laws

MDPI

Viewpoint

Beyond Auto-Brewery: Why Dysbiosis and the Legalome Matter to Forensic and Legal Psychology

Alan C. Logan [1,*], Susan L. Prescott [1,2,3], Erica M. LaFata [4], Jeffrey J. Nicholson [5] and Christopher A. Lowry [6]

1 Nova Institute for Health, Baltimore, MD 21231, USA; susan.prescott@telethonkids.org.au
2 School of Medicine, University of Western Australia, Perth, WA 6009, Australia
3 Department of Family and Community Medicine, School of Medicine, University of Maryland, Baltimore, MD 21201, USA
4 Center for Weight, Eating, and Lifestyle Science, Drexel University, 3141 Chestnut St, Philadelphia, PA 19104, USA; es3344@drexel.edu
5 Faculty of Business and Law, Humber College, Toronto, ON M9W 5L7, Canada; jeffrey.nicholson@humber.ca
6 Departments of Integrative Physiology and Psychology and Neuroscience, Center for Neuroscience and Center for Microbial Exploration, University of Colorado Boulder, Boulder, CO 80309, USA; christopher.lowry@colorado.edu
* Correspondence: alanxlogan@gmail.com

Abstract: International studies have linked the consumption of ultra-processed foods with a variety of non-communicable diseases. Included in this growing body of research is evidence linking ultra-processed foods to mental disorders, aggression, and antisocial behavior. Although the idea that dietary patterns and various nutrients or additives can influence brain and behavior has a long history in criminology, in the absence of plausible mechanisms and convincing intervention trials, the topic was mostly excluded from mainstream discourse. The emergence of research across nutritional neuroscience and nutritional psychology/psychiatry, combined with mechanistic bench science, and human intervention trials, has provided support to epidemiological findings, and legitimacy to the concept of nutritional criminology. Among the emergent research, microbiome sciences have illuminated mechanistic pathways linking various socioeconomic and environmental factors, including the consumption of ultra-processed foods, with aggression and antisocial behavior. Here in this review, we examine this burgeoning research, including that related to ultra-processed food addiction, and explore its relevance across the criminal justice spectrum—from prevention to intervention—and in courtroom considerations of diminished capacity. We use auto-brewery syndrome as an example of intersecting diet and gut microbiome science that has been used to refute *mens rea* in criminal charges. The legalome—microbiome and omics science applied in forensic and legal psychology—appears set to emerge as an important consideration in matters of criminology, law, and justice.

Keywords: forensic psychology; criminal justice; microbiome; ultra-processed food addiction; diminished capacity; aggression; auto-brewery syndrome; biological criminology; nutrition

Citation: Logan, Alan C., Susan L. Prescott, Erica M. LaFata, Jeffrey J. Nicholson, and Christopher A. Lowry. 2024. Beyond Auto-Brewery: Why Dysbiosis and the Legalome Matter to Forensic and Legal Psychology. *Laws* 13: 46. https://doi.org/10.3390/laws13040046

Academic Editors: Raúl Quevedo-Blasco and Amparo Díaz-Román

Received: 2 May 2024
Revised: 23 June 2024
Accepted: 5 July 2024
Published: 11 July 2024

1. Introduction

> *"It appears, then, that the digestive tract of the healthy, upright citizen is on a mild scale an unlicensed brewery"*
>
> The Age, 1910 (Anon 1910)

Recent years have witnessed a dramatic growth in the scientific scrutiny of ultra-processed foods, with a vast number of epidemiological studies linking consumption with non-communicable diseases (Lane et al. 2024; Dai et al. 2024). Ultra-processed products typically contain assembled combinations of refined sugar, industrial fat, emulsifiers, flavor enhancers, synthetic ingredients, isolated fiber, and/or extruded meat remnants

(Popkin et al. 2024). These combinations are often engineered to promote rewarding properties and enhanced palatability. Products classified as ultra-processed include ready-to-heat and ready-to-consume pre-packaged meals, carbonated soft drinks, energy drinks, savory packaged snacks, ice cream, sweets (candies), cookies/biscuits, "energy" bars, mass-produced packaged breads and buns, pre-packed cake mixes, sweetened breakfast cereals, margarines and other spreads, pastries, sweetened milk drinks, "fruit" yogurts, imitation "fruit" drinks, "cocoa" drinks, "instant" sauces/soups, poultry and fish "nuggets" and "sticks", sausages, burgers, hot dogs, reconstituted meat products, and home/restaurant meals assembled with ultra-processed ingredients such as refined starches and hydrogenated oils (Prescott et al. 2024b; Monteiro et al. 2019; Martinez-Steele et al. 2023). Included in the emerging epidemiological research are increasingly robust associations between ultra-processed food consumption (or the high sugar/fat typically found in such foods) and mental disorders, aggression, and antisocial behavior (Lane et al. 2024; Werneck et al. 2024; Zahedi et al. 2014; Mohseni et al. 2021; Abiri et al. 2023; Wu et al. 2020; Gketsios et al. 2023; Khayyatzadeh et al. 2019; Mrug et al. 2021).

Although the subject of diet (including nutrient deficiencies and/or excess exposure to dietary additives/toxins) has been discussed in the periphery of criminology for many years, advances in nutritional neuroscience and nutritional psychology/psychiatry, including mechanistic and intervention studies, have underscored the relevancy of nutrition to mental health and behavior. As this research has matured, it is becoming clear that nutrition may be more relevant to criminology and carceral institutions, in both prevention and intervention, than previously appreciated (Prescott et al. 2024a). Amid this body of research, the gut microbiota (as influenced by diet and other environmental factors) are emerging as mediators of behavior. That is, volumes of research now demonstrate that the gut microbiota are not only influenced by the host's behavior, such as dietary choices, the behavior of the host is also influenced by the microbiota. This research is disrupting notions of the biological 'self' (Rees et al. 2018; Ironstone 2019), and the assumption of free will that underpins legal decision-making (A. C. Logan et al. 2024).

In this review, we examine this burgeoning research, including that related to ultra-processed food addiction, and explore its relevance across the criminal justice spectrum—from prevention to intervention—and in courtroom considerations of diminished capacity. We introduce the concept of the legalome—microbiome and omics science applied in biological criminology and in matters of forensic and legal psychology (A. C. Logan et al. 2024). Combined with microbiome findings, omics technologies (including genomics, epigenomics, transcriptomics, an/or metabolomics) are illuminating biological contributors to behavioral problems, including aggression, addiction, impulsivity, excessive risk-taking, and diminished concern for future consequences (Hagenbeek et al. 2023; García-Cabrerizo and Cryan 2024; Y. Chen et al. 2024; J. Wang et al. 2024). As a point of entry into discussions of the legalome, we provide a brief overview of auto-brewery syndrome—a microbiota-driven condition—which has already challenged the legal requirement of intent, or *mens rea*, in criminal cases of driving while intoxicated (DWI) (Akbaba 2020). Our discussion is oriented toward the United States legal system, although the research discussed below has global implications.

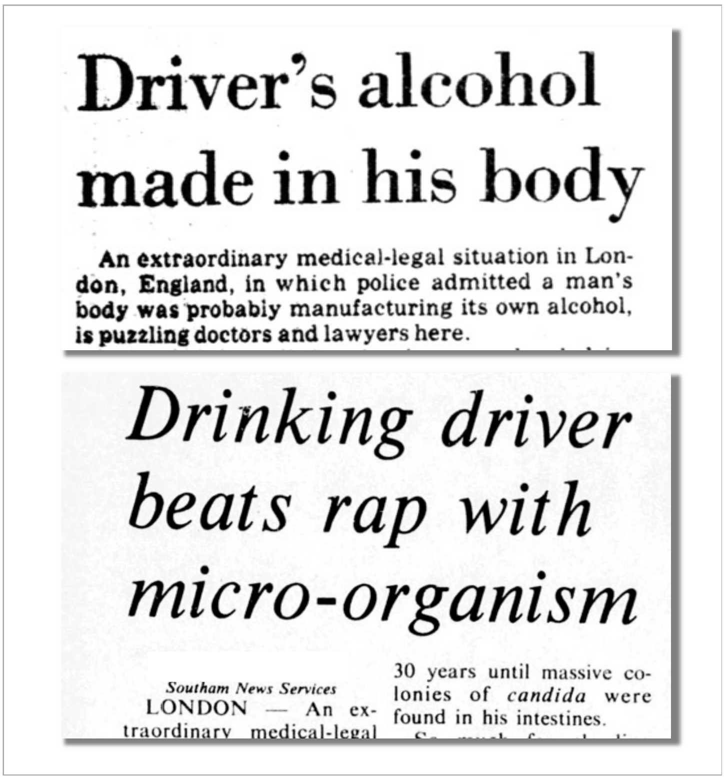
2. Auto-Brewery Syndrome

> "*Those who might otherwise be wrongly convicted now have an explanation which may someday be better researched and understood by scientists, and may provide a defense*"
>
> Ray Twohig, Esq. 1991 (Twohig 1991)

In December 1990, Albuquerque defense attorney Ray Twohig argued that his client's conviction on DWI charges should be vacated because the client had an intestinal overgrowth of the alcohol-producing microbe, *Candida albicans*. The prosecutor, Timothy Cornish, was unimpressed: "This thing is baloney. It is laughable," he told the press (Rosales 1990). The judge, Richard Traub, did not allow the defense to move forward, informing Twohig that "the court does not give credence to the involuntary intoxication defense"

(The Editors 1990). Local media scoffed at the defense—the *Albuquerque Journal* penned an editorial stating that Twohig's legal theory "wreaks havoc on the credence of the legal profession" (The Editors 1990). Even though he was unsuccessful, and the subject of ridicule, Twohig maintained that the evidence he gathered, if supported by future research, would one day provide a microbe-mediated defense strategy.

Insofar as DWI is concerned, Twohig has been proved correct. In December 2015, the "auto-brewery" syndrome defense was successfully used in New York State, with the dismissal of DWI charges against a 34-year-old woman. The defense attorney had provided ample evidence of elevations in blood alcohol, in the absence of alcohol consumption, when his client was tested under tightly-controlled conditions (Herbeck 2016). Since this landmark dismissal, less-publicized dismissals and/or reductions in charges have been reported in the United States (Nelson 2017; Rudnick Law 2021). In April, 2024, the Belgian courts also dismissed DWI charges against a 40-year-old man with lab-proven auto-brewery syndrome (Reuters 2024). Lesser-known is that in 1978, DWI charges against Russell Kerr, a 57-year-old Member of Parliament in the United Kingdom, were dismissed when his urine sample was found to have high levels of alcohol-producing *Candida* species (Hills 1978) (Figure 1). Later, Scotland Yard indicated that Kerr's case was likely due to lab contamination (Anon 1978).


Driver's alcohol made in his body

An extraordinary medical-legal situation in London, England, in which police admitted a man's body was probably manufacturing its own alcohol, is puzzling doctors and lawyers here.

Drinking driver beats rap with micro-organism

Southam News Services

LONDON — An extraordinary medical-legal

30 years until massive colonies of *candida* were found in his intestines.

Figure 1. International wire service headlines describe the 1978 microbe-based DWI dismissal involving Russell Kerr, MP. Scotland Yard later claimed lab contamination.

The idea that disturbances to the normal gastrointestinal microbiota (and the collective microbe-habitat ecosystem, now known as the microbiome) is associated with excess production of alcohol, and other potentially harmful products of microbial action, is over a century old (Adami and Nicholls 1911; Macfadyen 1903). In 1907, Dr. Walter E. Dixon proved that sugar is transformed into alcohol by intestinal fermentation, with minimal amounts of alcohol subsequently delivered to various tissues; Dixon theorized that chronic low-grade alcohol production, via dietary sugar, could account for higher levels of cirrhosis in England vs. Scotland, despite equivalent alcohol consumption in both regions (Anon 1907). In the 1920s, researchers reported that conditions involving disturbances to gastrointestinal structure and function, with coincident shifts in the microbial ecosystem, could result in significant alcohol production from carbohydrate foods: "Even if normal food is free from alcohol, from other carbohydrate-containing foods there are produced certain amounts of alcohol, this being accomplished by the actions of yeast, which is always present in the stomach and intestines. . .this yeast fermentation and the alcohol produced by it can be carried to such a degree that a state of chronic alcoholic autointoxication may possibly result" (Marcovici 1928). During this period, the idea that excess sugar and refined carbohydrate consumption can lead to internal alcohol production, behavioral change, and a cycle of sugar/carbohydrate addiction, was circulated in popular press articles: "The digestive tract of the food drunkard—the starch poisoned—is like a fermenting vat, with its accompanying carbonic acid and alcohol, irritating the whole system, the brain, beclouding the judgement. . .their digestive tracts resemble a beer vat at a brewery or a mash tub at a distillery, especially if they eat freely of sugar. This explains why [they] find it so difficult to give up the habit" (Froude 1924).

Among the yeasts involved in endogenous alcohol production, *Candida* species were early suspects. In 1959, professor Shuji Sasaki of Hokkaido University reported on a case of *Candida*-involved auto-brewery syndrome in Japan; the case involved a 46-year-old agriculture worker Kozo Ohishi, and was widely reported in North American media via Reuters and Time magazine (Anon 1959; Reuters 1959) (Figure 2). Ohishi had figured out on his own that heavy starch and sugar meals were provocateurs of his inebriated state, although it was not until he was provided test meals under controlled supervision, with lab-confirmed evidence of *Candida albicans* overgrowth, that his claims were taken seriously. One sentence buried within Time magazine's reporting is of relevance to contemporary discussions of ultra-processed foods and socioeconomic realities—"Ohishi tried to avoid starches, but with a wife and four growing children he could not always afford the more expensive meats and vegetables" (Anon 1959). Individuals with so-called auto-brewery syndrome (also called gut fermentation syndrome) can witness significant elevations in blood alcohol after the consumption of sugar and high-carbohydrate foods (like many ultra-processed products); sugar is well established as a growth accelerator for *Candida* species (Weerasekera et al. 2017), and acts as a substrate for microbial fermentation and the subsequent production of alcohol.

Until recently, auto-brewery syndrome was thought to be exclusively a product of the overgrowth of *Candida* and other fungal species (Kaji et al. 1976). Many of the cases of auto-brewery syndrome were reported to be triggered by courses of antibiotics which kill off the bacteria that otherwise keep *Candida* and other yeasts in check. For example, the odds of candidiasis are almost 8 times greater after amoxicillin treatment (Gillies et al. 2015). However, researchers have found that the overgrowth of multiple ethanol-producing bacteria, including *Klebsiella* species, can also cause auto-brewery syndrome (Xue et al. 2023). Over sixty bacterial species and two dozen yeasts are known ethanol producers (Mbaye et al. 2023), which suggests that any significant shift in the gut microbiome (a phenomenon known as dysbiosis), rather than *Candida* overgrowth per se, could increase the risk of auto-brewery syndrome. Moreover, emerging research is demonstrating that the local production of alcohol by gut microbes appears to be a significant contributor to metabolic dysfunction-associated steatotic liver disease (formerly known as nonalcoholic fatty liver disease, which, unlike alcohol consumption-related fatty liver disease, afflicts individuals who drink no/little alcohol). For example, over 60% of patients with metabolic dysfunction-associated steatotic liver disease have high levels of *Klebsiella pneumoniae*, a microbe that can produce alcohol in significant amounts; after an oral glucose tolerance test, these subjects with nonalcoholic liver disease had a blood alcohol level 3.6 times higher than healthy controls (Yuan et al. 2019).

This chronic internal production of alcohol is a likely contributor to intestinal permeability (Kuo et al. 2024), a topic to be discussed later. Whether related to alcohol production or not, it is worth noting that patients with schizophrenia are at much higher risk of metabolic dysfunction-associated steatotic liver disease (even when the patient is non-obese) (Yi et al. 2024), and that an elevated immune (IgA) reaction to *Klebsiella pneumoniae* is reported to be the single best predictor of residual psychotic symptoms in first-episode and multi-episode schizophrenia (Maes et al. 2021). *Klebsiella pneumoniae* has also been linked to susceptibility to seizure disorders (Lin et al. 2021) and *Klebsiella* as a genus has been associated with risk of depression (Lin et al. 2017). Like *Candida*, diets rich in sugar and simple carbohydrates, and absent naturally-occurring fiber as found in whole, minimally-processed foods, facilitate the growth of *Klebsiella pneumoniae* (Hecht et al. 2024).

Walking Distillery

Things He Ate Made Japanese Man Drunk

By United Press International

SAPPORO, Japan, July 8.—With one Japanese it wasn't something he drank that made him drunk. It was everything he ate. He was a walking distillery. The patient, identified by Japanese authorities only as Mr. O. was a

Walking Distillery Brewed His Own Alcohol From Food

SAPPORO, Japan—(UPI)—With one Japanese it wasn't something he drank that made him drunk. It was everything he ate. He was a walking distillery.

The patient, identified by Japanese authorities only as Mr. "O", was a 46-year-old farm association executive from Hokkaido who complained of chronic

Figure 2. International headlines used to describe the 1959 case of "Mr. O", emphasizing the diet-microbe connection to inebriation.

In the past, skeptics of auto-brewery syndrome, including the former director of the Washington State Forensic Laboratory Services Bureau, claimed that the extremely rare cases of forensically-relevant elevated blood alcohol (in the absence of alcohol consumption) were a phenomenon observed in Asian individuals; that is, the cause of auto-brewery in historical Japanese reports was suggested to be the ultra-rare intersection of the common East Asian genetic polymorphism (i.e., aldehyde dehydrogenase—resulting in reduced activity of enzymes involved in the hepatic metabolism of ethanol and minimal liver metabolism), medical-related conditions/iatrogenic causes, and the carbohydrate-heavy Asian diet. Such skeptics scoffed at the idea that any "non-Asian" individual in the United States could "generate sufficient amounts of ethanol in the body by natural processes to yield forensically significant concentrations in peripheral venous blood" (B. K. Logan and Jones 2000). Testifying for the prosecution in a 1993 case wherein auto-brewery was unsuccessfully used as a DWI defense, the Wisconsin State Laboratory of Hygiene toxicologist stated that "It doesn't happen in real life" (Associated Press 1993). Such claims have now been adequately disproven (Cordell et al. 2021), and the issue is no longer whether or not forensically relevant auto-brewery syndrome exists, including in non-Asians; the concern is that it may be much more common than previously appreciated (Malik et al. 2019).

Metabolic dysfunction-associated steatotic liver disease, now known to elevate blood alcohol, has increased dramatically in the last two decades—with a global prevalence increase from 25% in 1990–2006 to 38% in 2016–2019 (Welsh et al. 2013; Wong et al. 2023; Samanta and Sen Sarma 2024). Ultra-processed food consumption has been linked to metabolic dysfunction-associated steatotic liver disease (in a dose–response manner) in multiple studies (Henney et al. 2023; Nseir et al. 2010; Assy et al. 2008). In Spain, according to a randomly-drawn sample from a public healthcare database, the reported prevalence of metabolic dysfunction-associated steatotic liver disease among adult women and men is 22% (Cusacovich et al. 2023), whereas in prison settings it is 34% (Rivera-Esteban et al. 2023). In addition, COVID-19-related changes to the gastrointestinal microbiota, including post-COVID-19 auto-brewery syndrome, are cause for alarm (Yates and Saito 2024). It is worth noting that just two decades ago, small intestinal bacterial overgrowth, one of the reported pathways to auto-brewery syndrome, was thought to be an extremely rare sequalae of intestinal surgery (Vanderhoof et al. 1998). However, increased utilization of lab testing has shown that small intestinal bacterial overgrowth is detected in approximately one-third of patients with functional dyspepsia, irritable bowel syndrome, and individuals with gastrointestinal complaints (Efremova et al. 2023). Small intestinal bacterial overgrowth has been associated with depression, anxiety, neuroticism, and catastrophizing (Kossewska et al. 2022), and treatment has been shown to improve mood, memory, and concentration (Pimentel et al. 2000).

Auto-brewery sits on a continuum of symptomology and physiological markers, whereon one person might have a blood alcohol level over three times the legal limit after a sugar/carbohydrate heavy meal, and another might be just under the legal limit. The behavioral consequences of sub-clinical auto-brewery syndrome are unknown. To date, legal discussions of auto-brewery syndrome have remained almost exclusively focused on DWI. However, elevations in blood alcohol have long been associated with risk-taking, aggression, and loss of inhibition (Field et al. 2010; Paulsen 1961). Beyond impairments in operating vehicles, how might auto-brewery and associated dysbiosis intersect with other biopsychosocial vulnerabilities already known to be connected to risks for antisocial behavior, aggression, and risk-taking? Case reports provide some hints. The first widely publicized US resident with lab-proven auto-brewery syndrome was Charles M. Swaart. In 1977, Swaart's medical history of significant post-prandial elevations in blood alcohol (without alcohol consumption) was presented in a variety of syndicated media articles. Swaart's behavioral symptoms included belligerence and aggression. Swaart's wife Betty put it this way: "I never knew what to expect. Before my eyes, my dignified, loving, and considerate husband would turn sloppy, overbearing, and hostile—sometimes even violent" (C. M. Swaart 1977). After an arrest for disorderly conduct, his Phoenix attorney, Murray Miller (1927–2013), successfully used lab reports to have the charges dismissed (C. M. Swaart 1977).

Recent case reports involving individuals with auto-brewery syndrome report increased aggression (Iati 2019). Links between dysbiosis and aggression are not new. Speaking at the annual meeting of the American Society for the Study of Inebriety, Alcohol and Drug Neurosis, in 1908, physician George H. Benton argued that inebriety can result from dysbiosis, and that it is not uncommon for adults to turn to alcohol and drugs to attempt to "cover up" the psychiatric symptoms of dysbiosis (Anon 1908). It was also noted, historically, that dysbiosis was associated with depression, anxiety (Bested et al. 2013), and in some cases, "the patient loses control, and fits of irritability or violent passion are not infrequent" (Anon 1922). Salient to the discussions that follow, especially on ultra-processed food addiction, auto-brewery syndrome is typically managed by a strategy of select anti-microbial medications and dietary interventions that minimize sugar-rich carbohydrates; failure to adhere to a diet low in carbohydrates and sugar-rich ultra-processed foods can lead to a return of symptoms (Zewude et al. 2024).

Our discussion here transcends *Candida*, the internal brewing of ethanol, and DWI. Alcohol is not the only gut microbially produced chemical or metabolite that makes its way into the blood stream, and onward to the brain. Gut microbes have a profound influence on the metabolome—that is, the many hundreds of metabolites found in blood and other tissue samples (Lee-Sarwar et al. 2020). Our focus is based on a wider-lens examination of how gut microbes, microbial metabolites, and microbe-mediated inflammatory chemicals, might influence behavior in ways that are currently underappreciated by the criminal justice system, writ large. Auto-brewery syndrome is now the most obvious legally relevant manifestation of the intestinal microbiome as it intersects with diet, antibiotic overprescriptions, and other environmental considerations. However, based on the emergent research to be discussed below, we argue that auto-brewery syndrome is merely a harbinger of the legalome, and the difficult questions that it will present to the courts vis à vis intent, diminished capacity, and free will.

3. Dysbiotic Drift

Over the last two decades, it has become clear that dietary patterns leaning toward highly processed foods (or foods high in fat and/or refined carbohydrates that would now likely be categorized as ultra-processed) are associated with disturbances to the gut microbiome (Fernandes et al. 2023; Song et al. 2023; Martínez Leo and Segura Campos 2020). Researchers have examined the ways in which sugar, industrialized fats, and sodium can cause dysbiosis, and a growing body of research is also demonstrating that additives—including emulsifiers, artificial sweeteners, and flavor enhancers common to ultra-processed foods—can cause significant shifts in the mammalian gut microbiome (Whelan et al. 2024; Nahok et al. 2021; Kyaw et al. 2022). Moreover, ultra-processed foods often include isolated fibers retrofitted into the final product, and these industrial fibers have also been associated with intestinal inflammation and undesirable permeability of the intestinal lining (K. Chen et al. 2022; He et al. 2022; Ten Bruggencate et al. 2005; F. Liu et al. 2017), so-called 'leaky gut'.

Although our focus here is on diet, it is also important to consider other environmental factors that push toward dysbiosis and small intestinal bacterial overgrowth. There is ample evidence that antibiotics, well-known to cause significant alterations to the microbiome, continue to be over-prescribed in medical practices. Remarkably, over 15% of visits to a primary care physician in Canada result in an unnecessary antibiotic prescription (Schwartz et al. 2020), and in the United States approximately one-third of antibiotics prescribed in ambulatory care are unnecessary (Hersh et al. 2021). Even in the absence of a bacterial co-infection, antibiotics have been widely prescribed to patients presenting with COVID-19 (Langford et al. 2021). Multiple studies have linked antibiotic prescriptions with subsequent anxiety, depression, and suicidal ideation/behaviors (Pouranayatihosseinabad et al. 2023; Köhler-Forsberg et al. 2019; Prichett et al. 2024), and this risk might be heightened after broad-spectrum antibiotic use (Prichett et al. 2022).

It is worth noting that antibiotic prescriptions have been reported to be more frequent in communities living with socioeconomic deprivation, and this phenomenon cannot be attributed solely to lifestyle factors such as smoking or the presence of common medical conditions (Adekanmbi et al. 2020). In calendar year 2020, each percentage increase in prevalence of poverty within a US state was associated with 17.4 additional courses of antibiotics per 1000 population (Tarkhashvili 2023). In addition, stomach-acid-suppressing medications, such as proton pump inhibitors and histamine-2 blockers, represent a multi-billion-dollar global industry. These, too, are more frequently used in persons living with low socioeconomic position (van Boxel et al. 2009; Targownik et al. 2007; Haastrup et al. 2016). These medications have been shown to disturb the microbiome, provoke *Candida* growth, and cause small intestinal bacterial overgrowth (Tian et al. 2023); (Mottaghi et al. 2021; Shindo and Fukumura 1995). In the early case reports of auto-brewery syndrome, it was noted that patients typically have very low stomach acid, which might be a predisposing factor (Anon 1972). Like antibiotics, prescriptions for proton pump inhibitors and over-the-counter use of acid-suppressing drugs are often unnecessary (Kurlander et al. 2024), and use has been connected to higher risk of depression, anxiety, and suicidal ideation (Murthy et al. 2023; Y. -H. Wang et al. 2022; Fong et al. 2022).

These findings related to antibiotics and acid-suppressing drugs sit within a larger frame of dysbiotic forces that press upon individuals and communities living with socioeconomic disadvantage. Among the wide array of environmental and individual/community factors associated with dysbiosis—ranging from airborne particulate matter and food insecurity to neighborhood disorder and sleep disruption—the 'variables' are shouldered by persons/communities living with deprivation, discrimination, and poverty (Prescott et al. 2018; Kwak et al. 2024; Pearson et al. 2020). This socioeconomic gradient, aided and abetted by the formulation and marketing tactics of the unhealthy products industries (including ultra-processed 'foods' target-marketed to marginalized communities) (Moodie 2017; Fazzino et al. 2024), is known as dysbiotic drift (A. C. Logan 2015). We underscore these associations because in countries where ultra-processed foods dominate, such as the United States, violent criminal behavior and crime victimization does not sit on a level socioeconomic ground. Rather, exposure to violent crime is slanted toward disadvantage and deprivation (Lofstrom and Raphael 2016; De Courson and Nettle 2021) and the mass incarceration in the United States has been described as the criminalization of poverty (Simes 2018; Edelman 2019); interestingly, subjective experiences of relative deprivation increase aggressive behavior (Greitemeyer and Sagioglou 2016) and alter dietary choices in an unhealthy direction (Rahal et al. 2023; Sim et al. 2018; Wijayatunga et al. 2019; Cardel et al. 2016; Bratanova et al. 2016).

Dysbiosis is related to the known biochemical biomarkers of crime, most notably those linked to aggression, risk taking and diminished concern for future consequences. For example, low-grade inflammation (measured through markers such as C-reactive protein and pro-inflammatory cytokines) has been linked to impulsivity, aggression, irritability, anger, and an inability to delay gratification (Gassen et al. 2019; Hagenbeek et al. 2016; Zalcman and Siegel 2006). At least one conduit between dysbiosis and systemic low-grade inflammation is the permeability of the intestinal barrier; optimally, the mucus cover and epithelial cells of the gut lining act as an efficient barrier to undesirable microbial breakdown products (including portions of microbial membranes known as endotoxin) and environmental toxins, while allowing entry for electrolytes and vital nutrients. However, gut dysbiosis can disturb the mucus layer and the integrity of the gut barrier, leading to increased permeability (i.e., 'leaky gut') and inappropriate access for endotoxin and other antigens. The result is a systemic immune response, including elevations in the circulating levels of behavior-altering inflammatory cytokines (Ohlsson et al. 2019; Wasiak and Gawlik-Kotelnicka 2023). Other markers of aggression, risk-taking, and lowered mood, such as neurotransmitters, lipoproteins, and hormones, are also influenced by the gut microbiota (Choi et al. 2020; de Vries et al. 2022; Miri et al. 2023; P. Liu et al. 2021). Neuroimaging studies are connecting gut microbe-produced metabolites to functional connectivity in human brain networks (Z. Li et al. 2022).

Remarkably, from a forensics perspective, enhanced metagenomic sequencing and other advances on 'omics' sciences are beginning to allow researchers to use oral and gut microbiome data to distinguish between occupation and lifestyle habits of unidentified adults (Dou et al. 2023), the presence of mental disorders (Malan-Muller et al. 2022; Z. Dong et al. 2021; T. S. Dong et al. 2020; X. Zhang et al. 2023), and whether or not an individual might respond to treatment (Madan et al. 2020; Z. Dong et al. 2022; Dedon et al. 2024). In other words, the oral and gut microbiomes are emerging as storybooks capturing lived experiences.

4. Gut Microbes and Behavior

Thus far, we have discussed the many factors that can influence dysbiosis. How might these shifts in gut microbiota influence human behavior? What evidence do we have, beyond the sparsely reported cases of auto-brewery, that microbes are relevant to forensic and legal psychology, especially as mitigating factors or in arguments of diminished capacity? Similar to the research on ultra-processed products, for answers we can look to the convergence of epidemiology, mechanistic bench science, and intervention studies.

First, volumes of international studies have linked gut microbiota to important factors in forensic psychology, including various mental disorders (Q. Zhang et al. 2021; Z. Dong et al. 2021; Malan-Muller et al. 2022; S. Li et al. 2021), substance use (Ames et al. 2020; Hofford and Kiraly 2024), personality features and temperament (Johnson 2020; Fan et al. 2023; Sumich et al. 2022; Ueda et al. 2023), impulsivity (W. Liu et al. 2024; Carbia et al. 2023), aggressive or violent tendencies (X. Chen et al. 2021; Deng et al. 2022), emotional regulation (Fujihara et al. 2023; Ke et al. 2023), and antisocial vs. prosocial behaviors (Ou et al. 2022; Delgadillo et al. 2022). Second, a robust body of pre-clinical and bench science is identifying microbial taxa and species involved in mental disorders and aggression, and illuminating the mechanisms by which microbes can influence behavior (Cheng et al. 2023; Gulledge et al. 2023; Tcherni-Buzzeo 2023). These pathways include, but are not limited to: (a) direct communication between gut microbes and the brain via the vagus and spinal nerves (Bonaz et al. 2018); (b) loss of integrity of the gastrointestinal barrier (leaky gut—which allows microbial breakdown products and other chemicals into systemic circulation) (C. Wang et al. 2021); (c) impact on humoral signaling molecules (e.g., cytokines, neuropeptides, and hormonal messengers) that otherwise contribute to mood and behavior (Donoso et al. 2023); (d) bile acid metabolism, which yields diverse bile acid metabolites that signal through host receptors (Fogelson et al. 2023; Mohanty et al. 2024); and (e) the manufacture, transformation, and/or absorption of nutrients, including vitamins, omega-3 fatty acids, and polyphenols (Ortega et al. 2022; Kerman et al. 2023; Barone et al. 2022). Third, human intervention studies targeting the microbiome with probiotics and specialized 'psychobiotic' diets are demonstrating value in reducing psychological stress (Zhu et al. 2023; Berding et al. 2023), depression and anxiety (Q. Zhang et al. 2023), aggressive thoughts (Steenbergen et al. 2015), behavioral aggression (Matiș et al. 2023), risk taking (Dantas et al. 2022), and impulsivity (Roman et al. 2018; Elhossiny et al. 2023).

Although parasitic infections are often overlooked in forensic and legal psychology, there is increased recognition that the gastrointestinal pathogen *Toxoplasma gondii* is capable of disturbing the behavior of its host (Severance et al. 2016). Multiple human studies have found associations between anti-*T. gondii* antibodies and behavioral problems that include rule breaking, risk taking, impulsivity, aggressiveness, and suicidal ideation (Martinez et al. 2018; Zerekidze et al. 2024). The mechanisms by which *T. gondii* can disturb behavior are not completely understood, although it is becoming evident that *T. gondii* exposure can contribute to dysbiosis (Prandovszky et al. 2018). This *T. gondii*-induced dysbiosis appears to play a causal role in cognitive disturbances (X. Yang et al. 2024). Observed relationships between *T. gondii* exposure and unhealthy dietary patterns (and higher Body Mass Index) allow for the hypothesis that the organism plays a causative role in diet–mental health relationships (Cuffey et al. 2021).

5. Fecal Transplant and Causation

While the above-mentioned studies have provided support for the idea that microbes are involved in neurocognition, neurophysiology, and behavior, they do not prove causation. The credibility of the legalome requires evidence of causal relationships between gut microbes and behavior, as is the case in auto-brewery syndrome. The emergence of studies involving fecal transplants (also called fecal transfer or fecal microbiome transfers) provide compelling evidence, substantiating a causal role for microbes in control of behavior. In pre-clinical research, the general methodology in these microbiota transplant studies is to take the fecal matter from 'donor' animals that have been exposed to a manipulated variable (examples include regular consumption of an ultra-processed-like diet, chronic unpredictable stressors, and social isolation) and transplant the fecal material into healthy recipient animals. Collectively, these studies show that transplants from donor animals exposed to these 'lifestyle' factors and environmental stressors (vs. healthy unexposed donors consuming standard lab chow) leads to cognitive deficits and behavioral changes in the recipient animal, including those that reflect depression and anxiety (Bruce-Keller et al. 2015; Y. Yang et al. 2019; Duan et al. 2021; N. Li et al. 2019; Huang et al. 2021). Studies have also examined reverse effects. For example, in substance dependence models the transplant of fecal microbes from healthy animals reduces dependence and depression-like behavior in recipient animals (D. Li et al. 2023; Q. Wang et al. 2023). On the other hand, the transfer of microbes from alcohol dependent donor animals causes an increase in voluntary alcohol consumption in transplant recipients (Segovia-Rodríguez et al. 2022). Interestingly, the transfer of microbes from either aggressive or less aggressive chickens into a neutral commercial line of recipient chicks leads to increased or decreased aggression in the recipients based on the donor line aggression. Moreover, the changes in aggression among recipient chicks were noted to coincide with alterations in activities of brain serotonergic and catecholaminergic systems (Fu et al. 2023). In other words, the transplanting of microbes is changing both neurophysiology and observable behavior.

Animal donors are not the only source of microbes used in the growing number of fecal transplant studies. Multiple studies are now using human donors living with mental disorders, intense antibiotic exposure, or substance abuse. For example, the transfer of fecal microbiota from human infants who had been exposed to antibiotics (vs. healthy unexposed infants) leads to aggressive-like behavior in recipient lab animals (Uzan-Yulzari et al. 2023). The transplant of fecal microbiota from patients with schizophrenia into recipient animals induces schizophrenia-like behavioral changes, including deficits in sociability and hyperactivity. These behavioral changes are also accompanied by modifications to the transcriptomic profile in the brain (Wei et al. 2024). Comparable research designs involving donor patients with autism, depression, anxiety, cognitive decline, and substance use disorder, have produced similar behavioral changes and accompanying changes to neurophysiology in recipient animals (Xiao et al. 2021; Wolstenholme et al. 2022; Kelly et al. 2016; Vasiliu 2023; Shen et al. 2020).

To date, there is limited research on human-to-human fecal transplant for the treatment of mental disorders. Although fecal transplant is currently approved by the United States Food and Drug Administration for *Clostridium difficile* infection, ongoing trials are exploring use in multiple diseases and disorders. Several case reports have described benefit in major depressive disorder and bipolar disorder, and randomized controlled studies are ongoing (Chang et al. 2024; Cooke et al. 2021). One case report, published in the *Annals of Internal Medicine*, indicates that fecal transplant leads to remission in auto-brewery syndrome (Vandekerckhove et al. 2020). Fecal transplant is emerging as a promising intervention for metabolic dysfunction-associated steatotic liver disease (Abenavoli et al. 2022) and preliminary results from one randomized controlled intervention shows that fecal transplant might offer benefit in adults with alcohol use disorder, demonstrating post-transplant reductions in alcohol craving and consumption (Bajaj et al. 2021).

6. Ultra-Processed Food Addiction

> "*There are many persons who probably never have tasted strong drink in their lives who actually are suffering from an intoxication similar to that produced by alcohol, due to injurious eating of sugar and starches*"
>
> Walter H. Eddy, PhD, 1924 (Eddy 1924)

Earlier, we discussed ultra-processed foods and their connection to mental disorders, aggression, and antisocial behavior, and we reviewed emerging evidence that speaks to the plausibility that ultra-processed foods may be a major dysbiotic force within the commercial determinants of health. If these foods represent multiple health-related harms, why are they consumed so widely? In the context of the legalome, a brief discussion of the addictive properties of ultra-processed products seems worthwhile. At the outset, we underscore that ultra-processed food addiction intersects with the same biopsychosocial vulnerabilities described in the dysbiotic drift section, compounded by the marketing of these products to vulnerable populations (Fazzino et al. 2024; Rook 2024).

Ultra-processed foods, as a group, are carefully formulated by food technologists to enhance taste, texture, and palatability. These engineered combinations of industrial fats, refined sugar, sodium, emulsifiers, and flavor enhancers (such as monosodium glutamate and other excitotoxins), are not found in naturally occurring or minimally processed foods and appear to contribute to the highly reinforcing, potentially addictive properties of ultra-processed foods (LaFata and Gearhardt 2022; Whatnall et al. 2022). Preliminary research in animal and human studies has observed core features of addiction—tolerance and withdrawal—in response to attempts to eliminate or significantly reduce ultra-processed food intake (Parnarouskis and Gearhardt 2022). Individuals meeting criteria for ultra-processed food addiction as measured on the widely validated Yale Food Addiction Scale have exhibited similar neural and behavioral responses (e.g., enhanced emotional reactivity, and craving, compulsive patterns of consumption) to images of such ultra-processed food products and/or intake as seen among individuals with substance-use disorders in relation to their substance of choice (Delgado-Rodríguez et al. 2023; Vasiliu 2021). Though not a recognized clinical diagnosis, the global scope of ultra-processed food addiction is significant, and likely growing as these products penetrate expanding markets. In a recent meta-analysis, the overall pooled prevalences of ultra-processed food addiction, assessed by the Yale Food Addiction Scale and its international versions, in non-clinical samples has been estimated at 14% in adults and 12% in children (Gearhardt et al. 2023).

In keeping with the previously discussed research themes on dysbiotic forces and vulnerabilities to crime perpetration/victimization, individuals and communities living with food insecurity may be particularly prone to ultra-processed food addiction—food insecurity has been associated with nearly 4-fold higher odds of endorsing ultra-processed food addiction on the Yale Food Addiction Scale (Leung et al. 2023). In the United States, ultra-processed foods are widely consumed, as reflected in commercial availability—approximately 58% of staples in U.S. leading supermarkets are ultra-processed, which is 41% more than supermarkets in Europe (Amaraggi et al. 2024). However, consumption is highest in association with poverty, food insecurity, and less education (Leung et al. 2022; Baraldi et al. 2018). Ultra-processed food consumption has been associated with the use of addictive substances, such as alcohol, tobacco, and illicit drugs (A. E. Mesas et al. 2023). Akin to addictive substances, ultra-processed food consumption may be driven by attempts to mitigate stress; for example, exposure to violence victimization has been linked to increased consumption of ultra-processed foods (A. E. Mesas et al. 2024; Marques et al. 2021).

While most US adults partake in some level of ultra-processed product consumption and purchase foods from fast-food outlets on a regular basis, the contextual frame of other daily dietary choices matters. That is, a person living with high-income and socioeconomic advantage may eat ultra-processed foods but may be more able to consume a balanced diet due to having increased access to minimally-processed dietary choices rich in fiber, omega-3 fatty acids, and polyphenols, all of which are critical in maintaining a healthy gut microbiome (Prescott and Logan 2017). Therefore, discussions of ultra-processed dietary patterns/meals vis à vis the microbiome and behavior involve considerations of components that promote dysbiosis (e.g., high fat/sugar/sodium, emulsifiers, flavor enhancers, and other additives) and the absence of protective constituents found in minimally-processed foods (e.g., polyphenols, omega-3 fatty acids, fiber naturally found in the food matrix). Shifts in the gut microbiome in adults living with food insecurity have been noted depending on the quality of dietary intake— higher nutrition quality scores are associated with the favorable outcome of a wider range of bacterial taxa (Bixby et al. 2022).

In cases of auto-brewery syndrome, patients often report craving high-sugar and/or high-carbohydrate foods (typically ultra-processed foods). As described by a 62-year-old male with physician and lab-confirmed auto-brewery syndrome: "I started having horrendous cravings for Victoria sponge cake, and I don't usually have a sweet tooth. There are points where I would have killed for a slice of Victoria sponge and it's ridiculous – it triggers an appetite reflex in your brain" (Fox 2021). The idea that the gut microbiome, including select microbial taxa and their metabolites, are drivers of food choices and addictive behavior is no longer outlandish (Alcock et al. 2014; Acuña and Olive 2024; Ren and Lotfipour 2022; Kristie and Hsia 2023). Interestingly, this particular case of auto-brewery syndrome in an otherwise healthy adult is thought to have been initiated by heavy occupational exposure to airborne volatile organic compounds. Thus, it is worth pointing out that in recent years, multiple studies have linked airborne toxins with subsequent gut dysbiosis in animals and humans (Gupta et al. 2022; O'Piela et al. 2022). Airborne pollution has been linked to crime and deviant behavior in many studies (Burkhardt et al. 2020; Cho et al. 2022; Younan et al. 2018), and although the mechanisms remain obscure, there is little debate that the burden of airborne pollution is slanted toward socioeconomic disadvantage (Cheeseman et al. 2022). Viewed through the lens of prevention, the path to dysbiosis and ultra-processed food addiction is complex, and likely involves the many well-known psychosocial factors related to vulnerability to criminal behavior/victimization.

7. Quo Vadis, Legalome?

Taken as a whole, the rapidly evolving microbiome research is demonstrating that microbes are not distinct from the biopsychological self. In the context of individual choice and criminal jurisprudence, auto-brewery syndrome is arguably the premier example of the microbial 'tail wagging the dog'. However, the degree of influence of microbes on aggression, violence, risk taking, lack of concern for future consequences, and criminal intent more broadly, remains an open question. Although the available evidence indicates that dysbiosis can influence the human capacity to choose, there is an urgent need to translate bench and pre-clinical research into knowledge of relevance to the criminal justice system. There is a specific need to examine the role of ultra-processed food addiction and associated withdrawal symptoms more closely in various populations, including patients with metabolic dysfunction-associated steatotic liver disease, small intestinal bacterial overgrowth, and auto-brewery syndrome. Psychological instruments such as the Modified Highly Processed Food Withdrawal Scale (Hu et al. 2024) can be paired with objective metabolomic measurements, including samples drawn from breath and blood. Using alcohol breathalyzers as the model, an expansion of breath testing for hydrogen, methane, hydrogen sulfide, and volatile organic chemicals (the latter known to be uniquely altered in schizophrenia and depression (Jiang et al. 2022; Henning et al. 2023; Lueno et al. 2022)), can aid researchers attempting to pair internal ecology with behavior (Haworth et al. 2022).

Despite media headlines consistently describing auto-brewery syndrome as 'rare,' we have no evidence that it is, in fact, rare. On the contrary, insofar as internal alcohol production can reach the minimal thresholds of mood and cognitive changes (which are much lower than defined legal limits for DWI) (Moskowitz et al. 1985; Holloway 1994), the condition might be far from rare. In a 1990 study, researchers showed that over 60% of out-patients with miscellaneous medical complaints (n = 546) can produce significant quantities of alcohol after an oral glucose load (Hunnisett et al. 1990); several patients had a post-glucose blood alcohol level that was one quarter of the way to Sweden's DWI limit of 0.02% and at least one of the patients studied by the group was at the Swedish limit (McCall 1990). At present, there is no epidemiology of auto-brewery syndrome or a knowledge base concerning the extent to which members of select patient populations might have elevated alcohol production in response to oral glucose tests or ultra-processed/high-sugar test meals over extended periods. Individuals with auto-brewery syndrome often discover that they have dysbiosis only *after* a law enforcement sobriety stop and subsequent self-directed (and expensive) efforts to determine cause. After the syndicated publications of Swaart's story, in 1977 and again in 1983 (Campbell 1983), he was contacted by many people with similar 'auto-brewery' stories (C. M. Swaart 1978). While interesting, this is no way to establish an epidemiological portrait.

In the quest to determine a more accurate picture of auto-brewery syndrome (and possible sub-clinical variants, below DWI thresholds), researchers might consider a complaint commonly reported in general practice clinics—'brain fog'. In one form or another, using language such as 'feeling scattered', 'fuzzy thinking', 'like I'm in a cloud', 'being in a daze', brain fog complaints are common in clinical practice (Lucius 2021). Validated scales to assess brain fog are now available (Debowska et al. 2024), and could be paired with ultra-processed food addiction assessments, along with post-prandial breath alcohol and other metabolomics. There is a need to understand more about brain fog, its origins, microbiome connections, and potential relationships to antisocial behavior, and the 'irresistible impulse' of unplanned criminal behavior.

Historically, legal jurisprudence in the United States has been heavily slanted toward a convenient 'free will' philosophy and the idea that society needs to see punishment. Prior advances in neuropsychology and genetics have presented inconvenient facts to courts embedded in free will (Jones 2003), which they have mostly ignored vis à vis criminal capacity and punishment (Sapolsky 2023). Of course, there has been tinkering around the edges, such as banning the death penalty in cases of serious intellectual disability (at the time of the offense) and in juveniles less than 18 years of age, yet it is still carried out in cases of serious mental illness and in persons just above Intelligence Quotient "cutoffs" (Miley et al. 2020; Bruenig 2021, p. A-26). We suggest that in contrast to prior challenges to the free will/punishment underpinnings, microbiome sciences might provide a tipping point for systemic change over time. As such, researchers might query how advances in sciences related to the legalome intersect with prevailing attitudes toward science within the legal profession. Although judges in the United States are tasked with being the gatekeepers for the admissibility of scientific testimony, research shows that they are not particularly skilled in this role (Kovera and McAuliff 2000; Nir and Liu 2021). What we know for now is that emerging research is challenging traditional assumptions of free will, including those that are deeply entrenched in legal frameworks oriented toward individual culpability and punishment (R.M. Sapolsky 2023). The available research presents multiple opportunities for transdisciplinary research including the fields of forensic psychology and related behavioral sciences.

8. Conclusions

An increasingly robust body of international research has linked the consumption of ultra-processed foods with mental disorders, aggression, and antisocial behavior. These studies, spanning epidemiology, mechanistic science, and intervention studies, are lending support to the concept of nutritional criminology. In the midst of plausible biophysiological explanations for links between diet (and other environmental factors) and potentially criminal behavior, disturbances to the microbiome are emerging as an important mechanistic factor. Based on mounting research, including fecal transplant studies, it has become obvious that gut microbes can make important contributions to mammalian behavior, including aggression and antisocial behavior. Although human research remains limited, there are clear indications that the animal findings can extend to humans. This presents a quandary to matters of culpability and punishment in justice systems that otherwise sit on a fulcrum of free will.

Since the gut ecosystem is a product of diet and other socioeconomically related environmental factors, including the consumption of ultra-processed foods, there is a need to scrutinize the 'causes of the causes' more closely. For now, auto-brewery syndrome remains the exemplar of the legal intersection between diet, gut microbiome sciences, and *mens rea*. Just two short decades ago, the idea of auto-brewery syndrome being of relevance to criminal culpability was "chortled" at by prosecution teams and their lab experts. That changed in 2015, with the first known dismissal of DWI charges (and the prosecution's decision not to appeal) based on lab-confirmed auto-brewery syndrome. The legalome—microbiome and omics science applied in forensic and legal psychology—had arrived. It is our contention auto-brewery syndrome is a mere portend of the microbiome revolution, a condition that has crossed the moat of long-held assumptions surrounding the courts.

Author Contributions: Conceptualization and preparing original draft, A.C.L. and S.L.P.; review and editing, J.J.N., C.A.L. and E.M.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The authors declare no conflicts of interest.

References

Abenavoli, Ludovico, Valentina Maurizi, Emanuele Rinninella, Jan Tack, Arianna Di Berardino, Pierangelo Santori, Carlo Rasetti, Anna Caterina Procopio, Luigi Boccuto, and Emidio Scarpellini. 2022. Fecal Microbiota Transplantation in NAFLD Treatment. *Medicina* 58: 1559. [CrossRef]

Abiri, Behnaz, Shirin Amini, Hajar Ehsani, MohammadAli Ehsani, Parisa Adineh, Hakimeh Mohammadzadeh, and Sima Hashemi. 2023. Evaluation of dietary food intakes and anthropometric measures in middle-aged men with aggressive symptoms. *BMC Nutrition* 9: 75. [CrossRef]

Acuña, Amanda M., and M. Foster Olive. 2024. Influence of gut microbiome metabolites on cocaine demand and cocaine-seeking behavior. *Neuropsychopharmacology* 49: 357–58. [CrossRef]

Adami, John G., and Albert G. Nicholls. 1911. *The Principles of Pathology: Systemic Pathology*. Philadelphia: Lea & Febiger.

Adekanmbi, Victor, Hywel Jones, Daniel Farewell, and Nick A. Francis. 2020. Antibiotic use and deprivation: An analysis of Welsh primary care antibiotic prescribing data by socioeconomic status. *Journal of Antimicrobial Chemotherapy* 75: 2363–71. [CrossRef] [PubMed]

Akbaba, Murat. 2020. A medicolegal approach to the very rare Auto-Brewery (endogenous alcohol fermentation) syndrome. *Traffic Injury Prevention* 21: 295–97. [CrossRef]

Alcock, Joe, Carlo C. Maley, and C. Athena Aktipis. 2014. Is eating behavior manipulated by the gastrointestinal microbiota? Evolutionary pressures and potential mechanisms. *Bioessays* 36: 940–9. [CrossRef] [PubMed]

Amaraggi, Bertrand, Wendy Wood, Laura Guinovart Martin, Jaume Gimenez Sanchez, Yolanda Fleta Sanchez, and Andrea de la Garza. 2024. Ultra-processed food staples dominate mainstream US supermarkets. Americans more than Europeans forced to choose between health and cost. *medRxiv*, 2024-02. [CrossRef]

Ames, Nancy J., Jennifer J. Barb, Kornel Schuebel, Sarah Mudra, Brianna K. Meeks, Ralph Thadeus S. Tuason, Alyssa T. Brooks, Narjis Kazmi, Shanna Yang, Kelly Ratteree, and et al. 2020. Longitudinal gut microbiome changes in alcohol use disorder are influenced by abstinence and drinking quantity. *Gut Microbes* 11: 1608–31. [CrossRef] [PubMed]

Anon. 1907. The physiological and therapeutical use of alcohol. *British Medical Journal* 2: 350–52.

Anon. 1908. Autointoxication. *St. Louis Medical Review* 57: 246.

Anon. 1910. Alcohol in nature. *The Age (Melbourne, Victoria, Australia)*, April 9, 4.

Anon. 1922. Autointoxication. *The Encyclopedia Britannica* 31: 547.

Anon. 1959. Medicine: The secret still. *Time*, July 20.

Anon. 1972. Unusual intoxication laid to GI fermentation. *Medical Tribune* 13: 23.

Anon. 1978. No loophole in breath test says Yard. *Daily Post (Liverpool, Merseyside, England)*, February 14, 11.

Associated Press. 1993. Yeast claim in drunken driving case rejected. *The Reporter (Fond du Lac, Wisconsin)*, March 19, 5.

Assy, Nimer, Gattas Nasser, Iad Kamayse, William Nseir, Zaza Beniashvili, Agness Djibre, and Maria Grosovski. 2008. Soft drink consumption linked with fatty liver in the absence of traditional risk factors. *Canadian Journal of Gastroenterology* 22: 811–16. [CrossRef] [PubMed]

Bajaj, Jasmohan S., Edith A. Gavis, Andrew Fagan, James B. Wade, Leroy R. Thacker, Michael Fuchs, Samarth Patel, Brian Davis, Jill Meador, Puneet Puri, and et al. 2021. A Randomized Clinical Trial of Fecal Microbiota Transplant for Alcohol Use Disorder. *Hepatology* 73: 1688–700. [CrossRef]

Baraldi, Larissa Galastri, Euridice Martinez Steele, Daniela Silva Canella, and Carlos Augusto Monteiro. 2018. Consumption of ultra-processed foods and associated sociodemographic factors in the USA between 2007 and 2012: Evidence from a nationally representative cross-sectional study. *BMJ Open* 8: e020574. [CrossRef] [PubMed]

Barone, Monica, Federica D'amico, Patrizia Brigidi, and Silvia Turroni. 2022. Gut microbiome-micronutrient interaction: The key to controlling the bioavailability of minerals and vitamins? *Biofactors* 48: 307–14. [CrossRef] [PubMed]

Berding, Kirsten, Thomaz F. S. Bastiaanssen, Gerard M. Moloney, Serena Boscaini, Conall R. Strain, Andrea Anesi, Caitriona Long-Smithe, Fulvio Mattivi, Catherine Stanton, Gerard Clarke, and et al. 2023. Feed your microbes to deal with stress: A psychobiotic diet impacts microbial stability and perceived stress in a healthy adult population. *Molecular Psychiatry* 28: 601–10. [CrossRef] [PubMed]

Bested, Alison C., Alan C. Logan, and Eva M. Selhub. 2013. Intestinal microbiota, probiotics and mental health: From Metchnikoff to modern advances: Part I—Autointoxication revisited. *Gut Pathogens* 5: 5. [CrossRef] [PubMed]

Bixby, Moira, Chris Gennings, Kristen M. C. Malecki, Ajay K. Sethi, Nasia Safdar, Paul E. Peppard, and Shoshannah Eggers. 2022. Individual Nutrition Is Associated with Altered Gut Microbiome Composition for Adults with Food Insecurity. *Nutrients* 14: 3407. [CrossRef]

Bonaz, Bruno, Thomas Bazin, and Sonia Pellissier. 2018. The Vagus Nerve at the Interface of the Microbiota-Gut-Brain Axis. *Frontiers in Neuroscience* 12: 49. [CrossRef]

Bratanova, Boyka, Steve Loughnan, Olivier Klein, Almudena Claassen, and Robert Wood. 2016. Poverty, inequality, and increased consumption of high calorie food: Experimental evidence for a causal link. *Appetite* 100: 162–71. [CrossRef] [PubMed]

Bruce-Keller, Annadora J., J. Michael Salbaum, Meng Luo, Eugene Blanchard IV, Christopher M. Taylor, David A. Welsh, and Hans-Rudolf Berthoud. 2015. Obese-type gut microbiota induce neurobehavioral changes in the absence of obesity. *Biological Psychiatry* 77: 607–15. [CrossRef] [PubMed]

Bruenig, Elizabeth. 2021. When an I.Q. Score Is a Death Sentence. *The New York Times*. January 11, p. A-26. Available online: https://www.nytimes.com/2021/01/11/opinion/death-penalty-mental-disability.html (accessed on 1 May 2024).

Burkhardt, Jesse, Jude Bayham, Ander Wilson, Jesse D. Berman, Katelyn O'Dell, Bonne Ford, Emily V. Fischer, and Jeffrey R. Pierce. 2020. The relationship between monthly air pollution and violent crime across the United States. *Journal of Environmental Economics and Policy* 9: 188–205. [CrossRef]

Campbell, Don G. 1983. The ordeal of poor old Charlie, drinkless drunk. *The Los Angeles Times (Los Angeles, California)*, January 4, sec. V. pp. 1, 5.

Carbia, Carina, Thomaz F.S. Bastiaanssen, Luigi Francesco Iannone, Rubén García-Cabrerizo, Serena Boscaini, Kirsten Berding, Conall R. Strain, Gerard Clarke, Catherine Stanton, Timothy G. Dinan, and et al. 2023. The Microbiome-Gut-Brain axis regulates social cognition & craving in young binge drinkers. *EBioMedicine* 89: 104442. [CrossRef]

Cardel, Michelle, Susan L. Johnson, Jimikaye Beck, Emily Dhurandhar, Akilah Dulin-Keita, Angela Tomczik, Gregory Pavela, Tianyao Huo, David Janicke, Keith Muller, and et al. 2016. The effects of experimentally manipulated social status on acute eating behavior: A randomized, crossover pilot study. *Physiology & Behavior* 162: 93–101. [CrossRef]

Chang, Minna, Kai Tuomas Chang, and Fuju Chang. 2024. Just a gut feeling: Faecal microbiota transplant for treatment of depression—A mini-review. *Journal of Psychopharmacology* 38: 353–61. [CrossRef] [PubMed]

Cheeseman, Michael J., Bonne Ford, Susan C. Anenberg, Matthew J. Cooper, Emily V. Fischer, Melanie S. Hammer, Sheryl Magzamen, Randall V. Martin, Aaron van Donkelaar, John Volckens, and et al. 2022. Disparities in Air Pollutants Across Racial, Ethnic, and Poverty Groups at US Public Schools. *GeoHealth* 6: e2022GH000672. [CrossRef]

Chen, Kaiyang, Shuli Man, Hongbin Wang, Congcong Gao, Xue Li, Liying Liu, Haikuan Wang, Yanping Wang, and Fuping Lu. 2022. Dysregulation of intestinal flora: Excess prepackaged soluble fibers damage the mucus layer and induce intestinal inflammation. *Food & Function* 13: 8558–71. [CrossRef]

Chen, Xiacan, Jiajun Xu, Hongren Wang, Jiaguo Luo, Zheng Wang, Gang Chen, Dan Jiang, Ruochen Cao, Haolan Huang, Dan Luo, and et al. 2021. Profiling the differences of gut microbial structure between schizophrenia patients with and without violent behaviors based on 16S rRNA gene sequencing. *International Journal of Legal Medicine* 135: 131–41. [CrossRef]

Chen, Yanjing, Ping Liu, Sijie Yi, Chunhua Fan, Wei Zhao, and Jun Liu. 2024. Investigating the shared genetic architecture between attention-deficit/hyperactivity disorder and risk taking behavior: A large-scale genomewide cross-trait analysis. *Journal of Affective Disorders* 356: 22–31. [CrossRef]

Cheng, Lingsha, Haoqian Wu, Zhuo Chen, Haiping Hao, and Xiao Zheng. 2023. Gut microbiome at the crossroad of genetic variants and behavior disorders. *Gut Microbes* 15: 2201156. [CrossRef]

Cho, Charles H., Zhongwei Huang, Siyi Liu, and Daoguang Yang. 2022. Contaminated Heart: Does Air Pollution Harm Business Ethics? Evidence from Earnings Manipulation. *Journal of Business Ethics* 177: 151–72. [CrossRef]

Choi, Tae-Yong, Young Pyo Choi, and Ja Wook Koo. 2020. Mental Disorders Linked to Crosstalk between the Gut Microbiome and the Brain. *Experimental Neurobiology* 29: 403–16. [CrossRef]

Cooke, Noah C. A., Asem Bala, Johane P. Allard, Susy Hota, Susan Poutanen, and Valerie H. Taylor. 2021. The safety and efficacy of fecal microbiota transplantation in a population with bipolar disorder during depressive episodes: Study protocol for a pilot randomized controlled trial. *Pilot and Feasibility Studies* 7: 142. [CrossRef] [PubMed]

Cordell, Barbara, Anup Kanodia, and Gregory K. Miller. 2021. Factors in an Auto-Brewery Syndrome group compared to an American Gut Project group: A case-control study. *F1000Research* 10: 457. [CrossRef]

Cuffey, Joel, Christopher A. Lepczyk, Shuoli Zhao, and Nicholas M. Fountain-Jones. 2021. Cross-sectional association of Toxoplasma gondii exposure with BMI and diet in US adults. *PLoS Neglected Tropical Diseases* 15: e0009825. [CrossRef] [PubMed]

Cusacovich, I., I. Sanchez-Lite, B. Toribio, J. M. Gonzalez, A. Perez-Rubio, and D. Andaluz-Ojeda. 2023. Prevalence of nonalcoholic fatty liver disease in a Spanish town: A population-based study. *Revista Clínica Española (Barcelona)* 223: 396–404. [CrossRef]

Dai, Shuhui, Judith Wellens, Nan Yang, Doudou Li, Jingjing Wang, Lijuan Wang, Shuai Yuan, Yazhou He, Peige Song, Ron Munger, and et al. 2024. Ultra-processed foods and human health: An umbrella review and updated meta-analyses of observational evidence. *Clinical Nutrition* 43: 1386–94. [CrossRef]

Dantas, Aline M., Alexander T. Sack, Elisabeth Bruggen, Peiran Jiao, and Teresa Schuhmann. 2022. The effects of probiotics on risk and time preferences. *Scientific Reports* 12: 12152. [CrossRef]

De Courson, Benoît, and Daniel Nettle. 2021. Why do inequality and deprivation produce high crime and low trust? *Scientific Reports* 11: 1937. [CrossRef]

de Vries, Lianne P., Margot P. van de Weijer, and Meike Bartels. 2022. The human physiology of well-being: A systematic review on the association between neurotransmitters, hormones, inflammatory markers, the microbiome and well-being. *Neuroscience & Biobehavioral Reviews* 139: 104733. [CrossRef]

Debowska, Agata, Daniel Boduszek, Marek Ochman, Tomasz Hrapkowicz, Martyna Gaweda, Anastazja Pondel, and Beata Horeczy. 2024. Brain Fog Scale (BFS): Scale development and validation. *Personality and Individual Differences* 216: 112427. [CrossRef]

Dedon, Liv R., Hanshu Yuan, Jinhua Chi, Haiwei Gu, Albert J. Arias, Jonathan M. Covault, and Yanjiao Zhou. 2024. Baseline gut microbiome and metabolites are correlated with alcohol consumption in a zonisamide clinical trial of heavy drinking alcoholic civilians. *medRxiv*. [CrossRef]

Delgadillo, Desiree R., Sarah D. Pressman, Lisa M. Christian, Jeffrey D. Galley, and Michael T. Bailey. 2022. Associations Between Gut Microbes and Social Behavior in Healthy 2-Year-Old Children. *Psychosomatic Medicine* 84: 749–56. [CrossRef] [PubMed]

Delgado-Rodríguez, Rafael, María Moreno-Padilla, Silvia Moreno-Domínguez, and Antonio Cepeda-Benito. 2023. Food Addiction Correlates with Emotional and Craving Reactivity to Industrially Prepared (Ultra-Processed) and Home-Cooked (Processed) Foods but not Unprocessed or Minimally Processed Foods. *Food Quality and Preference*, August 8, 104961.

Deng, Hongxin, Lei He, Chong Wang, Teng Zhang, Hua Guo, Hongwei Zhang, Yanning Song, and Bangtao Chen. 2022. Altered gut microbiota and its metabolites correlate with plasma cytokines in schizophrenia inpatients with aggression. *BMC Psychiatry* 22: 629. [CrossRef] [PubMed]

Dong, Tien S., Emeran A. Mayer, Vadim Osadchiy, Candace Chang, William Katzka, Venu Lagishetty, Kimberly Gonzalez, Amir Kalani, Jean Stains, Jonathan P. Jacobs, and et al. 2020. A Distinct Brain-Gut-Microbiome Profile Exists for Females with Obesity and Food Addiction. *Obesity (Silver Spring)* 28: 1477–86. [CrossRef] [PubMed]

Dong, Zaiquan, Xiaoling Shen, Yanni Hao, Jin Li, Haizhen Xu, Li Yin, and Weihong Kuang. 2022. Gut microbiome: A potential indicator for predicting treatment outcomes in major depressive disorder. *Frontiers in Neuroscience* 16: 813075. [CrossRef]

Dong, Zaiquan, Xiaoling Shen, Yanni Hao, Jin Li, Haoran Li, Haizheng Xu, Li Yin, and Weihong Kuang. 2021. Gut Microbiome: A Potential Indicator for Differential Diagnosis of Major Depressive Disorder and General Anxiety Disorder. *Front Psychiatry* 12: 651536. [CrossRef] [PubMed]

Donoso, Francisco, John F. Cryan, Loreto Olavarría-Ramírez, Yvonne M. Nolan, and Gerard Clarke. 2023. Inflammation, Lifestyle Factors, and the Microbiome-Gut-Brain Axis: Relevance to Depression and Antidepressant Action. *Clinical Pharmacology & Therapeutics* 113: 246–59. [CrossRef]

Dou, Shujie, Guanju Ma, Yu Liang, Guangping Fu, Jie Shen, Lihong Fu, Qian Wang, Tao Li, Bin Cong, and Shujin Li. 2023. Preliminary exploratory research on the application value of oral and intestinal meta-genomics in predicting subjects' occupations-A case study of the distinction between students and migrant workers. *Frontiers in Microbiology* 14: 1330603. [CrossRef]

Duan, Chengxing, Ling Huang, Chi Zhang, Lu Zhang, Xiuwen Xia, Zhanqiong Zhong, Baojia Wang, Yili Wang, Maggie Pui Man Hoi, Weijun Ding, and et al. 2021. Gut commensal-derived butyrate reverses obesity-induced social deficits and anxiety-like behaviors via regulation of microglial homeostasis. *European Journal of Pharmacology* 908: 174338. [CrossRef]

Eddy, Walter H. 1924. Your meals and your health. *Popular Science* 105: 40–41.

Edelman, Peter. 2019. *Not a Crime to Be Poor: The Criminalization of Poverty in America*. New York: The New Press.

Efremova, Irina, Roman Maslennikov, Elena Poluektova, Ekaterina Vasilieva, Yury Zharikov, Andrey Suslov, Yana Letyagina, Evgenii Kozlov, Anna Levshina, and Vladimir Ivashkin. 2023. Epidemiology of small intestinal bacterial overgrowth. *World Journal of Gastroenterology* 29: 3400–21. [CrossRef] [PubMed]

Elhossiny, Reham M., Heba H. Elshahawy, Hanan M. Mohamed, and Reham I. Abdelmageed. 2023. Assessment of probiotic strain Lactobacillus acidophilus LB supplementation as adjunctive management of attention-deficit hyperactivity disorder in children and adolescents: A randomized controlled clinical trial. *BMC Psychiatry* 23: 823. [CrossRef] [PubMed]

Fan, Xiaoxiao, Tianzi Zang, Jun Liu, Ni Wu, Jiamiao Dai, Jinbing Bai, and Yanqun Liu. 2023. Changes in the gut microbiome in the first two years of life predicted the temperament in toddlers. *Journal of Affective Disorders* 333: 342–52. [CrossRef]

Fazzino, Tera L., Daiil Jun, Lynn Chollet-Hinton, and Kayla Bjorlie. 2024. US tobacco companies selectively disseminated hyper-palatable foods into the US food system: Empirical evidence and current implications. *Addiction* 119: 62–71. [CrossRef] [PubMed]

Fernandes, Ariana E., Paula W.L. Rosa, Maria E. Melo, Roberta C.R. Martins, Fernanda G.O. Santin, Aline M.S.H. Moura, Graziele S. M. A. Coelho, Ester C. Sabino, Cintia Cercato, and Marcio C. Mancini. 2023. Differences in the gut microbiota of women according to ultra-processed food consumption. *Nutrition, Metabolism and Cardiovascular Diseases* 33: 84–89. [CrossRef] [PubMed]

Field, Matt, Reinout W. Wiers, Paul Christiansen, Mark T. Fillmore, and Joris C. Verster. 2010. Acute alcohol effects on inhibitory control and implicit cognition: Implications for loss of control over drinking. *Alcohol: Clinical and Experimental Research* 34: 1346–52. [CrossRef]

Fogelson, Kelly A., Pieter C. Dorrestein, Amir Zarrinpar, and Rob Knight. 2023. The Gut Microbial Bile Acid Modulation and Its Relevance to Digestive Health and Diseases. *Gastroenterology* 164: 1069–85. [CrossRef]

Fong, Pedro, Sut Tong Chan, Pui Nap Lei, Hao Ian Cheong, I. Man Cheong, and Weng Lam Hoe. 2022. Association of suicidal ideation and depression with the use of proton pump inhibitors in adults: A cross-sectional study. *Scientific Reports* 12: 19539. [CrossRef]

Fox, Leah. 2021. Man with rare condition that turns carbs into alcohol in his stomach. *News.Com.Au*, January 13. Available online: https://www.news.com.au/lifestyle/health/health-problems/man-with-rare-condition-that-turns-carbs-into-alcohol-in-his-stomach/news-story/8da273705829dbe0c979fe329f4493e4 (accessed on 26 April 2024).

Froude, Charles C. 1924. Human distillery. *The St. Louis Star and Times (St. Louis, Missouri)*, December 29, 5.

Fu, Yuechi, Jiaying Hu, Marisa A. Erasmus, Huanmin Zhang, Timothy A. Johnson, and Hengwei Cheng. 2023. Cecal microbiota transplantation: Unique influence of cecal microbiota from divergently selected inbred donor lines on cecal microbial profile, serotonergic activity, and aggressive behavior of recipient chickens. *Journal of Animal Science and Biotechnology* 14: 66. [CrossRef] [PubMed]

Fujihara, Hideaki, Michiko Matsunaga, Eriko Ueda, Takamasa Kajiwara, Aya K. Takeda, Satoshi Watanabe, Kairi Baba, Keisuke Hagihara, and Masako Myowa. 2023. Altered Gut Microbiota Composition Is Associated with Difficulty in Explicit Emotion Regulation in Young Children. *Microorganisms* 11: 2245. [CrossRef] [PubMed]

García-Cabrerizo, Rubén, and John F. Cryan. 2024. A gut (microbiome) feeling about addiction: Interactions with stress and social systems. *Neurobiology of Stress* 30: 100629. [CrossRef] [PubMed]

Gassen, Jeffrey, Marjorie L. Prokosch, Micah J. Eimerbrink, Randi P. Proffitt Leyva, Jordon D. White, Julia L. Peterman, Adam Burgess, Dennis J. Cheek, Andreas Kreutzer, Sylis C. Nicolas, and et al. 2019. Inflammation Predicts Decision-Making Characterized by Impulsivity, Present Focus, and an Inability to Delay Gratification. *Scientific Reports* 9: 4928. [CrossRef] [PubMed]

Gearhardt, Ashley N., Nassib B. Bueno, Alexandra G. DiFeliceantonio, Christina A. Roberto, Susana Jiménez-Murcia, and Fernando Fernandez-Aranda. 2023. Social, clinical, and policy implications of ultra-processed food addiction. *BMJ* 383: e075354. [CrossRef]

Gillies, Malcolm, Anggi Ranakusuma, Tammy Hoffmann, Sarah Thorning, Treasure McGuire, Paul Glasziou, and Christopher Del Mar. 2015. Common harms from amoxicillin: A systematic review and meta-analysis of randomized placebo-controlled trials for any indication. *CMAJ: Canadian Medical Association Journal* 187: E21–E31. [CrossRef] [PubMed]

Gketsios, Ioannis, Thomas Tsiampalis, Aikaterini Kanellopoulou, Tonia Vassilakou, Venetia Notara, George Antonogeorgos, Andrea Paola Rojas-Gil, Ekaterina N. Kornilaki, Areti Lagiou, Demosthenes B. Panagiotakos, and et al. 2023. The Synergetic Effect of Soft Drinks and Sweet/Salty Snacks Consumption and the Moderating Role of Obesity on Preadolescents' Emotions and Behavior: A School-Based Epidemiological Study. *Life* 13: 633. [CrossRef]

Greitemeyer, Tobias, and Christina Sagioglou. 2016. Subjective Socioeconomic Status Causes Aggression: A Test of the Theory of Social Deprivation. *Journal of Personality and Social Psychology* 111: 178–94. [CrossRef]

Gulledge, Laura, Damilola Oyebode, and Janet R. Donaldson. 2023. The influence of the microbiome on aggressive behavior: An insight into age-related aggression. *FEMS Microbiology Letters* 370: fnac114. [CrossRef]

Gupta, Nishant, Virendra Kumar Yadav, Amel Gacem, M. Al-Dossari, Krishna Kumar Yadav, N. S. Abd El-Gawaad, Nidhal Ben Khedher, Nisha Choudhary, Pankaj Kumar, and Simona Cavalu. 2022. Deleterious Effect of Air Pollution on Human Microbial Community and Bacterial Flora: A Short Review. *International Journal of Environmental Research and Public Health* 19: 15494. [CrossRef]

Haastrup, P. F., M. S. Paulsen, R. D. Christensen, J. Sondergaard, J. M. Hansen, and D. E. Jarbol. 2016. Medical and non-medical predictors of initiating long-term use of proton pump inhibitors: A nationwide cohort study of first-time users during a 10-year period. *Alimentary Pharmacology & Therapeutics* 44: 78–87. [CrossRef]

Hagenbeek, Fiona A., Cornelis Kluft, Thomas Hankemeier, Meike Bartels, Harmen H. M. Draisma, Christel M. Middeldorp, Ruud Berger, Antonio Noto, Milena Lussu, René Pool, and et al. 2016. Discovery of biochemical biomarkers for aggression: A role for metabolomics in psychiatry. *American Journal Of Medical Genetics Part B-Neuropsychiatric Genetics* 171: 719–32. [CrossRef] [PubMed]

Hagenbeek, Fiona A., Jenny van Dongen, René Pool, Peter J. Roetman, Amy C. Harms, Jouke Jan Hottenga, Cornelis Kluft, Olivier F. Colins, Catharina E. M. van Beijsterveldt, Vassilios Fanos, and et al. 2023. Integrative Multi-omics Analysis of Childhood Aggressive Behavior. *Behavior Genetics* 53: 101–17. [CrossRef] [PubMed]

Haworth, Jordan J., Charlotte K. Pitcher, Giuseppe Ferrandino, Anthony R. Hobson, Kirk L. Pappan, and Jonathan L.D. Lawson. 2022. Breathing new life into clinical testing and diagnostics: Perspectives on volatile biomarkers from breath. *Critical Reviews in Clinical Laboratory Sciences* 59: 353–72. [CrossRef] [PubMed]

He, Ying, Xie Peng, Yang Liu, Qing Wu, Qiang Zhou, Yingyan Huang, Shiya Liu, Liang Hu, Zhengfeng Fang, Yan Lin, and et al. 2022. Long-term maternal intake of inulin exacerbated the intestinal damage and inflammation of offspring rats in a DSS-induced colitis model. *Food & Function* 13: 4047–60. [CrossRef]

Hecht, Aaron L., Lisa C. Harling, Elliot S. Friedman, Ceylan Tanes, Junhee Lee, Jenni Firrman, Fuhua Hao, Vincent Tu, LinShu Liu, Andrew D. Patterson, and et al. 2024. Dietary carbohydrates regulate intestinal colonization and dissemination of Klebsiella pneumoniae. *The Journal of Clinical Investigation* 134: e174726. [CrossRef] [PubMed]

Henney, Alex E., Conor S. Gillespie, Uazman Alam, Theresa J. Hydes, and Daniel J. Cuthbertson. 2023. Ultra-Processed Food Intake Is Associated with Non-Alcoholic Fatty Liver Disease in Adults: A Systematic Review and Meta-Analysis. *Nutrients* 15: 2266. [CrossRef] [PubMed]

Henning, Dariush, Marian Lüno, Carina Jiang, Gabriela Meyer-Lotz, Christoph Hoeschen, and Thomas Frodl. 2023. Gut-brain axis volatile organic compounds derived from breath distinguish between schizophrenia and major depressive disorder. *Journal of Psychiatry and Neuroscience* 48: E117–25. [CrossRef] [PubMed]

Herbeck, Dan. 2016. Prosecutors won't appeal bizarre DWI dismissal. *The Buffalo News*, May 1, D1–D2.

Hersh, Adam L., Laura M. King, Daniel J. Shapiro, Lauri A. Hicks, and Katherine E. Fleming-Dutra. 2021. Unnecessary Antibiotic Prescribing in US Ambulatory Care Settings, 2010–2015. *Clinical Infectious Diseases* 72: 133–37. [CrossRef]

Hills, Nicholas. 1978. Drinking driver beats wrap with micro-organism. *The Ottawa Citizen (Ottawa, Ontario, Canada)*, February 15, 114.

Hofford, Rebecca S., and Drew D. Kiraly. 2024. Clinical and Preclinical Evidence for Gut Microbiome Mechanisms in Substance Use Disorders. *Biological Psychiatry* 95: 329–38. [CrossRef]

Holloway, Frank A. 1994. *Low-Dose Alcohol Effects on Human Behavior and Performance: A Review of Post 1984 Research*; Washington, DC: Office of Aviation Medicine, Federal Aviation Administration. Available online: https://rosap.ntl.bts.gov/view/dot/21422/dot_21422_DS1.pdf (accessed on 2 May 2024).

Hu, Shuchen, Ashley N. Gearhardt, and Erica M. LaFata. 2024. Development of the Modified Highly Processed Food Withdrawal Scale (mProWS). *Appetite* 198: 107370. [CrossRef] [PubMed]

Huang, Ling, Chengxing Duan, Xiuwen Xia, Huaifu Wang, Yili Wang, Zhanqiong Zhong, Baojia Wang, Weijun Ding, and Youjun Yang. 2021. Commensal microbe-derived propionic acid mediates juvenile social isolation-induced social deficits and anxiety-like behaviors. *Brain Research Bulletin* 166: 161–71. [CrossRef] [PubMed]

Hunnisett, Adrian, John Howard, and Stephen Davies. 1990. Gut fermentation (or the 'auto-brewery') syndrome: A new clinical test with initial observations and discussion of clinical and biochemical implications. *Journal of Nutritional Medicine* 1: 33–38. [CrossRef]

Iati, Marisa. 2019. Man's stomach was brewing its own beer, honest. *The Herald (Jasper, Indiana)*, October 26, A7.

Ironstone, Penelope. 2019. Me, my self, and the multitude: Microbiopolitics of the human microbiome. *European Journal of Social Theory* 22: 325–41. [CrossRef]

Jiang, Carina, Henrik Dobrowolny, Dorothee Maria Gescher, Gabriela Meyer-Lotz, Johann Steiner, Christoph Hoeschen, and Thomas Frodl. 2022. Volatile organic compounds from exhaled breath in schizophrenia. *The World Journal of Biological Psychiatry* 23: 773–84. [CrossRef] [PubMed]

Johnson, Katerina V.-A. 2020. Gut microbiome composition and diversity are related to human personality traits. *Human Microbiome Journal* 15: 100069. [CrossRef] [PubMed]

Jones, Matthew. 2003. Overcoming the myth of free will in criminal law: The true impact of the genetic revolution. *Duke Law Journal* 52: 1031–53. [PubMed]

Kaji, H., Y. Asanuma, H. Ide, N. Saito, M. Hisamura, M. Murao, T. Yoshida, and K. Takahashi. 1976. The auto-brewery syndrome—The repeated attacks of alcoholic intoxication due to the overgrowth of Candida (albicans) in the gastrointestinal tract. *Materia Medica Polona* 8: 429–35.

Ke, Shanlin, Anne-Josee Guimond, Shelley S. Tworoger, Tianyi Huang, Andrew T. Chan, Yang-Yu Liu, and Laura D. Kubzansky. 2023. Gut feelings: Associations of emotions and emotion regulation with the gut microbiome in women. *Psychological Medicine* 53: 1–10. [CrossRef]

Kelly, John R., Yuliya Borre, Ciaran O'Brien, Elaine Patterson, Sahar El Aidy, Jennifer Deane, Paul J. Kennedy, Sasja Beers, Karen Scott, Gerard Moloney, and et al. 2016. Transferring the blues: Depression-associated gut microbiota induces neurobehavioural changes in the rat. *Journal of Psychiatric Research* 82: 109–18. [CrossRef]

Kerman, Bilal E., Wade Self, and Hussein N. Yassine. 2023. Can the gut microbiome inform the effects of omega-3 fatty acid supplementation trials on cognition? *Current Opinion in Clinical Nutrition and Metabolic Care* 27: 116–24. [CrossRef]

Khayyatzadeh, Sayyed Saeid, Safieh Firouzi, Maral Askari, Farzane Mohammadi, Irandokht Nikbakht-Jam, Maryam Ghazimoradi, Mohammad Mohammadzadeh, Gordon A. Ferns, and Majid Ghayour-Mobarhan. 2019. Dietary intake of carotenoids and fiber is inversely associated with aggression score in adolescent girls. *Nutrition and Health* 25: 203–8. [CrossRef] [PubMed]

Köhler-Forsberg, Ole, Liselotte Petersen, Christiane Gasse, Preben B. Mortensen, Soren Dalsgaard, Robert H. Yolken, Ole Mors, and Michael E. Benros. 2019. A Nationwide Study in Denmark of the Association Between Treated Infections and the Subsequent Risk of Treated Mental Disorders in Children and Adolescents. *JAMA Psychiatry* 76: 271–79. [CrossRef] [PubMed]

Kossewska, Joanna, Karolina Bierlit, and Vladimir Trajkovski. 2022. Personality, Anxiety, and Stress in Patients with Small Intestine Bacterial Overgrowth Syndrome. The Polish Preliminary Study. *International Journal of Environmental Research and Public Health* 20: 93. [CrossRef]

Kovera, Margaret, and Bradley D. McAuliff. 2000. The effects of peer review and evidence quality on judge evaluations of psychological science: Are judges effective gatekeepers? *Journal of Applied Psychology* 85: 574–86. [CrossRef]

Kristie, B. Yu, and Elaine Y. Hsia. 2023. Gut microbiota: A sweet tale of mice and microbes. *Current Biology* 33: R18–R20. [CrossRef]

Kuo, Cheng-Hao, Li-Ling Wu, Hsiao-Ping Chen, Jun Yu, and Chun-Ying Wu. 2024. Direct effects of alcohol on gut-epithelial barrier: Unraveling the disruption of physical and chemical barrier of the gut-epithelial barrier that compromises the host-microbiota interface upon alcohol exposure. *Journal of Gastroenterology and Hepatology*. [CrossRef]

Kurlander, Jacob E., Loren Laine, Hyungjin Myra Kim, Christopher B. Roberts, Darcy Saffar, Aimee Myers, Robert Holleman, Yuqing Gao, Michelle Shank, Richard Nelson, and et al. 2024. Impact of large scale, multicomponent intervention to reduce proton pump inhibitor overuse in integrated healthcare system: Difference-in-difference study. *BMJ* 385: e076484. [CrossRef] [PubMed]

Kwak, Soyoung, Mykhaylo Usyk, Dia Beggs, Heesun Choi, Dariush Ahdoot, Feng Wu, Lorraine Maceda, Huilin Li, Eun-Ok Im, Hae-Ra Han, and et al. 2024. Sociobiome-Individual and neighborhood socioeconomic status influence the gut microbiome in a multi-ethnic population in the US. *NPJ Biofilms and Microbiomes* 10: 19. [CrossRef]

Kyaw, Thin Su, Manatsaphon Sukmak, Kanokwan Nahok, Amod Sharma, Atit Silsirivanit, Worachart Lert-Itthiporn, Nichapa Sansurin, Vichai Senthong, Sirirat Anutrakulchai, Sakkarn Sangkhamanon, and et al. 2022. Monosodium glutamate consumption reduces the renal excretion of trimethylamine N-oxide and the abundance of Akkermansia muciniphila in the gut. *Biochemical and Biophysical Research Communications* 630: 158–66. [CrossRef]

LaFata, Erica M., and Ashley N. Gearhardt. 2022. Ultra-Processed Food Addiction: An Epidemic? *Psychotherapy and Psychosomatics* 91: 363–72. [CrossRef]

Lane, Melissa M., Elizabeth Gamage, Shutong Du, Deborah N. Ashtree, Amelia J. McGuinness, Sarah Gauci, Phillip Baker, Mark Lawrence, Casey M. Rebholz, Bernard Srour, and et al. 2024. Ultra-processed food exposure and adverse health outcomes: Umbrella review of epidemiological meta-analyses. *BMJ* 384: e077310. [CrossRef] [PubMed]

Langford, Bradley J., Miranda So, Sumit Raybardhan, Valerie Leung, Jean-Paul R. Soucy, Duncan Westwood, Nick Daneman, and Derek R. MacFadden. 2021. Antibiotic prescribing in patients with COVID-19: Rapid review and meta-analysis. *Clinical Microbiology & Infection* 27: 520–31. [CrossRef]

Lee-Sarwar, Kathleen A., Jessica Lasky-Su, Rachel S. Kelly, Augusto A. Litonjua, and Scott T. Weiss. 2020. Metabolome-Microbiome Crosstalk and Human Disease. *Metabolites* 10: 181. [CrossRef] [PubMed]

Leung, Cindy W., Aarohee P. Fulay, Lindsey Parnarouskis, Euridice Martinez-Steele, Ashley N. Gearhardt, and Julia A. Wolfson. 2022. Food insecurity and ultra-processed food consumption: The modifying role of participation in the Supplemental Nutrition Assistance Program (SNAP). *The American Journal of Clinical Nutrition* 116: 197–205. [CrossRef]

Leung, Cindy W., Lindsey Parnarouskis, Melissa J. Slotnick, and Ashley N. Gearhardt. 2023. Food Insecurity and Food Addiction in a Large, National Sample of Lower-Income Adults. *Current Developments in Nutrition* 7: 102036. [CrossRef]

Li, Dezhi, Wei Liang, Wentong Zhang, Zhiqiang Huang, Haipeng Liang, and Qing Liu. 2023. Fecal microbiota transplantation repairs intestinal permeability and regulates the expression of 5-HT to influence alcohol-induced depression-like behaviors in C57BL/6J mice. *Frontiers in Microbiology* 14: 1241309. [CrossRef]

Li, Nannan, Qi Wang, Yan Wang, Anji Sun, Yiwei Lin, Ye Jin, and Xiaobai Li. 2019. Fecal microbiota transplantation from chronic unpredictable mild stress mice donors affects anxiety-like and depression-like behavior in recipient mice via the gut microbiota-inflammation-brain axis. *Stress* 22: 592–602. [CrossRef]

Li, Shijia, Jie Song, Pengfei Ke, Lingyin Kong, Bingye Lei, Jing Zhou, Yuanyuan Huang, Hehua Li, Guixiang Li, Jun Chen, and et al. 2021. The gut microbiome is associated with brain structure and function in schizophrenia. *Scientific Reports* 11: 9743. [CrossRef]

Li, Zhiming, Jianbo Lai, Peifen Zhang, Jiahong Ding, Jiajun Jiang, Chuanfa Liu, Huimin Huang, Hefu Zhen, Caixi Xi, Yuzhe Sun, and et al. 2022. Multi-omics analyses of serum metabolome, gut microbiome and brain function reveal dysregulated microbiota-gut-brain axis in bipolar depression. *Molecular Psychiatry* 27: 4123–35. [CrossRef]

Lin, Peijia, Aolei Lin, Kaiyan Tao, Min Yang, Qinglin Ye, Hongnian Chen, Yuanyuan Chen, Yuanlin Ma, Zijun Lin, Miaoqing He, and et al. 2021. Intestinal Klebsiella pneumoniae infection enhances susceptibility to epileptic seizure which can be reduced by microglia activation. *Cell Death Discovery* 7: 175. [CrossRef] [PubMed]

Lin, Ping, Bingyu Ding, Chunyan Feng, Shuwei Yin, Ting Zhang, Xin Qi, Huiying Lv, Xiaokui Guo, Ke Dong, Yongzhang Zhu, and et al. 2017. Prevotella and Klebsiella proportions in fecal microbial communities are potential characteristic parameters for patients with major depressive disorder. *Journal of Affective Disorders* 207: 300–4. [CrossRef] [PubMed]

Liu, Feitong, Pan Li, Muxuan Chen, Yuemei Luo, M. Prabhakar, Huimin Zheng, Yan He, Qi Qi, Haoyu Long, Yi Zhang, and et al. 2017. Fructooligosaccharide (FOS) and Galactooligosaccharide (GOS) Increase Bifidobacterium but Reduce Butyrate Producing Bacteria with Adverse Glycemic Metabolism in healthy young population. *Scientific Reports* 7: 11789. [CrossRef]

Liu, Penghong, Mingxue Gao, Zhifen Liu, Yanyan Zhang, Hongwei Tu, Lei Lei, Peiyi Wu, Aixia Zhang, Chunxia Yang, Gaizhi Li, and et al. 2021. Gut Microbiome Composition Linked to Inflammatory Factors and Cognitive Functions in First-Episode, Drug-Naive Major Depressive Disorder Patients. *Frontiers in Neuroscience* 15: 800764. [CrossRef]

Liu, Wen, Linzi Liu, Zijing Deng, Ruina Liu, Tao Ma, Yide Xin, Yu Xie, Yifang Zhou, and Yanqing Tang. 2024. Associations between impulsivity and fecal microbiota in individuals abstaining from methamphetamine. *CNS Neuroscience & Therapeutics* 30: e14580. [CrossRef]

Lofstrom, Magnus, and Steven Raphael. 2016. Crime, the Criminal Justice System, and Socioeconomic Inequality. *Journal of Economic Perspectives* 30: 103–26. [CrossRef]

Logan, Alan C. 2015. Dysbiotic drift: Mental health, environmental grey space, and microbiota. *Journal of Physiological Anthropology* 34: 1–16. [CrossRef]

Logan, Alan C., Jeffrey J. Nicholson, Stephen J. Schoenthaler, and Susan L. Prescott. 2024. Neurolaw: Revisiting Huberty v. McDonald's through the Lens of Nutritional Criminology and Food Crime. *Laws* 13: 17. [CrossRef]

Logan, Barry Kerr, and Alan Wayne Jones. 2000. Endogenous ethanol 'auto-brewery syndrome' as a drunk-driving defence challenge. *Medicine, Science and the Law* 40: 206–15. [CrossRef]

Lucius, Khara. 2021. "Brain Fog": Exploring a Symptom Commonly Encountered in Clinical Practice. *Alternative and Complementary Therapies* 27: 23–30. [CrossRef]

Lueno, Marian, Henrik Dobrowolny, Dorothee Gescher, Laila Gbaoui, Gabriele Meyer-Lotz, Christoph Hoeschen, and Thomas Frodl. 2022. Volatile Organic Compounds From Breath Differ Between Patients With Major Depression and Healthy Controls. *Front Psychiatry* 13: 819607. [CrossRef] [PubMed]

Macfadyen, Allan. 1903. Lecture on autointoxication. *Clinical Journal* 23: 369–75.

Madan, A., D. Thompson, J. C. Fowler, N. J. Ajami, R. Salas, B. C. Frueh, M. R. Bradshaw, B. L. Weinstein, J. M. Oldham, and J. F. Petrosino. 2020. The gut microbiota is associated with psychiatric symptom severity and treatment outcome among individuals with serious mental illness. *Journal of Affective Disorders* 264: 98–106. [CrossRef] [PubMed]

Maes, Michael, Aristo Vojdani, Sunee Sirivichayakul, Decio S. Barbosa, and Buranee Kanchanatawan. 2021. Inflammatory and Oxidative Pathways Are New Drug Targets in Multiple Episode Schizophrenia and Leaky Gut, Klebsiella pneumoniae, and C1q Immune Complexes Are Additional Drug Targets in First Episode Schizophrenia. *Molecular Neurobiology* 58: 3319–34. [CrossRef]

Malan-Muller, Stefanie, Mireia Valles-Colomer, Christine L. Foxx, Sara Vieira-Silva, Leigh L. van den Heuvel, Jeroen Raes, Soraya Seedat, Christopher A. Lowry, and Sian M. J. Hemmings. 2022. Exploring the relationship between the gut microbiome and mental health outcomes in a posttraumatic stress disorder cohort relative to trauma-exposed controls. *European Neuropsychopharmacology* 56: 24–38. [CrossRef] [PubMed]

Malik, Fahad, Prasanna Wickremesinghe, and Jessie Saverimuttu. 2019. Case report and literature review of auto-brewery syndrome: Probably an underdiagnosed medical condition. *BMJ Open Gastroenterology* 6: e000325. [CrossRef]

Marcovici, Eugene E. 1928. *Handbook on Diet*. Philadelphia: FA Davis Publishers.

Marques, Emanuele Souza, Tatiana Henriques Leite, Aline Gaudard E. Silva de Oliveira, Diana Barbosa Cunha, Eliseu Verly Junior, and Catarina Machado Azeredo. 2021. Association between Family Physical Violence Victimization and Food Consumption among Brazilian Adolescents. *Journal of Interpersonal Violence* 36: 10182–97. [CrossRef]

Martinez, Victor Otero, Fernanda Washington de Mendonça Lima, Chrissie Ferreira De Carvalho, and José Antônio Menezes-Filho. 2018. Toxoplasma gondii infection and behavioral outcomes in humans: A systematic review. *Parasitology Research* 117: 3059–65. [CrossRef] [PubMed]

Martinez-Steele, Euridice, Neha Khandpur, Carolina Batis, Maira Bes-Rastrollo, Marialaura Bonaccio, Gustavo Cediel, Inge Huybrechts, Filippa Juul, Renata B. Levy, Maria Laura da Costa Louzada, and et al. 2023. Best practices for applying the Nova food classification system. *Nature Food* 4: 445–48. [CrossRef]

Martínez Leo, Edwin E., and Maira R. Segura Campos. 2020. Effect of ultra-processed diet on gut microbiota and thus its role in neurodegenerative diseases. *Nutrition* 71: 110609. [CrossRef]

Matiș, Loredana, Bogdana Ariana Alexandru, Radu Fodor, Lucia Georgeta Daina, Timea Claudia Ghitea, and Silviu Vlad. 2023. Effect of Probiotic Therapy on Neuropsychiatric Manifestations in Children with Multiple Neurotransmitter Disorders: A Study. *Biomedicines* 11: 2643. [CrossRef] [PubMed]

Mbaye, Babacar, Reham Magdy-Wasfy, Maryam Tidiani-Alou, Patrick Boretntain, Rene Gerolami, Jeans Charles Dufour, and Matthieu Million. 2023. Repertoire of Ethanol-Producing Human Microbes. *Research Square*. [CrossRef]

McCall, Alastair. 1990. Sweet tooth could lead to driving ban. *The Daily Telegraph (London, Greater London, England)*, October 5, 9.

Mesas, Arthur Eumann, Edmarlon Girotto, Renne Rodrigues, Vicente Martínez-Vizcaíno, Estela Jiménez-López, and José Francisco López-Gil. 2023. Ultra-Processed Food Consumption is Associated with Alcoholic Beverage Drinking, Tobacco Smoking, and Illicit Drug Use in Adolescents: A Nationwide Population-Based Study. *International Journal of Mental Health and Addiction* 21: 1–24. [CrossRef]

Mesas, Arthur Eumann, Selma Maffei de Andrade, Francine Nesello Melanda, José Francisco López-Gil, Nuria Beneit, Vicente Martínez-Vizcaíno, and Estela Jiménez-López. 2024. Is Violence Victimization Associated with the Consumption of Ultra-Processed Food? A Population-Based Study with 96 K Adolescent Students Exploring the Mediating Role of Psychoactive Substance Use. *International Journal of Mental Health and Addiction* 26: 1–7. [CrossRef]

Miley, Lauren N., Ellie Heiss-Moses, John K. Cochran, Kathleen M. Heide, Sondra J. Fogel, M. Dwayne Smith, and Beth J. Bejerregaard. 2020. An examination of the effects of mental disorders as mitigating factors on capital sentencing outcomes. *Behavioral Sciences & the Law* 38: 381–405. [CrossRef]

Miri, Saba, JuDong Yeo, Sarah Abubaker, and Riadh Hammami. 2023. Neuromicrobiology, an emerging neurometabolic facet of the gut microbiome? *Frontiers in Microbiology* 14: 1098412. [CrossRef]

Mohanty, Ipsita, Helena Mannochio-Russo, Joshua V. Schweer, Yasin El Abiead, Wout Bittremieux, Shipei Xing, Robin Schmid, Simone Zuffa, Felipe Vasquez, Valentina B. Muti, and et al. 2024. The underappreciated diversity of bile acid modifications. *Cell* 187: 1801–18.e20. [CrossRef]

Mohseni, Houra, Fatemeh Malek Mohammadi, Zahra Karampour, Shirin Amini, Behnaz Abiri, and Mehdi Sayyah. 2021. The relationship between history of dietary nutrients intakes and incidence of aggressive behavior in adolescent girls: A case-control study. *Clinical Nutrition ESPEN* 43: 200–5. [CrossRef]

Monteiro, Carlos A., Geoffrey Cannon, Renata B. Levy, Jean-Claude Moubarac, Maria LC Louzada, Fernanda Rauber, Neha Khandpur, Gustavo Cediel, Daniela Neri, Euridice Martinez-Steele, and et al. 2019. Ultra-processed foods: What they are and how to identify them. *Public Health Nutrition* 22: 936–41. [CrossRef]

Moodie, Rob A. 2017. What Public Health Practitioners Need to Know About Unhealthy Industry Tactics. *American Journal of Public Health* 107: 1047–49. [CrossRef]

Moskowitz, Herbert, Marcelline M. Burns, and Allan F. Williams. 1985. Skills performance at low blood alcohol levels. *Journal of Studies on Alcohol* 46: 482–85. [CrossRef] [PubMed]

Mottaghi, Batoul, Mohammad Hassan Emami, Padideh Riahi, Alireza Fahim, Hojjatolah Rahimi, and Rasoul Mohammadi. 2021. Candida colonization of the esophagus and gastric mucosa; a comparison of patients taking proton pump inhibitors and those taking histamine receptor antagonist drugs. *Gastroenterology and Hepatology from Bed to Bench* 14: 349–55.

Mrug, Sylvie, LaRita C. Jones, Marc N. Elliott, Susan R. Tortolero, Melissa F. Peskin, and Mark A. Schuster. 2021. Soft Drink Consumption and Mental Health in Adolescents: A Longitudinal Examination. *Journal of Adolescent Health* 68: 155–60. [CrossRef] [PubMed]

Murthy, Jeevan J., Sarah Hughes, Colin Travis, Ankit Chalia, Samira Khan, Michael Ang-Rabanes, and Raja Mogallapu. 2023. Chronic Use of Proton Pump Inhibitors: A Potential Link to Amino Acid Deficiency and the Development of Depression. *Cureus* 15: e51067. [CrossRef] [PubMed]

Nahok, Kanokwan, Jutarop Phetcharaburanin, Jia V. Li, Atit Silsirivanit, Raynoo Thanan, Piyanard Boonnate, Jarus Joonhuathon, Amod Sharma, Sirirat Anutrakulchai, Carlo Selmi, and et al. 2021. Monosodium Glutamate Induces Changes in Hepatic and Renal Metabolic Profiles and Gut Microbiome of Wistar Rats. *Nutrients* 13: 1865. [CrossRef] [PubMed]

Nelson, Steven. 2017. Woman Avoids DUI Explaining Orange Juice Made Her Drunk. *US News and World Report*, January 13. Available online: https://www.usnews.com/news/articles/2017-01-13/auto-brewery-syndrome-an-unusual-drunk-driving-excuse-slowly-gains-acceptance (accessed on 25 April 2024).

Nir, Esther, and Siyu Liu. 2021. What do the gatekeepers see? Perceptions and evaluations of scientific evidence among state court judges. *Criminology Criminal Justice Law & Society* 22: 1.

Nseir, William, Fares Nassar, and Nimer Assy. 2010. Soft drinks consumption and nonalcoholic fatty liver disease. *World Journal of Gastroenterology* 16: 2579–88. [CrossRef]

O'Piela, Devin R., Amy R. Mackos, Yael-Natalie Escobar, Mike Allen, Yan Zhang, and Loren E. Wold. 2022. The Gut Microbiome is Significantly Altered in APP/PS1 Mice Following Air Particulate Matter Exposure. *The FASEB Journal* 36. [CrossRef]

Ohlsson, Lars, Anna Gustafsson, Eva Lavant, Klara Suneson, Lena Brundin, Åsa Westrin, Lennart Ljunggren, and Daniel Lindqvist. 2019. Leaky gut biomarkers in depression and suicidal behavior. *Acta Psychiatrica Scandinavica* 139: 185–93. [CrossRef]

Ortega, Miguel A., Miguel Angel Alvarez-Mon, Cielo García-Montero, Oscar Fraile-Martinez, Luis G. Guijarro, Guillermo Lahera, Jorge Monserrat, Paula Valls, Fernando Mora, Roberto Rodríguez-Jiménez, and et al. 2022. Gut Microbiota Metabolites in Major Depressive Disorder-Deep Insights into Their Pathophysiological Role and Potential Translational Applications. *Metabolites* 12: 50. [CrossRef]

Ou, Yangwenshan, Clara Belzer, Hauke Smidt, and Carolina de Weerth. 2022. Development of the gut microbiota in healthy children in the first ten years of life: Associations with internalizing and externalizing behavior. *Gut Microbes* 14: 2038853. [CrossRef] [PubMed]

Parnarouskis, Lindsey, and Ashley N. Gearhardt. 2022. Preliminary evidence that tolerance and withdrawal occur in response to ultra-processed foods. *Current Addiction Reports* 9: 282–89. [CrossRef]

Paulsen, M. G. 1961. Intoxication as a defense to crime. *University of Illinois Law Forum* 1961: 1–24.

Pearson, Amber L., Jennifer Pechal, Zihan Lin, M. Eric Benbow, Carl Schmidt, and Suzanne Mavoa. 2020. Associations detected between measures of neighborhood environmental conditions and human microbiome diversity. *Science of The Total Environment* 745: 141029. [CrossRef] [PubMed]

Pimentel, Mark, David Hallegua, Evelyn J. Chow, Daniel Wallace, George Bonorris, and Henry C. Lin. 2000. Eradication of small intestinal bacterial overgrowth decreases symptoms in chronic fatigue syndrome: A double blind, randomized study. *Gastroenterology* 118: A414. [CrossRef]

Popkin, Barry M., Donna R. Miles, Lindsey Smith Taillie, and Elizabeth K. Dunford. 2024. A policy approach to identifying food and beverage products that are ultra-processed and high in added salt, sugar and saturated fat in the United States: A cross-sectional analysis of packaged foods. *The Lancet Regional Health—Americas* 32: 100713. [CrossRef]

Pouranayatihosseinabad, Mahsa, Yihienew Bezabih, Jason Hawrelak, Gregory M. Peterson, Felicity Veal, and Corinne Mirkazemi. 2023. Antibiotic use and the development of depression: A systematic review. *Journal of Psychosomatic Research* 164: 111113. [CrossRef]

Prandovszky, Emese, Ye Li, Sarven Sabunciyan, Curtis B. Steinfeldt, Lauro Nathaniel Avalos, Kristin L. Gressitt, James R. White, Emily G. Severance, Mikhail V. Pletnikov, Jianchun Xiao, and et al. 2018. Toxoplasma gondii-Induced Long-Term Changes in the Upper Intestinal Microflora during the Chronic Stage of Infection. *Scientifica (Cairo)* 2018: 2308619. [CrossRef]

Prescott, Susan L., and Alan C. Logan. 2017. Each meal matters in the exposome: Biological and community considerations in fast-food-socioeconomic associations. *Economics & Human Biology* 27, Pt B: 328–35. [CrossRef]

Prescott, Susan L., Alan C. Logan, Christopher R. D'Adamo, Kathleen F. Holton, Christopher A. Lowry, John Marks, Rob Moodie, and Blake Poland. 2024a. Nutritional Criminology: Why the Emerging Research on Ultra- Processed Food Matters to Health and Justice. *International Journal of Environmental Research and Public Health* 21: 120.

Prescott, Susan L., Ashka Naik, and Alan C. Logan. 2024b. Not food: Time to call ultra-processed products by their true name. *Gastronomy* 2: 47–56. [CrossRef]

Prescott, Susan L., Ganesa Wegienka, Alan C. Logan, and David L. Katz. 2018. Dysbiotic drift and biopsychosocial medicine: How the microbiome links personal, public and planetary health. *BioPsychoSocial Medicine* 12: 7. [CrossRef] [PubMed]

Prichett, Laura M., Emily G. Severance, Robert H. Yolken, Destini Carmichael, Yongyi Lu, Yong Zeng, Andrea S. Young, and Tina Kumra. 2024. Recent anti-infective exposure as a risk factor for first episode of suicidal thoughts and/or behaviors in pediatric patients. *Brain, Behavior, & Immunity—Health* 36: 100738. [CrossRef]

Prichett, Laura M., Robert H. Yolken, Linxuan Wu, Emily G. Severance, and Tina Kumra. 2022. Relationship between antibiotic exposure and subsequent mental health disorders in a primary care health system. *Brain, Behavior, & Immunity—Health* 21: 100430. [CrossRef]

Rahal, Danny, Jessica J. Chiang, Virginia W. Huynh, Julienne E. Bower, Heather McCreath, and Andrew J. Fuligni. 2023. Low subjective social status is associated with daily selection of fewer healthy foods and more high-fat/high sugar foods. *Appetite* 180: 106338. [CrossRef]

Rees, Tobias, Thomas Bosch, and Angela E. Douglas. 2018. How the microbiome challenges our concept of self. *PLoS Biology* 16: e2005358. [CrossRef]

Ren, Michelle, and Shahrdad Lotfipour. 2022. Dose- and Sex-Dependent Bidirectional Relationship between Intravenous Fentanyl Self-Administration and Gut Microbiota. *Microorganisms* 10: 1127. [CrossRef]

Reuters. 1959. Doctors close up distillery—In a patient's stomach. *The Buffalo News (Buffalo, New York)*, July 9, 4.

Reuters. 2024. Belgian man whose body makes its own alcohol cleared of drunk-driving. *Guardian*, April 22. Available online: https://www.theguardian.com/world/2024/apr/22/belgian-man-whose-body-makes-its-own-alcohol-cleared-of-drunk-driving (accessed on 25 April 2024).

Rivera-Esteban, Jesús, Alba Jiménez-Masip, Sergio Muñoz-Martínez, Salvador Augustin, Rafael A. Guerrero, Pablo Gabriel-Medina, Roser Ferrer-Costa, Francisco Rodríguez-Frías, Elisabet Turu, Andrés Marco, and et al. 2023. Prevalence and Risk Factors of MASLD and Liver Fibrosis amongst the Penitentiary Population in Catalonia: The PRISONAFLD Study. *Journal of Clinical Medicine* 12: 7276. [CrossRef]

Roman, Pablo, Angeles F. Estévez, Alonso Miras, Nuria Sánchez-Labraca, Fernando Cañadas, Ana B. Vivas, and Diana Cardona. 2018. A Pilot Randomized Controlled Trial to Explore Cognitive and Emotional Effects of Probiotics in Fibromyalgia. *Scientific Reports* 8: 10965. [CrossRef]

Rook, Graham. 2024. Evolution and the critical role of the microbiota in the reduced mental and physical health associated with low socioeconomic status (SES). *Neuroscience & Biobehavioral Reviews* 161: 105653. [CrossRef]

Rosales, Glen. 1990. Rare disease afflicts Vargas, lawyer says. *Albuquerque Journal*, December 21, pp. A-1, A-10.

Rudnick Law. 2021. DWI Dropped for Client Diagnosed with Auto-Brewery Syndrome. August 5. Available online: https://www.rudnicklaw.com/blog/dwi-dropped-for-client-diagnosed-with-auto-brewery-syndrome/ (accessed on 25 April 2024).

Samanta, Arghya, and Moinak Sen Sarma. 2024. Metabolic dysfunction-associated steatotic liver disease: A silent pandemic. *World Journal of Hepatology* 16: 511–16. [CrossRef]

Sapolsky, Robert M. 2023. *Determined: A Science of Life without Free Will*. London: Penguin Press.

Schwartz, Kevin L., Bradley J. Langford, Nick Daneman, Branson Chen, Kevin A. Brown, Warren McIsaac, Karen Tu, Elisa Candido, Jennie Johnstone, Valerie Leung, and et al. 2020. Unnecessary antibiotic prescribing in a Canadian primary care setting: A descriptive analysis using routinely collected electronic medical record data. *CMAJ Open* 8: E360–E369. [CrossRef]

Segovia-Rodríguez, Lucía, Víctor Echeverry-Alzate, I. Rincón-Pérez, Javier Calleja-Conde, K. M. Bühler, E. Giné, J. Albert, J. A. Hinojosa, E. Huertas, F. Gómez-Gallego, and et al. 2022. Gut microbiota and voluntary alcohol consumption. *Translational Psychiatry* 12: 146. [CrossRef] [PubMed]

Severance, Emily G., Jianchun Xiao, Lorraine Jones-Brando, Sarven Sabunciyan, Ye Li, Mikhail Pletnikov, Emese Prandovszky, and Robert Yolken. 2016. Toxoplasma gondii-A Gastrointestinal Pathogen Associated with Human Brain Diseases. *International Review of Neurobiology* 131: 143–63. [CrossRef] [PubMed]

Shen, Heping, Qiaobing Guan, Xiaoling Zhang, Chao Yuan, Zhengye Tan, Liping Zhai, Yanan Hao, Yanling Gu, and Chenyang Han. 2020. New mechanism of neuroinflammation in Alzheimer's disease: The activation of NLRP3 inflammasome mediated by gut microbiota. *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 100: 109884. [CrossRef] [PubMed]

Shindo, Kunihiko, and Motonori Fukumura. 1995. Effect of H2-receptor antagonists on bile acid metabolism. *Journal of Investigative* 43: 170–77.

Sim, Aaron Y., Elizabeth X. Lim, Ciaran G. Forde, and Bobby K. Cheon. 2018. Personal relative deprivation increases self-selected portion sizes and food intake. *Appetite* 121: 268–74. [CrossRef] [PubMed]

Simes, Jessica T. 2018. Place and Punishment: The Spatial Context of Mass Incarceration. *Journal of Quantitative Criminology* 34: 513–33. [CrossRef]

Song, Zheyi, Renyi Song, Yanan Liu, Zufang Wu, and Xin Zhang. 2023. Effects of ultra-processed foods on the microbiota-gut-brain axis: The bread-and-butter issue. *Food Research International* 167: 112730. [CrossRef]

Steenbergen, Laura, Roberta Sellaro, Saskia van Hemert, Jos A. Bosch, and Lorenza S. Colzato. 2015. A randomized controlled trial to test the effect of multispecies probiotics on cognitive reactivity to sad mood. *Brain, Behavior, and Immunity* 48: 258–64. [CrossRef]

Sumich, Alexander, Nadja Heym, Sabrina Lenzoni, and Kirsty Hunter. 2022. Gut microbiome-brain axis and inflammation in temperament, personality and psychopathology. *Current Opinion in Behavioral Sciences* 44: 101101. [CrossRef]

Swaart, Charles M. 1977. My bout with the secret still. *STAR: Kansas City Star Sunday Magazine (Kansas City, Missouri)*, October 16, 16–21.

Swaart, Charles M. 1978. Drunk for 30 years and never hit the bottle. *Arizona: The Arizona Republic Sunday Magazine*, March 19, 35–39.

Targownik, Laura E., Colleen Metge, Leslie Roos, and Stella Leung. 2007. The prevalence of and the clinical and demographic characteristics associated with high-intensity proton pump inhibitor use. *The American Journal of Gastroenterology* 102: 942–50. [CrossRef] [PubMed]

Tarkhashvili, Nato. 2023. Does poverty increase antibiotic prescribing rates through underlying health conditions? Ecological study using parallel mediation analysis. *Antimicrobial Stewardship & Healthcare Epidemiology* 3: e21. [CrossRef]

Tcherni-Buzzeo, Maria. 2023. Dietary interventions, the gut microbiome, and aggressive behavior: Review of research evidence and potential next steps. *Aggressive Behavior* 49: 15–32. [CrossRef]

Ten Bruggencate, Sandra J.M., Ingeborg M.J. Bovee-Oudenhoven, Mischa L.G. Lettink-Wissink, and Roelof Van der Meer. 2005. Dietary fructooligosaccharides increase intestinal permeability in rats. *Journal of Nutrition* 135: 837–42. [CrossRef] [PubMed]

The Editors. 1990. A new DWI defense. *Albuquerque Journal*, December 28, A-8.

Tian, Liang, Chongfei Huang, Wenkang Fu, Long Gao, Ningning Mi, Mingzhen Bai, Haidong Ma, Chao Zhang, Yawen Lu, Jinyu Zhao, and et al. 2023. Proton pump inhibitors may enhance the risk of digestive diseases by regulating intestinal microbiota. *Frontiers in Pharmacology* 14: 1217306. [CrossRef] [PubMed]

Twohig, Ray. 1991. Vargas case breaks new ground in DWI case. *Albuquerque Journal*, January 1, A-15.

Ueda, Eriko, Michiko Matsunaga, Hideaki Fujihara, Takamasa Kajiwara, Aya K. Takeda, Satoshi Watanabe, Keisuke Hagihara, and Masako Myowa. 2023. Temperament in early childhood is associated with gut microbiota composition and diversity. *bioRxiv*, 2023-12. [CrossRef]

Uzan-Yulzari, Atara, Sondra Turjeman, Dmitriy Getselter, Samuli Rautava, Erika Isolauri, Soliman Khatib, Evan Elliott, and Omry Koren. 2023. Aggression: A gut reaction? The effects of gut microbiome on aggression. *bioRxiv*, 2023-10. [CrossRef]

van Boxel, O. S., M. P. Hagenaars, A. J. Smout, and P. D. Siersema. 2009. Socio-demographic factors influence chronic proton pump inhibitor use by a large population in the Netherlands. *Alimentary Pharmacology & Therapeutics* 29: 571–79. [CrossRef]

Vandekerckhove, Elisabeth, Filip Janssens, David Tate, and Danny De Looze. 2020. Treatment of Gut Fermentation Syndrome with Fecal Microbiota Transplantation. *Annals of Internal Medicine* 173: 855. [CrossRef]

Vanderhoof, Jon A., Rosemary J. Young, Nancy Murray, and Stuart S. Kaufman. 1998. Treatment strategies for small bowel bacterial overgrowth in short bowel syndrome. *Journal of Pediatric Gastroenterology and Nutrition* 27: 155–60. [CrossRef] [PubMed]

Vasiliu, Octavian. 2021. Current Status of Evidence for a New Diagnosis: Food Addiction-A Literature Review. *Front Psychiatry* 12: 824936. [CrossRef] [PubMed]

Vasiliu, Octavian. 2023. Is fecal microbiota transplantation a useful therapeutic intervention for psychiatric disorders? A narrative review of clinical and preclinical evidence. *Current Medical Research and Opinion* 39: 161–77. [CrossRef] [PubMed]

Wang, Chong, Teng Zhang, Lei He, Ji-Yong Fu, Hong-Xin Deng, Xiao-Ling Xue, and Bang-Tao Chen. 2021. Bacterial Translocation Associates With Aggression in Schizophrenia Inpatients. *Frontiers in Systems Neuroscience* 15: 704069. [CrossRef] [PubMed]

Wang, Jiaqi, Ruolei Gu, Xiangzhen Kong, Shenghua Luan, and Yu L.L. Luo. 2024. Genome-wide association studies (GWAS) and post-GWAS analyses of impulsivity: A systematic review. *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 132: 110986. [CrossRef] [PubMed]

Wang, Qiuting, Xiuwen Guo, Qingwei Yue, Shaowei Zhu, Liying Guo, Guibao Li, Qidi Zhou, Yunzhi Xiang, Ganggang Chen, Wei Yin, and et al. 2023. Exploring the role and mechanism of gut microbiota in methamphetamine addiction using antibiotic treatment followed by fecal microbiota transplantation. *The Anatomical Record (Hoboken)* 306: 1149–64. [CrossRef]

Wang, Yun-Han, Viktor Wintzell, Jonas F. Ludvigsson, Henrik Svanström, and Björn Pasternak. 2022. Proton pump inhibitor use and risk of depression and anxiety in children: Nationwide cohort study. *Clinical and Translational Science* 15: 1112–22. [CrossRef] [PubMed]

Wasiak, Jakub, and Oliwia Gawlik-Kotelnicka. 2023. Intestinal permeability and its significance in psychiatric disorders—A narrative review and future perspectives. *Behavioural Brain Research* 448: 114459. [CrossRef] [PubMed]

Weerasekera, Manjula M., Thilini A. Jayarathna, Gayan K. Wijesinghe, Chinthika P. Gunasekara, Neluka Fernando, Nilwala Kottegoda, and Lakshman P. Samaranayake. 2017. The Effect of Nutritive and Non-Nutritive Sweeteners on the Growth, Adhesion, and Biofilm Formation of Candida albicans and Candida tropicalis. *Medical Principles and Practice* 26: 554–60. [CrossRef]

Wei, Nana, Mingliang Ju, Xichen Su, Yan Zhang, Yonghe Huang, Xinyue Rao, Li Cui, Zhibing Lin, and Yi Dong. 2024. Transplantation of gut microbiota derived from patients with schizophrenia induces schizophrenia-like behaviors and dysregulated brain transcript response in mice. *Schizophrenia (Heidelb)* 10: 44. [CrossRef]

Welsh, Jean A., Saul Karpen, and Miriam B. Vos. 2013. Increasing prevalence of nonalcoholic fatty liver disease among United States adolescents, 1988–1994 to 2007–2010. *The Journal of Pediatrics* 162: 496–500.e1. [CrossRef] [PubMed]

Werneck, André O., Euridice M. Steele, Felipe M. Delpino, Melissa M. Lane, Wolfgang Marx, Felice N. Jacka, Brendon Stubbs, Mathilde Touvier, Bernard Srour, Maria LC. Louzada, and et al. 2024. Adherence to the ultra-processed dietary pattern and risk of depressive outcomes: Findings from the NutriNet Brasil cohort study and an updated systematic review and meta-analysis. *Clinical Nutrition* 43: 1190–99. [CrossRef]

Whatnall, Megan, Erin Clarke, Clare E. Collins, Kirrilly Pursey, and Tracy Burrows. 2022. Ultra-processed food intakes associated with 'food addiction' in young adults. *Appetite* 178: 106260. [CrossRef] [PubMed]

Whelan, Kevin, Aaron S. Bancil, James O. Lindsay, and Benoit Chassaing. 2024. Ultra-processed foods and food additives in gut health and disease. *Nature Reviews Gastroenterology & Hepatology* 21: 406–27. [CrossRef]

Wijayatunga, Nadeeja N., Bridget Ironuma, John A. Dawson, Bailey Rusinovich, Candice A. Myers, Michelle Cardel, Gregory Pavela, Corby K. Martin, David B. Allison, and Emily J. Dhurandhar. 2019. Subjective social status is associated with compensation for large meals—A prospective pilot study. *Appetite* 132: 249–56. [CrossRef] [PubMed]

Wolstenholme, Jennifer T., Justin M. Saunders, Maren Smith, Jason D. Kang, Phillip B. Hylemon, Javier González-Maeso, Andrew Fagan, Derrick Zhao, Masoumeh Sikaroodi, Jeremy Herzog, and et al. 2022. Reduced alcohol preference and intake after fecal transplant in patients with alcohol use disorder is transmissible to germ-free mice. *Nature Communications* 13: 6198. [CrossRef] [PubMed]

Wong, Vincent Wai-Sun, Mattias Ekstedt, Grace Lai-Hung Wong, and Hannes Hagström. 2023. Changing epidemiology, global trends and implications for outcomes of NAFLD. *Journal of Hepatology* 79: 842–52. [CrossRef]

Wu, Wen-Chi, Ching-I. Lin, Yi-Fan Li, Ling-Yin Chang, and Tung-liang Chiang. 2020. The mediating effect of dietary patterns on the association between mother's education level and the physical aggression of five-year-old children: A population-based cohort study. *BMC Pediatrics* 20: 221. [CrossRef] [PubMed]

Xiao, Lu, Junyan Yan, Ting Yang, Jiang Zhu, Tingyu Li, Hong Wei, and Jie Chen. 2021. Fecal Microbiome Transplantation from Children with Autism Spectrum Disorder Modulates Tryptophan and Serotonergic Synapse Metabolism and Induces Altered Behaviors in Germ-Free Mice. *mSystems* 6: 10–1128. [CrossRef]

Xue, Guanhua, Junxia Feng, Rui Zhang, Bing Du, Ying Sun, Shiyu Liu, Chao Yan, Xinjuan Liu, Shuheng Du, Yanling Feng, and et al. 2023. Three Klebsiella species as potential pathobionts generating endogenous ethanol in a clinical cohort of patients with auto-brewery syndrome: A case control study. *EBioMedicine* 91: 104560. [CrossRef]

Yang, Xiaoying, Yuying Zhou, Shimin Tan, Xiaokang Tian, Xianran Meng, Yiling Li, Beibei Zhou, Guihua Zhao, Xing Ge, Cheng He, and et al. 2024. Alterations in gut microbiota contribute to cognitive deficits induced by chronic infection of Toxoplasma gondii. *Brain, Behavior, and Immunity* 119: 394–7. [CrossRef] [PubMed]

Yang, Youjun, Zhanqiong Zhong, Baojia Wang, Xiuwen Xia, Weiyi Yao, Ling Huang, Yili Wang, and Weijun Ding. 2019. Early-life high-fat diet-induced obesity programs hippocampal development and cognitive functions via regulation of gut commensal Akkermansia muciniphila. *Neuropsychopharmacology* 44: 2054–64. [CrossRef] [PubMed]

Yates, Sarah R., and Akira Saito. 2024. Auto-Brewery Syndrome after COVID-19 Infection. *ACG Case Reports Journal* 11: e01248. [CrossRef] [PubMed]

Yi, Wenying, Haibo Wu, Weibin Fu, Huimei Feng, Jie Huang, Haijing Li, Zhen Song, Yuwei Chen, Yingjun Zheng, and Shenglin She. 2024. Prevalence and Risk Factors of Non-Alcoholic Fatty Liver Disease (NAFLD) in Non-Obese Patients with Schizophrenia: A Retrospective Study. *Diabetes, Metabolic Syndrome and Obesity* 17: 841–49. [CrossRef] [PubMed]

Younan, Diana, Catherine Tuvblad, Meredith Franklin, Fred Lurmann, Lianfa Li, Jun Wu, Kiros Berhane, Laura A. Baker, and Jiu-Chiuan Chen. 2018. Longitudinal Analysis of Particulate Air Pollutants and Adolescent Delinquent Behavior in Southern California. *Journal of Abnormal Child Psychology* 46: 1283–93. [CrossRef]

Yuan, Jing, Chen Chen, Jinghua Cui, Jing Lu, Chao Yan, Xiao Wei, Xiangna Zhao, NanNan Li, Shaoli Li, Guanhua Xue, and et al. 2019. Fatty Liver Disease Caused by High-Alcohol-Producing Klebsiella pneumoniae. *Cell Metabolism* 30: 675–688.e7. [CrossRef] [PubMed]

Zahedi, Hoda, Roya Kelishadi, Ramin Heshmat, Mohammad Esmaeil Motlagh, Shirin Hasani Ranjbar, Gelayol Ardalan, Moloud Payab, Mohammad Chinian, Hamid Asayesh, Bagher Larijani, and et al. 2014. Association between junk food consumption and mental health in a national sample of Iranian children and adolescents: The CASPIAN-IV study. *Nutrition* 30: 1391–97. [CrossRef]

Zalcman, Steven S., and Allan Siegel. 2006. The neurobiology of aggression and rage: Role of cytokines. *Brain, Behavior, and Immunity* 20: 507–14. [CrossRef] [PubMed]

Zerekidze, Ani, Meng Li, Alexander Refisch, Justina Shameya, Thomas Sobanski, Martin Walter, and Gerd Wagner. 2024. Impact of Toxoplasma gondii and Human Microbiome on Suicidal Behavior: A Systematic Review. *Journal of Clinical Medicine* 13: 593. [CrossRef]

Zewude, Rahel T., Kenneth Croitoru, Ronit Das, Brian Goldman, and Isaac I. Bogoch. 2024. Auto-brewery syndrome in a 50-year-old woman. *CMAJ: Canadian Medical Association Journal* 196: E724–E727. [CrossRef]

Zhang, Qin, Bing Chen, Jinghui Zhang, Jingyi Dong, Jianglin Ma, Yuyan Zhang, Kangyu Jin, and Jing Lu. 2023. Effect of prebiotics, probiotics, synbiotics on depression: Results from a meta-analysis. *BMC Psychiatry* 23: 477. [CrossRef] [PubMed]

Zhang, Qi, Yajun Yun, Huimei An, Wenxuan Zhao, Ting Ma, Zhiren Wang, and Fude Yang. 2021. Gut Microbiome Composition Associated With Major Depressive Disorder and Sleep Quality. *Front Psychiatry* 12: 645045. [CrossRef] [PubMed]

Zhang, Xiaobei, Ravi R. Bhatt, Svetoslav Todorov, and Arpana Gupta. 2023. Brain-gut microbiome profile of neuroticism predicts food addiction in obesity: A transdiagnostic approach. *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 125: 110768. [CrossRef] [PubMed]

Zhu, Ruizhe, Yilin Fang, Hongyu Li, Ying Liu, Jing Wei, Shuwei Zhang, Liwei Wang, Rui Fan, Lingfang Wang, Shengjie Li, and et al. 2023. Psychobiotic Lactobacillus plantarum JYLP-326 relieves anxiety, depression, and insomnia symptoms in test anxious college via modulating the gut microbiota and its metabolism. *Frontiers in Immunology* 14: 1158137. [CrossRef]