

GUT INSTINCTS

Dr. Heather Finley

PART 3: TRAUMA AND EATING DISORDERS

ABOUT ME

Dr. Heather Finley

REGISTERED DIETITIAN

Experience in clinical settings, outpatient treatment and now virtual private practice

GUT HEALTH EXPERT

Focused my doctorate training on gut related research and have my own personal experience with 20+ years of digestive issues



TODAYS TOPICS

1

TRAUMA AND
THE GUT

2

BACTERIAL
DIVERSITY

3

MICRONUTRIENTS AND
MACRONUTRIENTS

Part 1 & 2 Recap

- The gut and the brain communicate through the vagus nerve
 - This is a bi-directional pathway
- Disruptions of the gut lead to disruptions of the brain
- Stress impacts gut motility, stomach acid production and bacterial diversity
- Stress management is key to optimizing gut health
- The gut can influence our basic emotions, pain sensitivity and guide decisions
- The gut has its own nervous system
 - Enteric nervous system (aka the second brain)

Part 1 & 2 Recap

- The immune cells residing in your gut makeup the largest component of your body's immune system
- The lining of your gut houses endocrine cells that contain up to 20 different hormones
- The gut is the largest storage facility for serotonin in our body
 - Essential for gut motility
- If our gut's sole responsibility was digestion why does it contain these signaling systems?
- Gut signals reaching the brain signal fullness, nausea, discomfort, wellbeing, etc
 - These resopnses are sent back to the brain= gut reactions
 - What we sense in our gut helps us make decisions

Part 1 & 2 Recap

- When you are depressed your intestines move very slowly, if at all
- Emotions on our face are reflected in our gut
 - Influenced by nerve signals in the limbic system

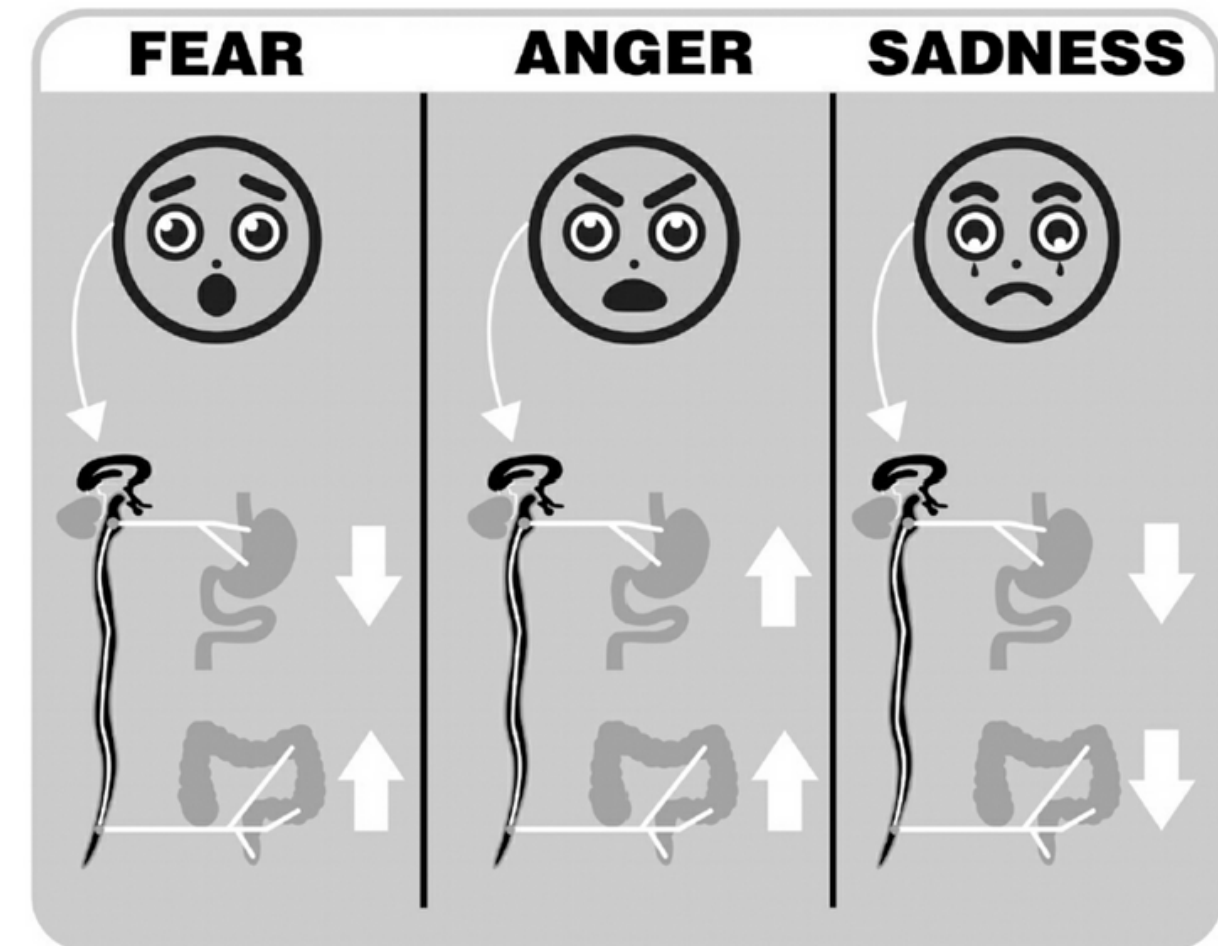


FIG. 3. THE GUT IS A MIRROR IMAGE OF EMOTIONAL FACIAL EXPRESSIONS

Trauma

DEFINITION

Individual trauma results from an event, series of events or a set of circumstances experienced by and individual that are physically, or emotionally harmful or life threatening that have lasting effects on the individuals functioning and mental, physical, social, emotional or spiritual well being.

TYPES

- Physical
- Emotional
- Psychological
- Sexual
- Traumatic event
- Natural disaster
- Unhealthy relationships

Trauma and the gut

- Early childhood trauma is linked to IBS symptoms
- Gut microbiome can indefinitely be impacted by intense, traumatic experiences due to the innate wiring between the gut and the brain
- Early trauma weakens immune system due to the effects of ongoing stress
 - Ongoing stress impacts microbiome diversity
- A stressed out gut is a stressed out brain
- Adrenal demand from stress impacts digestion, metabolism, gut bacterial diversity and anxiety response

Trauma and the gut

- Trauma and abuse have been reported in up to half of adults with IBS
 - Twice the prevalence of patients without IBS
- Trauma increases vulnerability to GI and mental health symptoms
- Animal studies have demonstrated that adversity-induced changes in the gut microbiome influence neurological development (need more human studies)
- Study at Columbia was the first to link disruption of a child's microbiome triggered by early-life adversity with brain activity in regions associated with emotional health

Childhood Trauma

- Trauma and abuse have been reported in up to half of adults with IBS
 - Twice the prevalence of patients without IBS
- 115 children adopted from orphanages or foster care on or before 2 years old and 229 children raised by biological caregiver
 - Children with past caregiving disruptions showed higher levels of stomach aches, constipation, nausea, vomiting
- Stool samples showed early caregiving disruption had distinctly different gut microbiomes from those raised with biological caregivers from birth
- Children with increased diversity in the gut (biological parents)
 - Linked to prefrontal cortex and emotion regulation

Follow Up Study

- Gastrointestinal symptoms were also associated with concurrent and future anxiety (measured across 5 years), and those gastrointestinal symptoms mediated the adversity–anxiety association at Time 1
- In children with 2 stool samples and FMRI brain studies
 - Individuals with EA had lower counts of bacterial diversity
- Study 2 showed proof of concept that GI microbiota was altered by early experiences of adverse caregiving
 - microbial variation was associated with brain reactivity within emotion networks in the brain

Trauma and Abuse

- Study that wanted to identify if subgroups of IBS subjects can be identified based on differences in gut composition
 - and if there are correlations between gut microbiota and structural brain signatures
- Is there an association between early adverse life event and gut composition?
- Can gut composition be used to classify IBS symptoms?
- Is there a relationship between gut composition and IBS-related brain biomarkers?

Trauma and Abuse

- IBS group had greater abundance of Firmicutes
 - Clostridia: intestinal serotonin dysregulation and IBS
- Significantly greater scores on emotional scale
 - Brain driven disturbances of the gut environment in early life can have a lasting effect?
- Moderate sized correlations with brain structure/IBS related
 - epigenetic factors?
- Preliminary evidence for involvement of specific microbes

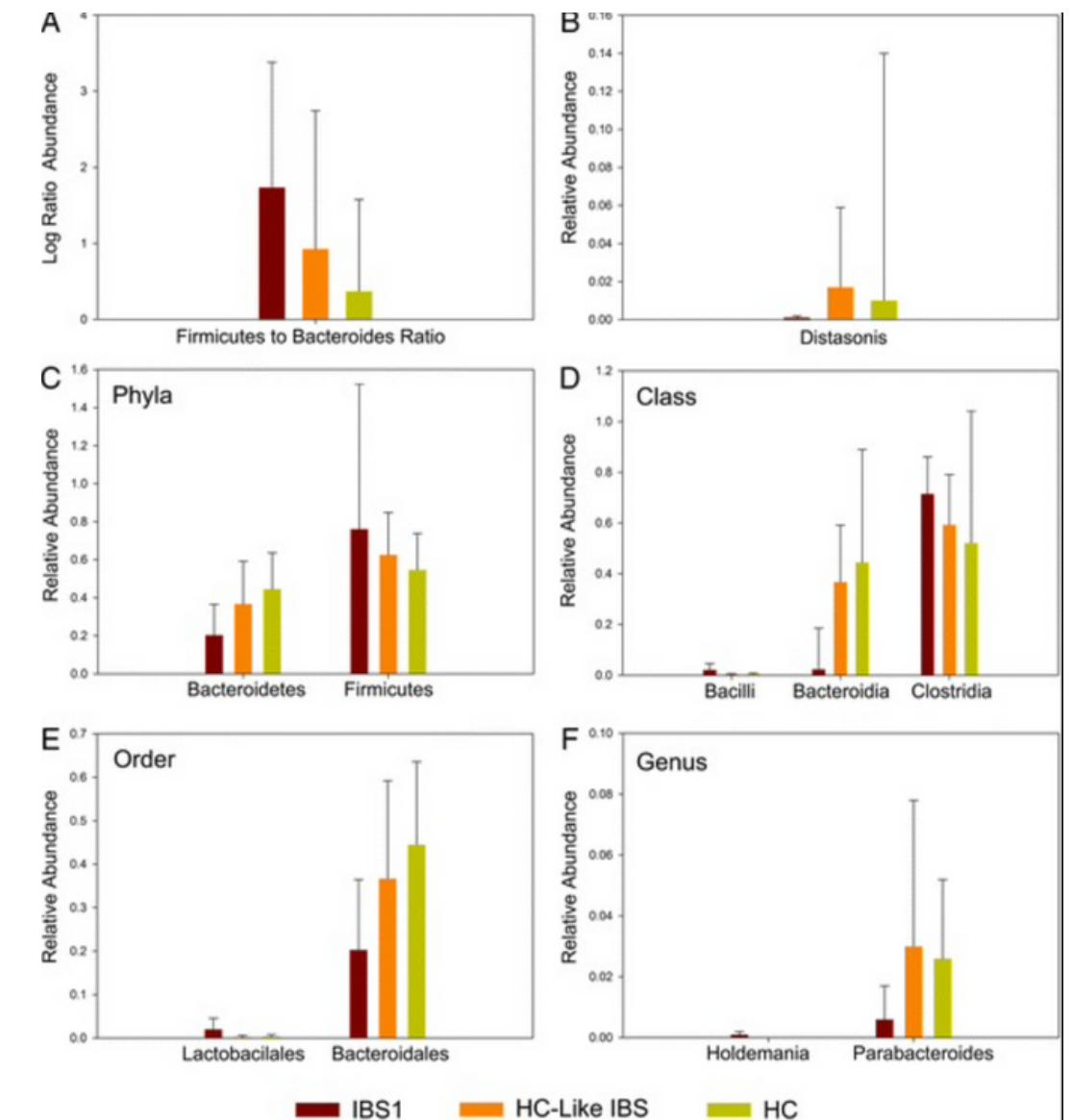


Fig. 4 Group differences in the relative abundance of microbiota. Bar graphs depict the Firmicutes to Bacteroidetes ratio (a), the mean relative abundance for identifiable operational taxonomic units (b), and taxa demonstrating group differences at each taxonomic level (phylum, class, order, family, and genus (c-f)). Error bars represent standard deviations

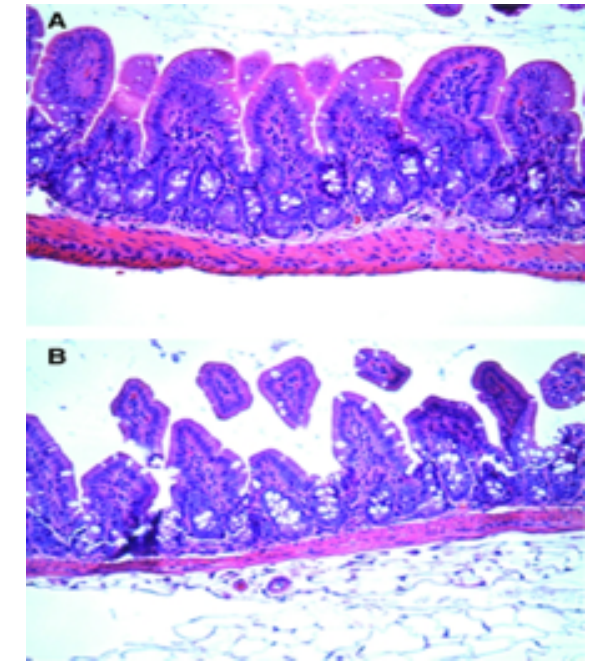
PTSD

- Individuals with PTSD have lower levels of bacteria associated with inflammation, immune function, brain functioning and behavior
- Gut bacteria strongly influence our metabolic, endocrine, immune and nervous systems
- Dysregulation of the HPA Axis
 - Imbalanced gut microbiota in early life may have long-lasting immune and other physiological effects that make individuals more susceptible to develop PTSD after a traumatic event

Leclercq, S., Forsythe, P., & Bienenstock, J. (2016). Posttraumatic Stress Disorder: Does the Gut Microbiome Hold the Key?. Canadian journal of psychiatry. Revue canadienne de psychiatrie, 61(4), 204–213. doi:10.1177/0706743716635535

Leclercq S, Forsythe P, Bienenstock J. Posttraumatic Stress Disorder: Does the Gut Microbiome Hold the Key? Can J Psychiatry. 2016 Apr;61(4):204-13. doi: 10.1177/0706743716635535. Epub 2016 Feb 24. PMID: 27254412; PMCID: PMC4794957.

Physical Trauma



AUTONOMIC NERVOUS SYSTEM

Alterations in the ANS can impact motility and peristalsis

INTESTINAL PERMEABILITY

TBI will impact intestinal microvilli 6 hours after brain injury (mice study)

INFLAMMATION

Breakdown blood brain barrier
Inflammatory compounds can access the brain

Zhu, C. S., Grandhi, R., Patterson, T. T., & Nicholson, S. E. (2018). A Review of Traumatic Brain Injury and the Gut Microbiome: Insights into Novel Mechanisms of Secondary Brain Injury and Promising Targets for Neuroprotection. *Brain sciences*, 8(6), 113. <https://doi.org/10.3390/brainsci8060113>

Bansal V, Costantini T, Kroll L, Peterson C, Loomis W, Eliceiri B, Baird A, Wolf P, Coimbra R. Traumatic brain injury and intestinal dysfunction: uncovering the neuro-enteric axis. *J Neurotrauma*. 2009 Aug;26(8):1353-9. doi: 10.1089/neu.2008.0858. PMID: 19344293; PMCID: PMC2989839.

Why bacteria matter

EXPOSURE STARTS AT BIRTH

- Bacteria is impacted by diet
- First inoculation to bacteria is at birth through the vaginal canal
- Breast milk then provides immunoglobulins to aid in lining the GI tract
- Specific fibers in breast milk prevent growth of bad bacteria
- Breast milk also provides live active cultures (probiotics) that positively influence the body

PHYLA OF BACTERIA

BACTEROIDETES

THE GOOD GUYS

They produce short chain fatty
acids

Need fiber to survive

FIRMICUTES

THE BAD GUYS

Increased ratio is associated with
dysregulated metabolism, inflammation
and pro-inflammatory cytokines

Bacterial Diversity

IN THE GUT

- Delayed gastric emptying and intestinal transit
- Reduced migrating motor complex
- Decreased immunity
- Higher rates of opportunistic bacteria
- Higher rates of mood disorders

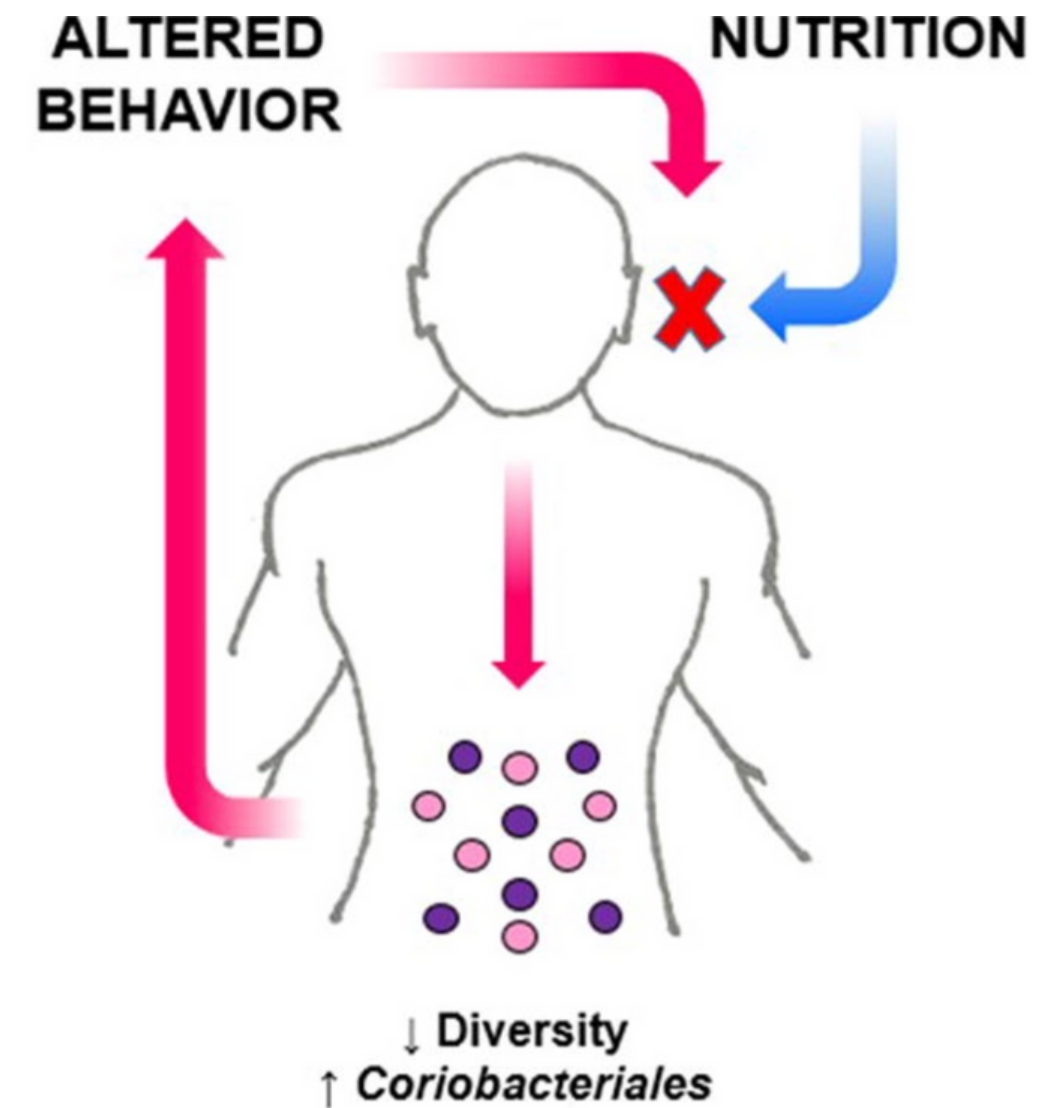
Bacterial Diversity

FOR THE BRAIN

- Altered expression of neurotransmitters
- Reduced in gene expression of enzymes involved in synthesis and transport of neurotransmitters
- Increases anxiety and function of HPA
- Memory dysfunction
- Decrease in brain-derived neurotrophic factor (BDNF)
- All functions restored when bacteria re-introduced

Bacterial Diversity in AN

- Intestinal dysbiosis in anorexia nervosa and an association with mood
- Potential relationship between the intestinal microbiota and behavior in patients with Anorexia Nervosa. Restricting calorie intake can have a profound impact on enteric microbes resulting in decreased microbial richness and a bloom of bacteria that can flourish in a nutrient depleted environment.
 - This altered composition in the intestinal microbiota could possibly impact the behavior of a patient with Anorexia Nervosa, perpetuating restriction of food intake.



Kleiman SC, Watson HJ, Bulik-Sullivan EC, Huh EY, Tarantino LM, Bulik CM, Carroll IM. The Intestinal Microbiota in Acute Anorexia Nervosa and During Renourishment: Relationship to Depression, Anxiety, and Eating Disorder Psychopathology. *Psychosom Med.* 2015 Nov-Dec;77(9):969-81. doi: 10.1097/PSY.0000000000000247. PMID: 26428446; PMCID: PMC4643361.

Carr J, Kleiman SC, Bulik CM, Bulik-Sullivan EC, Carroll IM. Can attention to the intestinal microbiota improve understanding and treatment of anorexia nervosa? *Expert Rev Gastroenterol Hepatol.* 2016;10(5):565-9. doi: 10.1586/17474124.2016.1166953. Epub 2016 Apr 4. PMID: 27003627; PMCID: PMC4861228.

Alessio Maria Monteleone, Jacopo Troisi, Alessio Fasano, Riccardo Dalle Grave, Francesca Marciello, Gloria Serena, Simona Calugi, Giovanni Scala, Giulio Corrivetti, Giammarco Cascino, Palmiero Monteleone, Mario Maj, Multi-omics data integration in anorexia nervosa patients before and after weight regain: A microbiome-metabolomics investigation, *Clinical Nutrition*, Volume 40, Issue 3, 2021, Pages 1137-1146, ISSN 0261-5614, <https://doi.org/10.1016/j.clnu.2020.07.021>.

Bacterial Diversity in ED

- Studies show a pattern of dysbiosis
 - Some findings are inconsistent
- Most research has been on male rodents
 - Need to accommodate for female hormones
- Challenges in creating bacterial diversity:
 - Sustainable and consistent eating patterns
 - Compliance with nutritional rehabilitation
 - Gut symptoms
- Prebiotic supplementation on enteral tube feeding patients improved quality of life

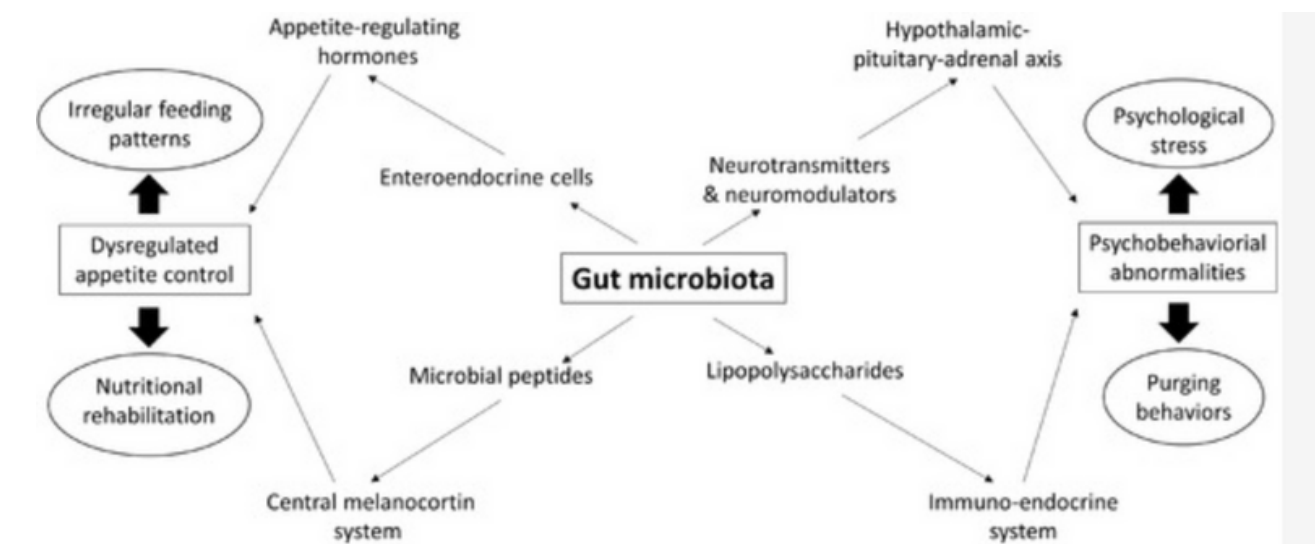


Figure 1

Butler MJ, Perrini AA, Eckel LA. The Role of the Gut Microbiome, Immunity, and Neuroinflammation in the Pathophysiology of Eating Disorders. *Nutrients*. 2021; 13(2):500. <https://doi.org/10.3390/nu13020500>

Wierdsma, N.J.; van Bodegraven, A.A.; Uitdehaag, B.M.; Arjaans, W.; Savelkoul, P.H.; Kruizenga, H.M.; van Bokhorst-de van der Schueren, M.A. Fructo-oligosaccharides and fibre in enteral nutrition has a beneficial influence on microbiota and gastrointestinal quality of life. *Scand. J. Gastroenterol.* 2009, 44, 804–812.

Eating disorder behaviors and consequences

- Caloric restriction
- Carbohydrate restriction
- Restriction of high fat foods
- Overexercise
- Laxatives
- Purging



- Malnutrition
- Poor energy and fuel
- Impaired memory
- Hormone depletion and cortisol
- GI Implications

TRAUMA AND ED

Implicaitons for
picky eating

Restrictive eating

Mood
disturbances

Stress increases
dopamine

Higher dopamine
lowers serotonin

Chicken or egg?



Vagus Nerve

My function:

SUPERHIGHWAY BETWEEN THE
BRAIN AND THE GUT

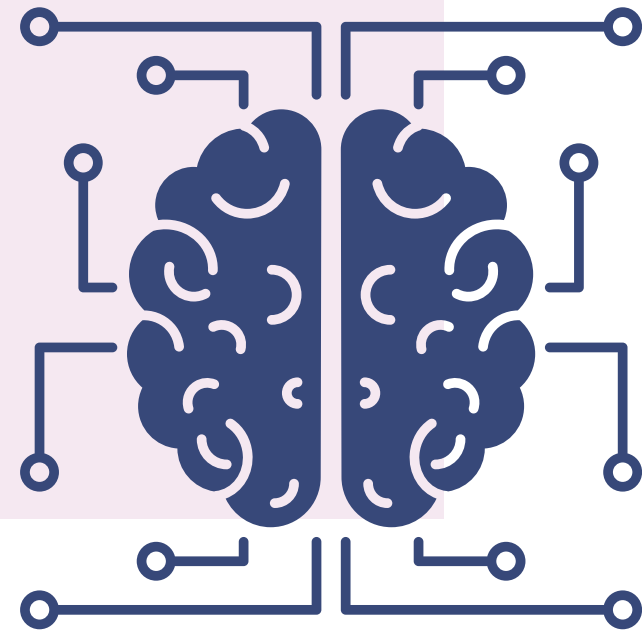
DICTATES "REST AND DIGEST MODE"
OR "FIGHT OR FLIGHT" MODE

TELLS THE MUSCLES OF THE
STOMACH TO CONTRACT

HELPS PUSH FOOD INTO THE
SMALL INTESTINE

STIMULATION OF VAGUS NERVE
HELPS WITH GUT MOTILITY

CAN STIMULATE WITH GARGLING,
HUMMING, SINGING



BDNF

My function:

PROTEIN THAT WORKS ON
GROWTH, MAINTENANCE AND
STABILITY OF NEURONS

LOW BDNF IN HIPPOCAMPUS LEADS
TO DEPRESSION AND ANXIETY

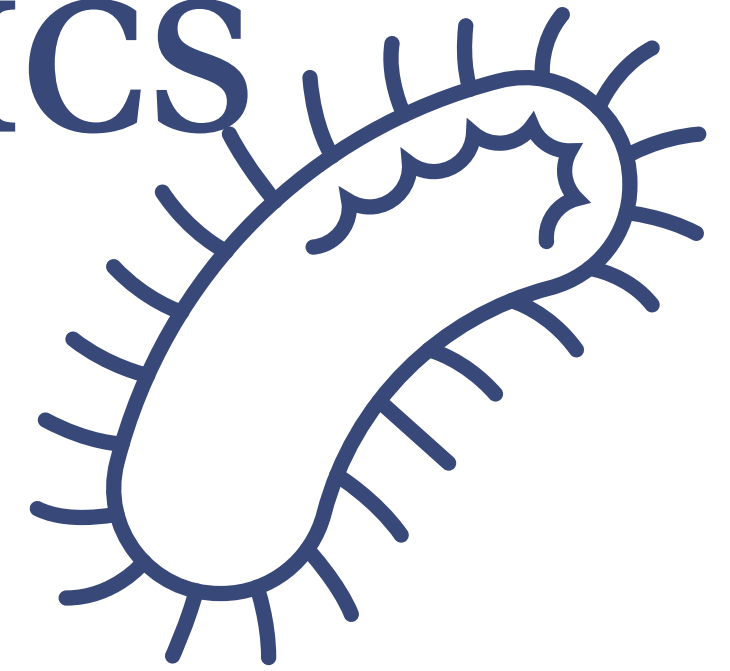
ANTI-ANXIETY MEDICATIONS
TARGET BDNF IN THE BRAIN

INCREASE OF BDNF HELPS WITH
ANXIETY

BDNF PRESERVES INTESTINAL
BARRIER FUNCTION

RESEARCH ON L.PLANATARUM
STAIN AND BDNF UPREGULATION

PRO, PRE AND POSTBIOTICS



PREBIOTICS

Fermentable fibers that feed probiotic bacteria

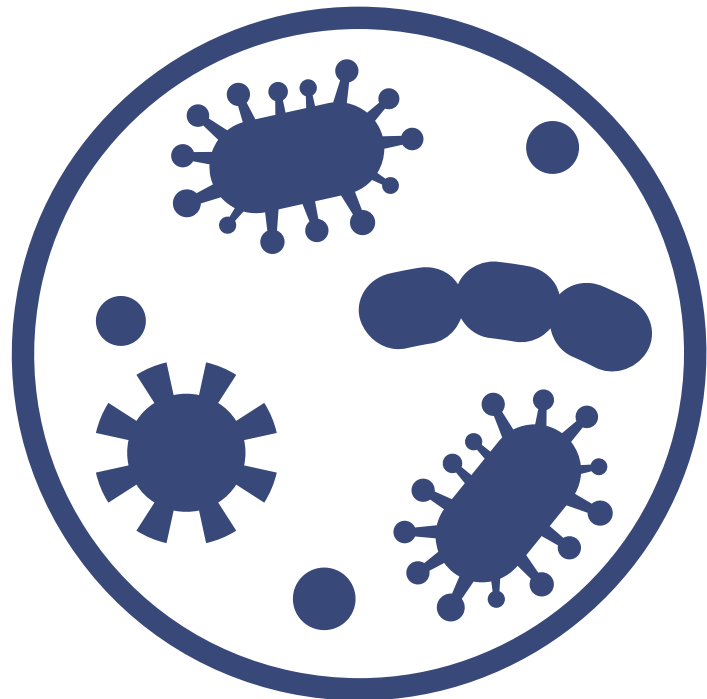
PROBIOTICS

Live bacterial organisms in the gut

POST-BIOTICS

Short chain fatty acids that are produced when probiotics eat prebiotics

ALL of these are important for healthy gut and brain function



TYPES OF FIBER

INSOLUBLE FIBER

The "roughage"
Passes through the colon and
comes out in the stool
Sweeps the intestines



SOLUBLE FIBER

Most are prebiotic fibers
Food for the gut microbes
We lack the enzymes to digest this
Microbes have the enzymes to digest
this
Feeding frenzy occurs
Probiotic bugs pay us back when we eat
these foods
Attracts water and turns to a gel

MICRONUTRIENTS

Vitamins, minerals,
amino acids

Neurotransmitter
support

Hormonal balance

Stress= increased
demand

Lifestyle, lifecycle
and life stage

Impact digestion

MICRONUTRIENTS

**HELP WITH
DIGESTIVE
ENZYMES**

**HELP WITH
HEALTHY
BOWEL
FUNCTION**

**IMPACT
ANXIETY**

**IMPACTED
BY
MEDICATION**



Magnesium

My function:

INVOLVED IN 300 ENZYME
PATHWAYS

68% OF AMERICANS ARE DEFICIENT IN
MAGNESIUM

SUPPRESSES CORTISOL AND
ADRENAL OUTPUT

CROSSES BBB TO BLOCK STRESS
HORMONES

FOOD SOURCES: DARK
CHOCOLATE, NUTS, SEEDS, LEAFY
GREENS, AVOCADOS, BEETS

THE ORIGINAL CHILL PILL--
INVOLVED IN 300 PATHWAYS



Zinc My function:

HORMONE REGULATION AND
IMMUNE SUPPORT

300 ENZYMES IN THE BODY

REPLETED WITH STRESS AND
ANXIETY

AIDS IN STOMACH ACID
PRODUCTION

STUDIES SHOW THAT CHRONIC
ANXIETY SUFFERERS HAVE HIGHER
COPPER AND LOWER ZINC

OYSTERS, BEEF, EGG YOLK, FISH,
PORK, TURKEY, PUMPKIN SEEDS,
SEASAME SEEDS, DARK
CHOCOLATE, NUTS

ZINC DEFICIENCY

Celiac/gluten
sensitivity

Gut infections

Puberty

Stress

Vegetarianism

Excessive
exercise/sweating

Environmental
toxins

Estrogen/birth
control

Results of Zinc Deficiency

- Fatigue
- Dermatitis
- Acne
- Loss of taste
- Poor wound healing
- Anorexia
- Decreased immunity
- Delayed growth
- Hypogonadism
- Delayed sexual maturation
- Diarrhea
- Skeletal abnormalities
- Alopecia
- Behavioral disturbances
- White spots on fingernails
- Infertility
- Night blindness

Physical symptoms of zinc deficiency

ZINC DEFICIENCY

- Decreased appetite and meat avoidance
- Decreased taste and smell
- Nausea and bloating during re-feeding
- Insomnia and poor sleep
- Depression
- Attention difficulties
- Amenorrhea
- Decreased melatonin
- Bloating

ANOREXIA NERVOSA

- Decreased appetite and meat avoidance
- Decreased taste and smell
- Nausea and bloating during re-feeding
- Insomnia and poor sleep
- Depression
- Attention difficulties
- Amenorrhea
- Decreased melatonin
- Bloating

Zinc and digestion

ZINC DEFICIENCY

- Zinc increases activity of digestive enzymes
- Zinc deficiency influences activity of carbonic anhydrase (CA)
- Inhibition of EFA metabolism
- Zinc deficiency causes insufficient gastric acid production
- Zinc is a co-enzyme in ALL digestive enzymes
- When patients complain of bloating distress—they have been Zn deficient for so long
- Zinc deficiency alters taste and smell receptors
- Taste is mediated through a salivary zinc dependent enzyme
- LOW WBC, LOW ALK PHOSPHATASE= low zinc

Zinc and digestion

ZINC AND APPETITE

- Cholecystokinin- neuropeptide secreted in duodenum to decrease rate of gastric emptying and promote satiety
- After a meal, anorexic patients show a peak of plasma CCK levels twice as normal
- Zinc is required to metabolism CCK
- CCK remains high—stay full for a long time

Zinc Supplementation and Anorexia

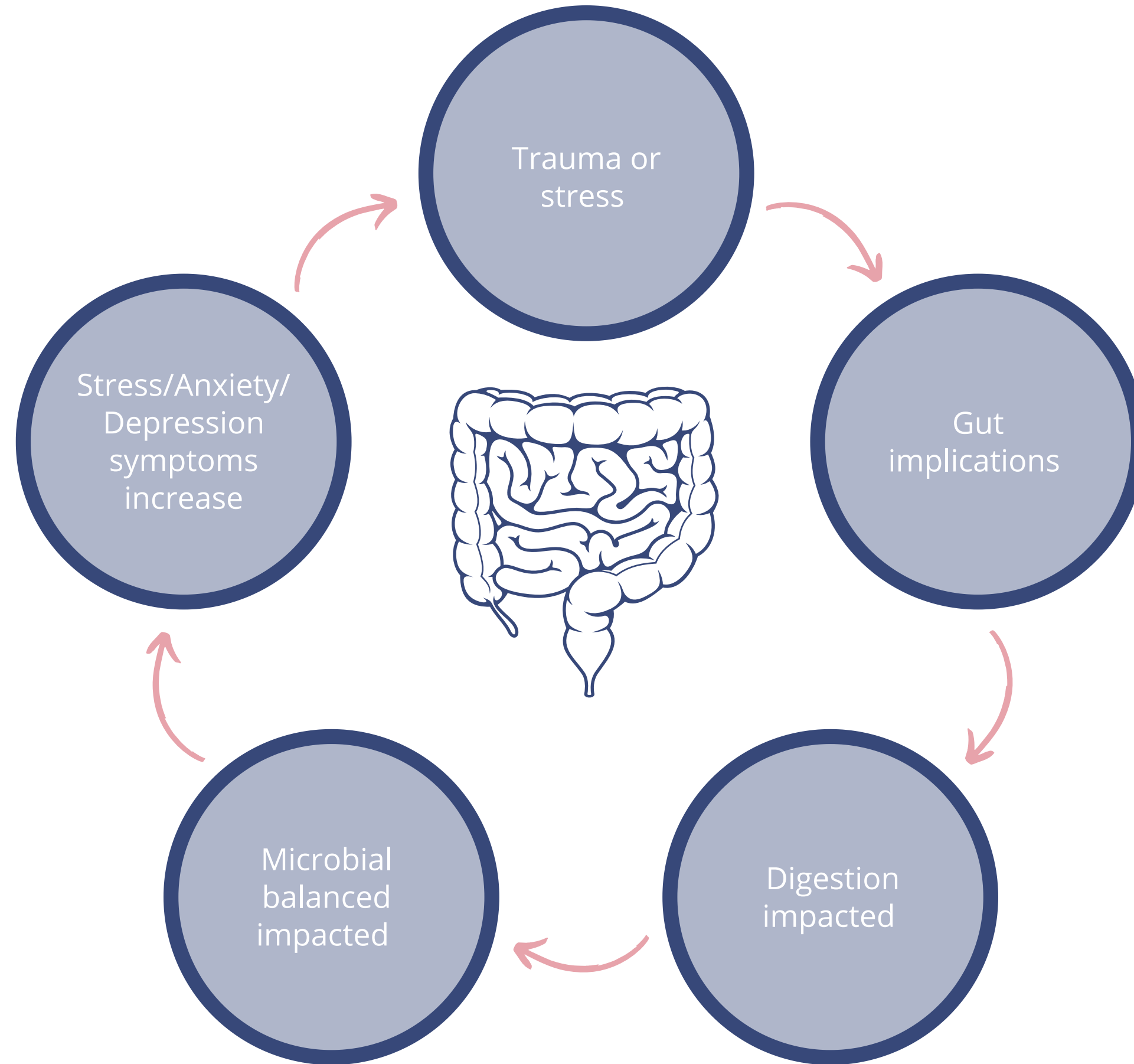
ZINC AND APPETITE

- 14 adolescents with AN and 20 healthy controls
- At start of the study, most of AN patients showed delayed sexual development and had no menstrual periods, had had hair loss, 66% had skin abnormalities and most had impaired ability to identify different tastes
- Zinc intake for the AN patients was 7.7 +/- 5.2 mg/day
- After 6 months of zinc supplementation (50 mg elemental zinc/day), AN patients improved in every area, including a decrease in level of depression, anxiety and improved taste

Birmingham, C.L., Gritzner, S. How does zinc supplementation benefit anorexia nervosa?. *Eat Weight Disord* 11, e109–e111 (2006). <https://doi.org/10.1007/BF03327573>

Bakan R.: The role of zinc in anorexia nervosa: etiology and treatment. *Med. Hypotheses*, 5, 731–736, 1979.

Lask B, Fosson A, Rolfe U, Thomas S. Zinc deficiency and childhood-onset anorexia nervosa. *J Clin Psychiatry*. 1993 Feb;54(2):63-6. PMID: 8444822.



TRAUMA, BACTERIAL DIVERSITY AND MOOD SYMPTOMS

01

Early life trauma can increase risk for IBS symptoms

02

IBS symptoms can alter bacterial diversity in the gut

03

Altered bacterial diversity impacts the brain and mood

04

Impacts in mood and bacterial diversity can impact eating behavior

IT IS IMPORTANT TO ASSESS FOR TRAUMA, STRESS AND OTHER LIFE CIRCUMSTANCES/FACTORS THAT IMPACT THE GUT

NEXT UP: April 22, 2021
12:00pm MST

Gut Instincts Part 4:
Gut Instincts: Utilizing the gut-brain
connection in the treatment of
mental health and eating disorders



Questions



Until next time....find me on
Instagram @gutbrain.nutrition

