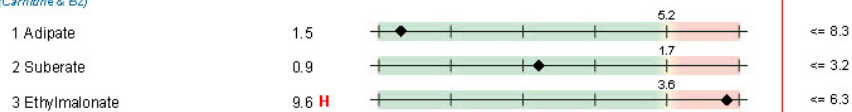
### Omega-3 / Omega-6 Ratios

The other ratios above highlight the gross imbalance between omega-3 and 6 fatty acids for this patient. High levels of EPA and DHA are most likely due to the patient's supplementation with fish oil, with normal capsules containing slightly high amounts of EPA relative to DHA, hence the high value for EPA.

## Organix™ Profile

The main findings of the patient's **Organix™ Profile** are shown below. The patient has a relatively normal profile, with the exception of a few markers, which suggests that his metabolic and cellular function are relatively good.

### Fatty Acid Metabolism (Carnitine & B2)



### Fatty Acid Metabolism

Ethylmalonate is thought to be formed from butyrate, the well-known short-chain fatty acid. High levels normally indicate inefficiencies in beta fatty acid oxidation of butyrate, and the need for vitamin B2 and carnitine. This is normally due to a mutation in the short-chain acyl-coenzyme A dehydrogenase (SCAD) enzyme, which is known to occur at a high incidence in the general population. This mutation leads to high urinary levels of ethylmalonate. The fact that ethylmalonate is very high increases the likelihood that the abnormality could be caused by a mild enzymatic defect. In such cases, aggressive therapy with vitamin B2 and carnitine is warranted.

### β-Complex Vitamin Markers (B1, B2, B3, B5, B6, Biotin)



### Branch-Chain Amino Acid Metabolism

The next significant finding on the patient's **Organix™ Profile** is elevation of the branch-chain keto acid markers (i.e. #15-#17). Given the patient is underweight, elevation of these markers are likely to reflect a heightened catabolic state, whereby the patient is oxidizing branch-chain amino acids in muscle tissue for energy; rather than functional b-vitamin deficiency. There is also some research suggesting that ethylmalonate may occur as a product of the metabolism of the branch-chain keto acids. This may in part explain the elevation of ethylmalonate.

### Vitamin B12 Deficiency

As seen below, the patient also had high methylmalonate levels; indicative of a functional vitamin B12 deficiency. This is despite daily supplementation with vitamin B12 and a multivitamin containing vitamin B12.

### Methylation Cofactor Markers (B12, Folate)



### Considerations in Methylmalonic Aciduria

One explanation for raised methylmalonate levels despite supplemental vitamin B12 is that the patient has poor stomach acid levels, leading to inactivation of intrinsic factor which is required for the efficient absorption of vitamin B12. A high level of putrefactive short chain fatty acids on the accompanying **Gastrointestinal Function Profile** is another indicator that the patient may have low stomach acid levels, resulting in poor protein absorption and subsequent putrefaction. One other explanation is that elevated methylmalonate is secondary to elevated propionic acid levels (the precursor to methylmalonic acid). Propionic acid is a major metabolic by-product of anaerobic bacterial metabolism in the human colon. Therefore, factors which modulate colonic bacterial production of propionic acid will also affect urinary methylmalonate levels. Considering these two explanations, we might assume in the case of this patient that raised methylmalonate levels are likely to reflect a bacterial dysbiosis rather than a functional B12 deficiency, given that one of the patient's major presenting symptoms is chronic gut problems in the form of constipation/diarrhea. As we will cover later, the patient's **Gastrointestinal Function Profile**, provides further evidence of an intestinal dysbiosis.

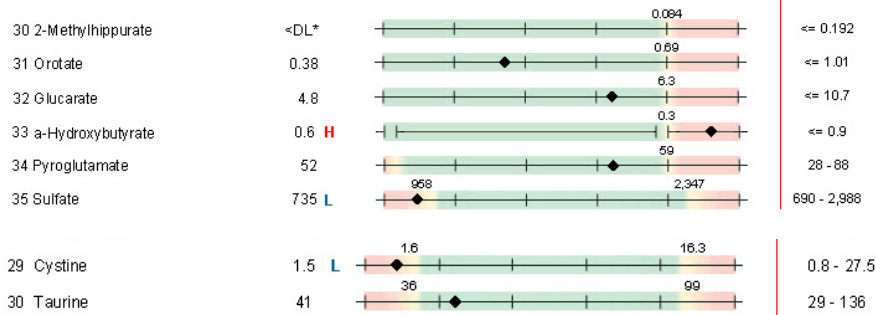
### Detoxification Indicators - Glutathione Synthesis & Demand

Abnormalities in two detoxification markers are the next significant finding on the patient's **Organix™ Profile**. High levels of alpha-hydroxybutyrate are thought to reflect an increase in demand for glutathione synthesis, which in turn can be an indication the patient is under some toxic or oxidative stress. To complement this, the patient also has low sulfate, which can be the result of overload of toxins requiring phase II sulfation. The other explanation is simply inadequate intake of dietary sulfur. A toxic load leading to depletion of sulfur stores is a more likely

**TOXICANTS AND DETOXIFICATION**

Detoxification Indicators

(Arg, NAC, Met, Mg and antioxidants)



explanation given that glutathione synthesis is also up-regulated. The question for the clinician is where is the toxic load coming from. Of interest to these detox markers is the concurrent finding of low cystine and low normal taurine on the accompanying amino acid profile, which can be taken as another sign of increased glutathione demand and synthesis.

**Gastrointestinal Function Profile**

From the results of the **ION™ Profile**, there are sufficient biochemical abnormalities to suggest the patient has compromised assimilation of nutrients, inflammation, oxidative stress and associated toxicity. Many of these symptoms can be theoretically linked to poor gut health. The results of the patient's **Gastrointestinal Function Profile** presented below lend some credibility to the notion that poor gut health/function is an underlying cause of a number of abnormalities featured on the patient's **ION™ Profile**.



**Predominant Bacteria & Digestion**

The predominant bacteria above show a relatively dispersed pattern indicating the patient has a significant degree of dysbiosis, which will adversely affect the patient's absorption and assimilation of nutrients as well as his immune function. This is evidenced partly by the elevated level of putrefactive short chain fatty acids and vegetable fibers in the patients stool.

**Yeast**

The only other major finding with regard to presence of pathogenic organisms is the presence of yeast at a level of +3. This suggests the patient's diet is having a significant bearing on their intestinal health and function. Suitable anti-fungal therapy should be considered alongside appropriate dietary modifications.



A taxonomy unavailable finding may indicate ingested mold. The higher the number, the greater the indication for treatment, particularly when accompanied by clinical symptoms.

## Summary

In summary this patient initially presented to his clinician with major complaints of joint pain, diarrhea alternating with constipation and low weight. It is also important to remember that the patient was diagnosed with steatorrhea 4 years prior. With this in mind, it is very probable that the patient's weight is largely secondary to poor gut health manifesting as constipation/diarrhea. Many clinicians would also argue that the patient's joint pain could largely be related to the patient's poor gut health as well.

Working off this assumption, one might theorize that many of the abnormalities featured on the **ION™ Profile** could be a reflection directly or at least in part of the patient's poor gut health/function. The question then arises to what extent does one focus on treating the nutrient deficiencies/toxicities featured on the **ION™ Profile** as opposed to targeting treatment aimed at correcting/restoring healthy gut function. A sensible approach may be to treat the nutrient abnormalities on face value, while at the same time trying to restore healthy gut function, with the aim of reducing much of the nutritional therapy as healthy gut function is restored. Periodic follow up testing will be important to assess the efficacy and specificity of treatment with a view to minimizing any unnecessary nutrient supplementation or dietary restrictions.