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Is Alcohol Ruining Your Gut Health?

MARCH 15, 2015 BY [EIRIK](#)



As I've repeatedly stated on the blog, I strongly believe **microbial imbalances** (dysbiosis) and increased intestinal permeability (a "leaky gut") are two of the main causes underlying the so-called diseases of civilization. This might seem like a far-fetched thing to say for those who aren't familiar with these conditions and/or are have never made the leap from the conventional medical community – where the importance of diet,

lifestyle, and gut health are often underestimated – to Darwinian/evolutionary, functional, or preventive medicine. However, for those who've taken the time to delve into the scientific literature on these things, the idea that poor gut health is a driving force behind most of the chronic **evolutionary mismatch conditions** that run rampant in today's societies makes complete sense. There are now thousands of studies linking gut dysbiosis, **loss of microbial "old friends"**, and increased intestinal permeability to a wide range of chronic health conditions. While there's still a way to go in terms of establishing a causal relationship between compromised gut health and certain diseases, there is no doubt that Hippocrates' statement that "all disease begins in the gut" does hold a lot of truth.

A pro-inflammatory modern lifestyle

Let's imagine that the western lifestyle is a giant puzzle composed of hundreds of pieces that each represent one single lifestyle component. A big bulk of these pieces represent things that **have been shown to negatively affect the gastrointestinal microbiota and/or intestinal lining in some way**, ranging from the greatest offenders like broad-spectrum antibiotics and highly processed food to less obvious things such as our disconnection from mother nature, exposure to pollutants, and ultra-clean food and drinking water. The scientific literature conveys one clear message: We've designed a lifestyle for ourselves that has a very damaging effect on our immune system and the invisible inhabitants we carry with us throughout life (1, 2).

The components of the western lifestyle that have been shown to promote dysbiosis, a leaky gut, and other similar health conditions are all in some way evolutionarily novel. Let's take highly processed foods like donuts, chips, and candy for example; all foods that we are clearly poorly adapted to eat. These products only entered into the human diet very recently, and they have a nutrient composition that is very different from anything you find in nature. This is clearly not to say that we should move back into the wild and adopt a **hunter-gatherer** lifestyle, it just means that we should be cautious about evolutionary novel stimulus, as it often falls in the category of being too new, too much, or too little when viewed in the light of what we're genetically adapted for.

Our evolutionary history with alcohol

A recent analysis suggests that a single mutation that occurred approximately 10 millions years ago endowed our ancestors with a markedly enhanced ability to metabolize ethanol (3). The explanation for this adaptation is that it provided an evolutionary advantage for primates who adopted a terrestrial lifestyle and started eating more highly fermented fruit. As fruit became increasingly replaced by tubers, meat, and other foods that make up the stereotypical hunter-gatherer diet, the intake of ethanol declined, and for our Paleolithic ancestors, little to no dietary energy came from ethanol. Wine, beer, liquor, and other alcoholic beverages are from an evolutionary perspective recent introductions in the human diet. Just like we are inadequately adapted for a very high intake of starch, salt, and other substances that many of us now eat in evolutionarily novel quantities, a very high intake of ethanol is also likely to cause problems.

From an evolutionary perspective, it's easy to see that the alcohol consumption pattern of the modern man, which might entail drinking a couple of six-packs of beer each week or throwing down several shots of hard liquor each saturday, could fall in the category of being *too much* or *too new*.

Alcohol can cause a leaky gut and upset the gut microbiota

In this post I'm not going to take an in-depth look at all of the pros and cons of alcohol. Rather, I wanted to highlight some research on alcohol and gut barrier function that I feel deserves a lot more attention than it's given.

Increasing evidence suggests that alcohol has the potential to perturb the intestinal microbiota and increase intestinal permeability. Here are two quotes from what is probably the best scientific paper (4) on the impact of alcohol on intestinal bacterial growth and intestinal permeability to endotoxin (bacterial toxins that are part of the outer membrane of the cell wall of Gram-negative bacteria)

“ Alcohol exposure can promote the growth of Gram negative bacteria in the intestine which may result in accumulation of endotoxin. In addition, alcohol metabolism by Gram negative bacteria and intestinal epithelial cells can result in accumulation of acetaldehyde, which in turn can increase intestinal permeability to endotoxin by increasing tyrosine phosphorylation of tight junction and adherens junction proteins. Alcohol-induced generation of nitric oxide may also contribute to increased permeability to endotoxin by reacting with tubulin, which may cause damage to microtubule cytoskeleton and subsequent disruption of intestinal barrier function. Increased intestinal permeability can lead to increased transfer of endotoxin from the intestine to the liver and general circulation where endotoxin may trigger inflammatory changes in the liver and other organs. Alcohol may also increase intestinal permeability to peptidoglycan which can initiate inflammatory response in liver and other organs.

Elevated levels of plasma endotoxin in response to alcohol ingestion may result from: 1) excessive production of endotoxin in the intestine through overgrowth of Gram negative bacteria; 2) increased permeability of the intestine to endotoxin; and 3) delayed clearance of endotoxin by Kupffer cells.

So, alcohol consumption clearly has the potential to jeopardise gut health. However, to really get a good picture of things we have to dig a little deeper. Let's take a look at some of the studies evaluating the effects of three different alcohol consumption patterns on gut barrier function and the intestinal microbiota.

Chronic alcohol abuse

It's well established that chronic alcohol abuse impairs the function of the intestinal barrier and upsets the gut microbiota (4, 5, 6, 7)

Binge drinking

Definition: "Binge drinking is defined as episodic excessive drinking. There is currently no world wide consensus on how many drinks constitute a "binge", but in the United States, the term is often taken to mean consuming five or more standard drinks (male), or four or more drinks (female), over a 2-hour period" (8).

How did last Saturday's binge drinking impact your gut barrier and intestinal microbiota? Let's take a look at two studies that look at this exact issue.

- A 2004 study assessed the impact of binge drinking by giving 11 men and 14 women enough alcohol to raise their blood alcohol levels to at least .08 g/dL within an hour. Blood samples were then taken every 30 minutes for four hours after and again 24 hours later. The study showed that the the alcohol binge resulted in increased gut permeability and elevations of endotoxin levels (9).
- A 2014 study that looked at the effects of acute binge drinking [2 ml vodka 40% v/v ethanol/kg body weight in a total volume of 300 ml orange/strawberry juice] in healthy adults on serum endotoxin levels found that "acute alcohol binge resulted in a rapid increase in serum endotoxin and 16S rDNA, a marker of bacterial translocation from the gut. Compared to men, women had higher blood alcohol and circulating endotoxin levels. In addition, alcohol binge caused a prolonged increase in acute phase protein levels in the systemic circulation. The biological significance of the in vivo endotoxin elevation was underscored by increased levels of inflammatory cytokines, TNF α and IL-6, and chemokine, MCP-1, measured in total blood after in vitro lipopolysaccharide stimulation. Our findings indicate that even a single alcohol binge results in increased serum endotoxin levels likely due to translocation of gut bacterial products and disturbs innate immune responses that can contribute to the deleterious effects of binge drinking" (10).

A moderate intake

Definition: Moderate ethanol consumption can be defined as one standard drink (i.e. 12 grams of ethanol) a day for women, and two standard drinks a day for men (11).

While everyone agrees that "excessive" alcohol consumption and binge drinking adversely affects health, there's a lot of controversy surrounding a more moderate intake. If you've

followed what's been going on in the nutritional community the last several years, you've probably heard that consuming some alcohol is better than avoiding it completely.

Those who speak in favor of a moderate intake of alcohol typically point out that some research suggests that alcohol imbibers tend to have greater microbial diversity than those that don't drink alcohol at all (12), make the case that the adverse effects of alcohol on protein synthesis, muscle growth, and parameters of health have been overblown, and/or highlight studies which at first sight seem to show that people who consume moderate amounts of alcohol are healthier than those who abstain completely.

On the other side of the coin we find those who advocate complete abstinence or a very restricted intake of alcohol. These people typically focus on the toxicity of ethanol, emphasise that new findings call into question previous studies which show that consuming light-to-moderate amounts of alcohol have a protective effect on cardiovascular health (14), say that it's likely that many of the health benefits attributed to the consumption of red wine are due to the antioxidant content, not the alcohol per se, and/or make the case that a big bulk of the studies underlying the conventional notion that light drinking has beneficial effects on cardiovascular health are filled with confounding variables, don't prove a causal relationship, and/or are observational in nature.

Personally, I think it would be great if alcoholic beverages were health drinks, as I certainly enjoy drinking now and then. However, as always, the important thing is to let the science speak for itself.

Anyways, let's get back on topic and look at what the scientific literature says about the relationship between a moderate intake of alcohol and gut health. The impact on gut health clearly isn't the end all be all in terms of how we should plan our alcohol consumption, but it's definitely an important factor. How will having a couple of glasses of wine with dinner impact your gut barrier function and intestinal microbiota? At the moment, there isn't enough research to make any firm conclusion in this area. However, recent studies do give us some hints.

- A 2012 *in vitro* study concluded "that ethanol at concentrations found in the blood after moderate drinking and acetaldehyde, alone and in combination, can increase the intestinal epithelial permeability. The data also point to the involvement of protein hyperacetylation in ethanol- and acetaldehyde-induced loss of tight junctions integrity." "These observations indicate that ethanol at concentrations in the blood observed in moderate drinkers already may give rise to intestinal barrier dysfunction" (13).
- Increasing evidence suggests that a moderate intake of alcohol could adversely affect gut health, and that acetaldehyde, the first and most toxic metabolite of ethanol

metabolism, can increase intestinal permeability to endotoxin (4).

Things to take into account

The negative impact of alcohol on gut health depends on several factors, including, but not limited to:

- **Dose/amount**

Obviously, drinking every day is very different from having an occasional glass of red wine with dinner.

- **Diet**

Some beverages, foods, and supplements (e.g., probiotics, prebiotics) contain compounds that may attenuate ethanol-induced increases in serum endotoxin levels.

- **The type of alcoholic beverage consumed**

A glass of red wine is in a whole other league than a sugar-heavy alcoholic drink.

- **The status of the gut microbiota and intestinal lining**

For people with gut dysbiosis and a compromised intestinal lining, even moderate alcohol consumption can be problematic. For example, a recent study showed that “one week of moderate consumption of red wine in inactive IBD was associated with a significant decrease in stool calprotectin and a significant increase in intestinal permeability (14)”.

Takeaway and practical applications

While the consumption of fruits that have undergone natural fermentation dates back millions of years, controlled fermentation of alcoholic beverages and the consumption of large quantities of alcohol are very recent phenomena when measured on an evolutionary timescale. Binge drinking and chronic alcohol consumption have been linked to several adverse health effects, including alterations of the gut microbiota and increased intestinal permeability. There is some evidence to suggest that a moderate intake might be problematic as well, but more data are needed to make any conclusive statements.

Personally, I don't completely steer away from alcohol, and I do drink when I go out with friends. However, recently I've started to reduce my consumption, largely because I don't like how alcohol affects my sleep, health, and physical performance. Although I rarely get an actual hangover, I can feel the negative impact alcohol has on my body, even if I just have a couple of drinks or a few glasses of wine. Others probably don't feel any adverse effects from a moderate intake of alcohol.

From the perspective of being as healthy as possible, complete abstinence or a restricted intake of alcohol is the way to go. However, as we know, there are several other factors that figure into the equation, and for most of us, the goal isn't to do everything in our power to always choose the healthiest route, but rather to find a balance between doing what we know is optimal for our health and what we find enjoyable.

Now I would like to hear from you. How do you feel alcohol impacts you? How many drinks/glasses can you drink without feeling like your sleep and health suffer?

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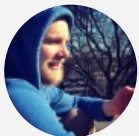
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About Eirik

Eirik Garnas is the creator and owner of [Darwinian-Medicine.com](#). His longstanding interest in nutrition, medicine, and health, topics he has spent a significant amount of time reading up on, was spurred by his desire to enhance his athletic performance and physique and overcome various health problems that had come to dominate many aspects of his life. Eirik is formally trained as a nutritionist and holds a bachelor's degree in Public Nutrition and a master's degree in Clinical Nutrition. Additionally, he is a science writer, health coach, and personal trainer schooled at the Norwegian School of Sport Sciences. During the years he's been working in the health/fitness sphere, Eirik has gone through several structured courses in order to improve his coaching skills and worked with a number of clients, both via the web and in real life. ([Request to become a client](#)) Over the past decade, Eirik has also written for a variety of health and fitness magazines and websites. You can read more about Eirik [here](#) and contact him [here](#).

Comments



Alison says

MARCH 15, 2015 AT 4:58 PM

I enjoy the occasional glass of red wine on the weekend. Last night while out for dinner with friends I consumed 3 glasses of red wine resulting in light headache and a sense of legarthy today.

[Reply](#)



Jennifer says

MARCH 15, 2015 AT 10:40 PM

I used to drink wine or spirits or both on Fri/Sat nights but haven't the last several years. This past Friday night I had one glass — ONE — of coffee-flavored rum with kefir milk and woke up with a mother of a headache. Seems the last time I had a drink I also woke up with a headache. Dehydration, maybe but doubtful. It cost me my weight lifting session, however I was able to do cardio and for whatever reason that helps.

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drwillip says

MARCH 16, 2015 AT 5:28 PM

I get dehydrated, even with one glass of red, and it's cumulative. My wife gets headaches with red, but mostly with American wine, not European. Sounds like she's reacting to some inflammatory signal from some soil bacteria.

[Reply](#)



Geri says

MARCH 17, 2015 AT 1:02 PM

My IBS gets worse with one to two glasses of wine. I swell up in my abdomen, become constipated and have a restless nights sleep.

[Reply](#)



Nick says

DECEMBER 22, 2017 AT 9:27 AM

This is my biggest challenge if I'm honest, I drink probably once every month on average but I HATE how I feel the next day and the impact it has on my productivity etc, despite limiting myself to five drinks maximum. Do you have any set rules around consumption Eirik?

I went off alcohol completely for a few months recently for the reasons mentioned above but found myself avoiding some social events or at least leaving them fairly early as people became incoherent. A balance I've found extremely difficult to find!

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