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# Gut Microbiome and Nutrition Interplay in Regulating and Improving Autism Spectrum Disorder Related Social Symptoms

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# GUT MICROBIOME AND NUTRITION INTERPLAY IN REGULATING AND IMPROVING AUTISM SPECTRUM DISORDER RELATED SOCIAL SYMPTOMS

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## BACKGROUND

- Autism Spectrum Disorder (ASD) is defined as a neurodevelopmental condition that is characterized by deficits in social interactions, repetitive behaviors, and limited range of interests <sup>1</sup>.
- Limited information is available about the biological pressures that eventually lead to differences in onset and severity of symptoms across patients.
- Recent research articles have identified a possible link between onset and severity of ASD related behaviors and the composition of the gut microbiome<sup>1-16</sup>.
- The GI tract is innervated by the enteric nervous system (ENS), which is thought to be in communication with the central nervous system (CNS), comprising the gut-brain axis, a term that refers to the communication between the brain and gut flora <sup>4</sup>.
- Various GI imbalances have been identified, including the presence and absence of various gut flora and alterations in tryptophan and phosphate metabolism <sup>6,9,13</sup>.

## PURPOSE

- Investigate the gut-brain axis with regards to ASD
- Determine potential therapeutic targets and treatment methods for the alleviation of ASD symptoms
- Bridge the gap in our limited understanding of the relationship between the microbiome, symptomatology, severity, and onset of ASD associated behaviors.

## METHOD: LITERATURE SEARCH

Inclusion Criteria	Exclusion Criteria
Peer-Reviewed	No full text available
Reviews/primary sources/clinical trials	Not relevant to the question
Children with autism	Study was in foreign language or out of scope

**Table 1:** Inclusion and Exclusion Criteria

Database Searched	Date of Search	Search String	Number of Results	Search Period
Pubmed	9/20/2023	Gut microbiome children autism	302	2013 - 2023
Pubmed	9/20/2023	Autism's effect of gut microbiome	157	2013 – 2023
Pubmed	9/20/2023	Diet changes that affect gut microbiome for autism	36	2015 – 2023
Embase	9/20/2023	Diet changes gut microbiome children with autism	26	2012 - 2023

**Table 2:** Search Strategy

## DISCUSSION

Population	Publication Year	Population	Follow Up	Male %	Female %	Response to intervention
Xiao et. al	2021	120 ASD and 60 TD children, ASD-BALC, TD-BALC Mice	N/A	N.R.	N.R.	Increased metabolites observed in ASD mice compared to TD mice
Sgritta et. Al	2019	6-7 mice per treatment and control group. Multiple mouse strains used	N/A	N.R.	N.R.	L. reuteri does not restore the composition of the gut microbiome, which is altered in all ASD models, but rather acts as a precision microbial-based therapy.
Grimaldi et. al	2018	30 ASD children on exclusion and prebiotic B-GOS diets	Week 9 and 10	76%	24%	B-GOS prebiotic intervention diet improved antisocial behavior and changed the metabolic composition of fecal and urine metabolites
Fouquier et al.	2021	49 with ASD, 5 sibling to someone with ASD, and 49 Control Unrelated	Sampling period between 3 to 13 months (average of 6 months)	79%	21%	ASD severity could be based on the geographical location and identified a few relationships between ASD and gut microbiome: increase in number of gut bacteria leads improved speech for those with ASD.
Kang et. al	2017	18 ASD children with GI disorders age 7-17 20 control ASD children without GI problems	Week 11-18	N.R.	N.R.	Improvement in bacterial diversity, GI symptoms and ASD behaviors observed in ASD children with GI disorders.
Newell et al.	2016	21 C57BL/6 mice 25 BTBR mice models of ASD	Weeks 6-7	100%	0%	Improved bacterial ratios of Firmicutes to Bacteroidetes, normalized bacteria levels, and antimicrobial effects noted.

**Table 3:** Research Highlights

N.R. = Not Recorded; L. reuteri = Lactobacillus reuteri; B-GOS = Bimuno galactooligosaccharide;

## CONCLUSION

- Dietary intervention as early as in utero, prebiotic supplementation and fecal transplantation alter the gut microbiota of children with ASD and demonstrate a positive correlation with improvement or delay of ASD related symptoms
- This could provide for a much safer and cheaper alternative therapy for thousands of people affected by ASD.

## FUTURE RESEARCH

- Determining which patients certain treatments are most effective for
- Improve statistical significance by increasing sample sizes
- Diversifying patient population by age, race, and gender
- Standardizing diagnostic criteria to better evaluate changes in behavior over the course of a study
- Building upon experimental designs to further connect the gut-brain axis

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