

## **Nutrition Can Modify Gut-Brain Axis and Medication Induced Metabolic Disorders in Autism Spectrum Disorder- A Hypothesis**

**Kimia Moiniafshari<sup>1</sup>, Farshad kalantari<sup>2</sup>, Hafez Behzadi Nezhad<sup>3</sup>**

<sup>1</sup>Food and Health group, Department of Land, Environment, Agriculture and Forestry, University of Padova, Padova, Italy  
ORCID ID: 0000-0002-5061-0136

<sup>2</sup>Department of physical education and sport sciences, Islamic Azad University, East Tehran Branch, Tehran, Iran

<sup>3</sup>Department of physical education and sport sciences, University of Tehran, Tehran, Iran

---

### **ABSTRACT**

Autism Spectrum Disorder (ASD), is a neurodevelopmental disorder which is accompanied by several health-related challenges. Nutritional and gastrointestinal problems are common among individuals with ASD. Gut microbiota imbalance may be a reason of nutritional problems including food selectivity and restricted dietary intake. Nutritional problems and gut microbiota imbalance can increase behavioral symptoms which may increase the possibility and necessity for medication. It has been suggested that some medications, may increase the risk of metabolic impairments including glucose homeostasis abnormality, insulin resistance and/or diabetes. In this manuscript, we hypothesized that gut microbiota improvement via probiotic consumption, may improve GI problems and modify behavioral symptoms, which seems to manage medication prescription necessity.

**KEYWORDS:** autism spectrum disorder, nutrition, gut microbiota, pharmaceutical agents, metabolism

---

### **ARTICLE DETAILS**

**Published On:**  
**27 September 2022**

**Available on:**  
**<https://ijpbms.com/>**

---

### **INTRODUCTION**

Autism Spectrum Disorder (ASD), is a neuro-developmental disorder which may affect individual's quality of life in several aspects including health-related complications (1). It has been suggested that there is a link between ASD and metabolic impairments including diabetes and related complications (2). There are several reasons for metabolic abnormalities in ASD, such as brain insulin resistance (IR) and reduction in glucose metabolism (3). It can be hypothesized that ASD and its related metabolic impairment, to be associated with maternal health status. It seems that prenatal metabolic syndrome, may increase the risk of ASD prevalence (4).

#### **What is the challenge?**

Prevalence of ASD, has gain a growing trend and individuals with ASD may face medical and health-related complications

including insulin resistance which is prevalent In ASD (5). Moreover, medications may bring adverse effect for metabolic status in individuals with ASD, for instance, risperidone, is a common consumed medication among individuals with ASD, for behavioral treatment and purposes which seems to induce insulin resistance (6).

On the other hand, nutritional problems are another challenge in individuals with ASD. it seems that gut microbiota which is related to nutrition and gut-brain axis, may affect insulin resistance in individual with ASD. gut microbiota imbalance may affect metabolic status including HOMA-β, HOMA-IR and triglyceride concentration (7). Investigations on gut microbiota in ASD, have suggested that obesity and gut microbiota is associated with each other in ASD. Studies which have focused on the relation of gut microbiota and weight in ASD, have indicated that some gut microbiota including

## Nutrition Can Modify Gut-Brain Axis and Medication Induced Metabolic Disorders in Autism Spectrum Disorder- A Hypothesis

Balutia, Holdemanella and Lachnosiracea incertae sedis, increase in obese individuals with ASD (8).

### What is the hypothesis?

According to the results from previous investigations, it can be hypothesized that there is a link between ASD, metabolic status including weight and insulin resistance and also gut microbiota. These health complications may also be induced by medications including risperidone which may cause hyperglycemia depending on the drugs interactions, dosage and duration of consumption (9).

### Nutrition, GI microbiota and ASD

Nutrition, plays important role in ASD management. There are several complications including gastrointestinal (GI), behavioral and immunological problems. GI disorder including bowel movement problems, autoimmune responses and food allergies may cause nutritional deficiencies which are challenges beside food selectivity and restricted dietary intakes. GI symptoms may affect behavioral symptoms as a result (10). The question is that, if GI disorder, induce behavioral symptoms and lead to medication prescription which may affect metabolic condition such as glucose homeostasis. This question, has led us to our assessment on the effect of probiotics as agents for GI health and and gut microbiota balance improvement, metabolic and behavioral management. Gut microbiota and ASD

It has been shown that gut microbiome composition and inflammation have high prevalence in ASD which may affect GI-brain axis and behavioral changes. It seems that probiotics, which are known as psycho-biotics, may improve ASD health-related challenges (11). There are several probiotic sources including both dietary and supplements which are introduced. Nutritional supplements can be considered as functional foods which can improve gut microbiota balance and improve ASD symptoms and metabolic status (12). probiotic consumption can improve GI health and behavioral symptoms in ASD (13). Moreover, probiotic and bioactive component consumption have beneficial effects for neurochemical abnormalities, oxidative stress and behavioral disorders (14).

### CONCLUSION

ASD, is a neuro-developmental disorder with several health complications which may affect individual's quality of life. GI disorder and gut microbiota imbalance, may be a nutrition-related impairment which may affect gut-brain axis and behavioral symptoms. It has been suggested that GI health and gut microbiota can be modified by probiotic consumption, which may improve behavioral symptoms as a result. We hypothesized that the improvement in behavioral symptoms, may decrease the need for medications, which may improve

metabolic status, glucose homeostasis and insulin resistance as a result.

### REFERENCES

- I. Lu, J., Wang, Z., Liang, Y., & Yao, P. (2022). Rethinking autism: The impact of maternal risk factors on autism development. *American Journal of Translational Research*, 14(2), 1136.
- II. Cortese, S., Gabellone, A., Marzulli, L., Iturmendi-Sabater, I., de La Chica-Duarte, D., Piqué, I. M., ... & Arrondo, G. (2022). Association between autism spectrum disorder and diabetes: systematic review and meta-analysis. *Neuroscience & Biobehavioral Reviews*, 104592.
- III. Katz, J., Reichenberg, A., & Klevzon, A. (2021). Prenatal and perinatal metabolic risk factors for autism: A review and integration of findings from population-based studies. *Current opinion in psychiatry*, 34(2), 94-104.
- IV. Dhaliwal, K. K., Avedzi, H. M., Richard, C., Zwaigenbaum, L., & Haqq, A. M. (2022). Brief Report: Plasma Leptin and Mealtime Feeding Behaviors Among Children with Autism Spectrum Disorder: A Pilot Study. *Journal of Autism and Developmental Disorders*, 1-8.
- V. Sukasem C, Vanwong N, Srisawasdi P, et al. Pharmacogenetics of risperidone-induced insulin resistance in children and adolescents with autism spectrum disorder. *Basic Clin Pharmacol Toxicol* 2018;123:42-50.
- VI. Hervas, A., Serra-LLovich, A., Rueda, I., Targa, I., Guijarro, S., Bigorra, A., ... & Arranz, M. J. (2021). Pharmacogenetic influences on the response to pharmacological treatment in autism spectrum disorders. *Journal of Translational Genetics and Genomics*, 5(3), 278-287.
- VII. Turpin, P. L., Ahrens, A. P., Russell, J. T., Kindgren, E., Berryman, M. A., Ilonen, J., ... & Ludvigsson, J. (2021). Adolescent autism and autoimmune diagnoses linked to infant gut bacteria whose prevalence is associated with at-risk genetics and/or diet. *medRxiv*.
- VIII. Zhang, Q., Zou, R., Guo, M., Duan, M., Li, Q., & Zheng, H. (2021). Comparison of gut microbiota between adults with autism spectrum disorder and obese adults. *PeerJ*, 9, e10946.
- IX. Biswas, M., Vanwong, N., & Sukasem, C. (2022). Pharmacogenomics in clinical practice to prevent risperidone-induced hyperprolactinemia in autism spectrum disorder. *Pharmacogenomics*, (0).
- X. Patel, D. (2022). Dietary Approaches to the Treatment of Autism Spectrum Disorders.

## **Nutrition Can Modify Gut-Brain Axis and Medication Induced Metabolic Disorders in Autism Spectrum Disorder- A Hypothesis**

- XI. Kong, X. J., Liu, J., Liu, K., Koh, M., Sherman, H., Liu, S., ... & Fong, M. (2021). Probiotic and Oxytocin Combination Therapy in Patients with Autism Spectrum Disorder: A Randomized, Double-Blinded, Placebo-Controlled Pilot Trial. *Nutrients* 2021, 13, 1552.
- XII. Kerry, R. G., Das, G., Golla, U., del Pilar Rodriguez-Torres, M., Shin, H. S., & Patra, J. K. (2022). Engineered probiotic and prebiotic nutraceutical supplementations in combating non-communicable disorders: A review. *Current Pharmaceutical Biotechnology*, 23(1), 72-97.
- XIII. Nettleton, J. E., Klancic, T., Schick, A., Choo, A. C., Cheng, N., Shearer, J., ... & Reimer, R. A. (2021). Prebiotic, Probiotic, and Synbiotic Consumption Alter Behavioral Variables and Intestinal Permeability and Microbiota in BTBR Mice. *Microorganisms*, 9(9), 1833.
- XIV. Sunand, K., Mohan, G. K., & Bakshi, V. (2021). Synergetic Potential of Combination Probiotic Complex with Phytopharmaceuticals in Valproic Acid Induced Autism: Prenatal Model. *INTERNATIONAL JOURNAL OF APPLIED PHARMACEUTICAL SCIENCES AND RESEARCH*, 6(03), 33-43.