

Application of different treatment methods for autism

Tianyu Ma^{1,4,†}, Haihan Wu^{2,†}, Yi Wang^{3,†}

¹ Beijing 21st Century International School, Beijing, 100142, China

² Ulink College, Guangzhou, 511400, China

³ College of Life Science and Technology, Inner Mongolia Normal University, Hohhot, 010022, China

⁴ haiwu2455@ulinkcollege.com

† These authors contributed equally.

Abstract. Today, more than 70 million people around the world suffer from autism, and scientists around the world are working hard to invest in research into autism treatment, hoping to identify the possibility of a cure among the various attempts. At present, there are a large number of studies on various treatment options for autism, but not many summaries of the studies. Due to the complex causes of autism, this research only summarizes some of the therapeutic and training programs that have made progress in autism. This research of existing research suggests that the adverse symptoms of autism can be improved through applied behavior analysis (ABA) therapy, symptom-relieving medications, talk-based cognitive-behavior therapy (CBT), behavioral therapy, gene therapy, gut probiotics supplementation, and web-based training. Although autism is a very complex disease, with the development of technology and in-depth research into its causes, autism is controllable and mitigated. In the future, with more in-depth research, there may be more ways to alleviate the suffering of people with autism.

Keywords: autism, ABA therapy, medications, behavioral therapy, gene therapy.

1. Introduction

As a result of the complicated pathogenic factors of autism spectrum disorder (ASD), it cannot be cured like other diseases caused by bacteria and viruses. In addition, the factors that contribute to the appearance of ASD symptoms can be complex and multifactorial in each case, thus single therapy is not enough to address all risk factors and symptoms. The primary treatments for ASD include behavioral intervention therapy, pharmacological approaches and psychological approach [1]. In the aspect of behavioral intervention therapy, a noteworthy method called applied behavior analysis (ABA) is generally used for curing ASD. The main objective of ABA is to correct behaviors that are harmful or interfere with learning. One of the dominant strategies is positive reinforcement. When the patients get something valuable after performing an action, they will tend to repeat this behaviour. Therefore, when they received rewards such as praise or a toy every time after using a behaviour successfully, this behaviour may be changed. The objective of the ABA program is to help patients learn skills and become more independent in short order as well as in the future. The ABA is considered as an

evidence-based best practice treatment, which contributes to the development of intellectual function, language development, daily living skills and social function.

As for pharmacological approaches, there is no medicine that is found to be effective in treating ASD at present. Current drugs are used to treat specific symptoms, particularly some behaviors including hyperactivity, inattention, impulsivity, aggression, outbursts, self-harming, compulsive behavior, stiffness repetitive behavior, also psychological problems such as anxiety, depression and sleep disorders [2]. Aripiprazole and risperidone are practical in reducing autism symptoms, repeating behaviors, improper expression, social avoidance and behavioral problems. It can also treat irritability in this population. Other drugs, such as neurotransmitter reuptake inhibitor (fluoxetine), tricyclic antidepressant (mimramine), anticonvulsants (lamotirizine), atypical antipsychotics (clozapine) and acetylcholinesterase inhibitors (rivastine) are applied to treat ASD likewise. Therefore, pharmacological therapy can only act on improving behaviors and emotions. Cognitive-behavior therapy (CBT) is a type of talking therapy, which helps patients manage their problems by altering their ways of thinking and acting. Unlike traditional psychotherapy, CBT takes problem as the core, starts with reaction, which means it's used to solve specific problems associated with specific mental disorders. Observations have shown that CBT alone can be effective in treating less severe mental illness compared to psychotropic drugs. It is also commonly recommended in combination with medication to treat ASD. CBT depends on the diagnosis of symptoms, and specific treatments are taken. Hence, compared to other therapies, CBT is much more beloved by the health care industry.

Behavioral therapy is designed to identify and help rectify the potential self-destructive and improper behaviors [3]. It is based on classical conditioning and operant conditioning. The types of behavioral therapy used depends on multiple factors including the condition and the severity of the patient's symptoms. Positive behavioral and support (PBS) is used to figure out why children engage in particular problem behaviors and enhance life quality by teaching new skills and altering personal environment. PRT aims to improve pivotal areas such as social skills and positive communication instead of certain behaviors. It provides child a large number of practice while training a skill in entertaining ways. EIBI is particularly used to help kids, working by formulating individuation intervention plan according to behavioral data. DTT is to break the training in smaller steps so that the kids can practice in a more detailed way, which make it more likely to master a skill. Despite these methods are either rigid or unconstrained, they all based on ABA principles. ABA commonly involves the following programs: assessing the child's current skills and troubles, target setting, designing and carrying out procedures that teach the target skill, measuring the skill to see if the program is effective after working on the program, assessing the program and make improvement. With the expansion of ABA, this therapy is found to be too difficult for children since it has a lot of repeated steps. Another problem is that ABA focus too much on eliminating behaviour instead of cultivating skills.

Gene therapy is a technique that is used to cure diseases by altering a person's genes. It works by replacing and inactivating a disease which causes a healthy copy of the gene and improper functioning of the gene respectively. Gene mutation is found to be one of the risk factors of ASD. For example, deletion of a single copy of SHANK3 on chromosome 22q13 causes cognitive deficit and language barrier, mutation in SPARCL1 leads to abnormal secretion of hevin (a type of extracellular matrix protein which is essential for synaptogenesis regulation and synaptic plasticity). As a result, gene therapy is a potential treatment for ASD which is being researching. Compared with conventional therapies, gene therapy has the ability to effect long-lasting clinical benefit with a single treatment. As a result, this research will analyze different treatments for autism.

2. Analysis of new treatment methods for autism

In recent years, with the development of medical levels, nearly 70 million autistic patients have been diagnosed worldwide, so this disease has aroused people's attention widely. More and more scientists have devoted themselves to the research on the treatment of this disease. Scientists have discovered many possible drugs, treatment regimens, and life adjustments for this disease. In this part, the research mainly analyzes various treatments for autism.

In terms of drugs, some studies have found that clomipramine, fluvoxamine, fluoxetine, sertraline, citalopram, escitalopram, venlafaxine, mirtazapine, and other drugs have some effectiveness in treating autism with repetitive behaviors, but some adverse reactions may also occur. Drugs such as haloperidol, pimozide, risperidone, olanzapine, and aripiprazole are effective in treating the irritating symptoms of autism, but can also cause some adverse events. Finally, methylphenidate, atomoxetine, and clonidine showed some positive effects compared with a placebo in the treatment of attention deficit problems in autism [4]. Other studies have shown that the use of simple gene replacement can restore the missing synaptic function that may lead to autism. Both gene therapy, which has produced many feasible results in mouse experiments, could also be developed as a new potential treatment for autism in the future [5]. In terms of behavioral training, children with autism can be trained in natural behavioral interventions to have positive effects on communication, language, and social behavior. This training method includes repeated language behavior corresponding training for patients to establish the correspondence between behaviors, things, and language to improve their language ability. Moreover, more and more laboratories have launched natural behavior intervention training projects and laboratories. In addition, training through the web can also greatly improve some of the symptoms of autistic children. Some training follow-up surveys on autistic children show that training has a significant effect on improving autistic children's various skills. Through training in spying-themed computer games, children with autism improved their social skills in home and school environments and improved their problem-solving abilities compared to untrained controls. Another experiment found that making a web page for autistic children included training on basic life and vocational skills, and several autistic children showed significant improvement in various skills for the experiment after each 30-minute intervention lasting two months, as shown in Figure 1 [6]. It can be seen that targeted web training can also be used to improve the basic abilities affecting subsequent survival of autistic children, such as social skills and life skills, which proves that this method plays a role in the improvement of autism.

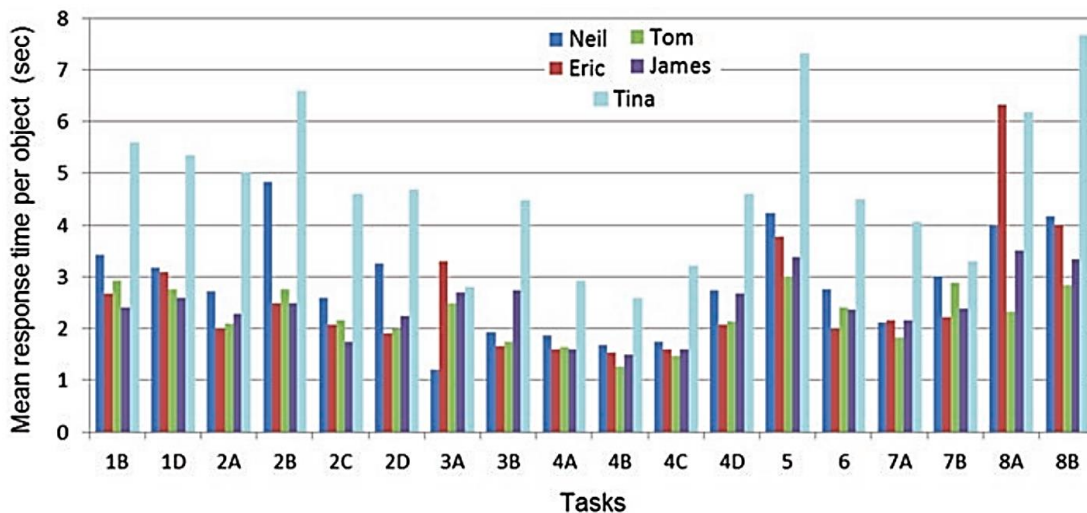


Figure 1. Average response time per object for students [6].

In addition, in terms of diet, some studies have shown that supplementing the intake of some vitamins and essential fatty acids, such as vitamin D, omega-3, omega-6, omega-29, DHA, EPA, and other nutrients has a significant effect on improving the symptoms of autism such as social withdrawal and decreased interest. In addition, eating a gluten-free, casein-free, soy-free diet during the diet can effectively alleviate the symptoms of pica and urinary retention of autism. In addition, the increased supplement of carnitine can significantly improve the declining strength and endurance of autistic patients with strict diet control. As shown in Figure 2, most of the improvement in symptoms occurs in the first three months, after which the change in symptoms becomes smaller [7].

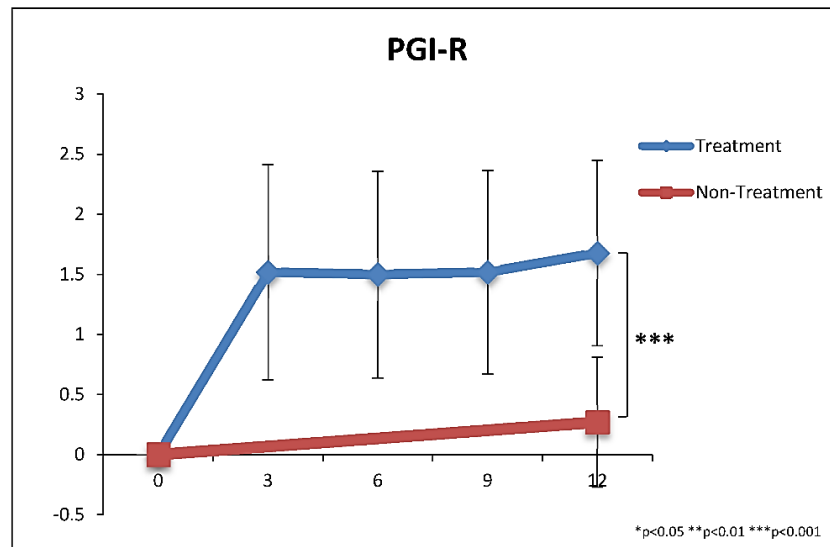


Figure 2. The main efficacy measurement for AD [7].

Autism is a complex disorder that affects many areas of a person's life. It can be very difficult to diagnose and there are no concrete signs or symptoms that can be identified. Autism is usually diagnosed based on the symptoms that are present in an individual, but it is not always clear if these symptoms are caused by autism or another condition. There are many different types of treatment for autism, but each child will have their own unique needs when it comes to treatment. There isn't one specific type of treatment for autism, but there are several different types of therapies and treatments. Some studies have shown that gut probiotics can have some effect on the human nervous system. As a result, the use of gut probiotics might have some effect on the treatment of autism. According to some animal studies and analyses, probiotics, such as bifidobacterium longum, bifidobacterium breviflora, lactobacillus swissoides and lactobacillus rhamnosus, can improve anxiety, depression, and memory-related behaviors when used as probiotic supplements alone or in combination [8]. And the gut microbiome can synthesize and recognize some neurochemicals. The most important thing is the intestinal microbiome, which regulates the activity level of BDNF and NMDAR in the central nervous system. The decrease of BDNF will lead to the failure of the activity and function of NMDAR, resulting in the decline of the function of receptors in the nervous center, which is the beginning of various mental diseases. The supplement of probiotics to the human body can maintain the normal progress of this process and reduce the occurrence of various mental diseases. In the study of mice, it was found that the reduction of intestinal microbes in mice can affect the maturation and function of glial cells in mice, and the study also found that intestinal microbes affect the development of disorders related to the behavioral disorder, such as autism. When the use of TLR3 interferes with the mother's offspring producing autism-like symptoms and when the progeny was given human intestinal bacteria *B. fragilis* at the end of lactation, the intestinal flora of mice was improved, and compared with the control group, the symptoms of social impairment were improved [9]. As shown in Figure 3, the interaction between the gut microbiota, the peripheral immune system, and the central nervous system are critical to maintaining host health. Therefore, it can be seen that the use of probiotics to regulate and improve human autism is of certain effect and value. Gut probiotics can have some effect on the human nervous system, where the use of gut probiotics might have some effect on the treatment of autism.

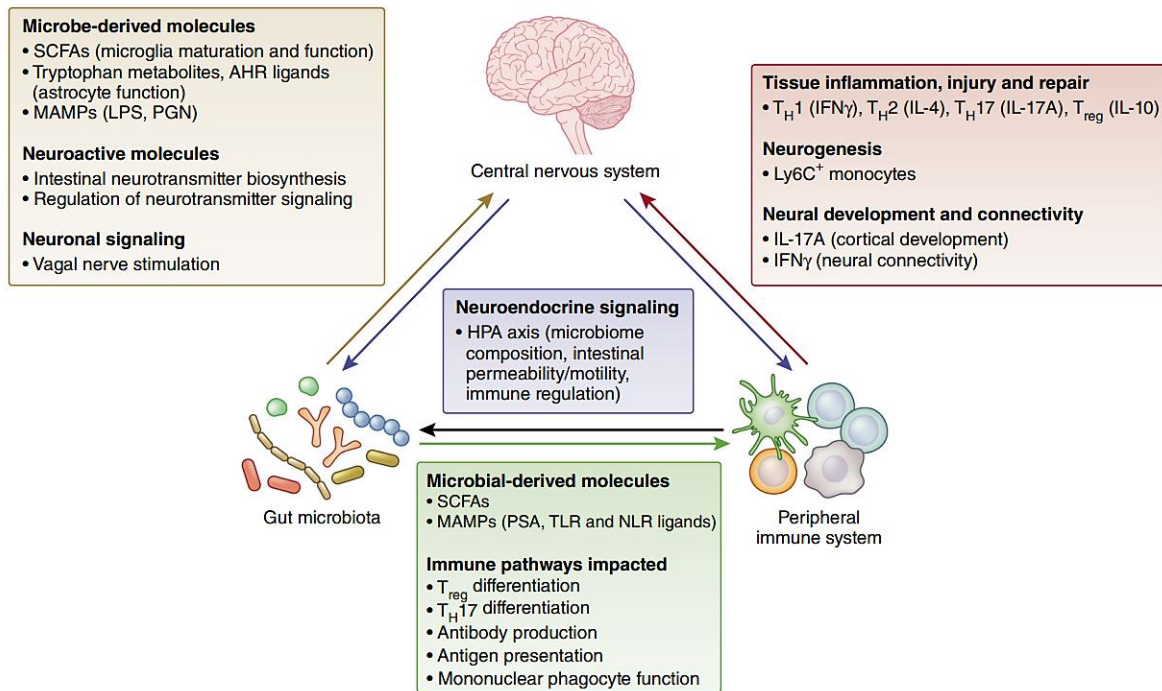


Figure 3. Interactions between the microbiome, immune system, and central nervous system [9].

Up until now, the therapies for the autism spectrum disorder cannot completely cure the disease itself, or to say, not any method is omnipotent. But until now, researchers have already found four ways to alleviate the symptoms, they are speech and language therapy, occupational therapy, behavioral therapy, and medication. This research will be going to explain is the last two, behavior therapy and medication.

For medication, although there is not any of the medicine can shift the thing forever, they can only alleviate the symptoms. For those kids who have this kind of problem, if they have some super active behaviors, they might need to use some medicines that cure these diseases. But they are not omnipotent, sometimes the side effect is even more than the positive effect itself. They can use x methyl and piemoline, which is a kind of central nervous cordial. This is helpful to cure the ASD that are significantly present as the way of cannot be focus or move a lot with no reason at all. However, they need to take the EEG at first to look closer to their brain electro wave and then determine whether they can take this. Of course, there are several other ways to cure, since the ASD have different symptoms and presence. For example, if the kids have a symptom that looked exactly like depression, they can take medicines that cure the depression, such as clomipramine and imipramine. Even though these medicines are meant to cure the depression, but they are pretty helpful in reduce the rate of stereotypical behavior, the behavior of self-injury, or even attack others. If this is not being controlled in time, they might cause a huge effect for the society and themselves.

The medicines that are responsible for cure the psychosis. These types of medicines can effectively reduce the rate of moving a lot, impulsive, hostile movements and repetitive movements. They can use typical antipsychotics that may include chlorpromazine, sulapride, haloperidol, and other medicines that are helpful to solve the disease. Also, in order to cure the hostile behaviors and the possibilities to attack others, risperidone (vicesstone), clozapine and olanzapine are very helpful to reduce. According to the recent research, these medicines will even reinforce and enhance the ability of social interactions [10]. In addition, mood stabilizer can be used to reduce the aggressive behavior and lower the rate of self-injury. These medicines, including sodium valproate, carbamazepine, lithium carbonate. For the mood stabilizer, they can peace the mood and let them have a clearer mind. It is well-known that the kids who have the ASD can be self-destructive, and they may even suicide or tend to kill

others to be killed with them too. As a result, the used of these medicines enables them to be like normal kids, at least on their mood.

Last but not least, in the medicine area, they can obtain vitamins and magnesium salts. They are two substances that can lower the metabolism of neurotransmitters, but these substances have different opinions among people. Some of them believe that these can impose a significant improvement on sleeping and reduce the motivation of anger and harmful behaviors. However, some other people believe that these medicines have no positive effect, only with harm. If it is overdosed, the side effect can be nausea, vomit, and abdominal contamination, excitement, insomnia, and withdrawal of medication. It will be pretty painful for the patients who take the medicine.

About the therapist using behaviors, it is pretty short, and only very helpful in the treatments among children in the early age. In this method, doctors will show infants the name of different objects. The kids with the ASD mainly have the problem with speaking, often refuse to talk to others. The goal for all these trials is to let kids make connections between words and object, let them understand why is it important to communicate with others. By using positive reinforcement, it can build a bond between the objects and words and allow them to speak with others.

3. Conclusion

As the research has demonstrated, the ASD causes abnormal brain function, where communication barriers and repetitive behaviors make it difficult for patients to integrate into society. Although the risk factors of ASD are complicated, a lot of treatments are found to have the potential to cure ASD. As a result, this research analyzes different treatment methods for the ASD. The main therapy for ASD is intervention therapy. It works by changing patients' behavior gradually, which attenuates the symptoms. Similarly, drugs help with the remission of symptoms but with side effects. Gene therapy is being studied during these years. It is possible to treat ASD thoroughly despite the specific method still not clear. Diet and gut probiotic are also proved to be related to the treatment of ASD. The prevalence of ASD keeps increasing these years, which may cost a lot of burden to families, schools, and even society. Although ASD has been studied for a long time, it lags behind other mental disorders. The conclusion of potential treatments for ASD gives details on the research status and may provide new ideas for treating ASD. Up to now, there are no accurate statistics on the number of people with autism due to the difficulty of diagnosing autism. Moreover, there is no cure and no universally applicable treatments. Therefore, the research direction should be focused on the diagnosis of ASD and the new treatments for it.

References

- [1] Velarde, M. and Cárdenas, A., "Trastornos del espectro autista y trastornos por déficit de atención con hiperactividad: desafíos en el diagnóstico y tratamiento [Autism spectrum disorder and attention-deficit/hyperactivity disorder: challenge in diagnosis and treatment]," *Medicina* 82, 67–70 (2022).
- [2] Amadi, C. N., Orish, C. N., Frazzoli, C. and Orisakwe, O. E., "Dietary interventions for autism spectrum disorder: An updated systematic review of human studies," *Psychiatriki* 33, 228–242 (2022).
- [3] Hirota, T. and King, B. H., "Autism Spectrum Disorder: A Review," *JAMA* 329, 157–168 (2023).
- [4] Doyle, C. A. and McDougle, C. J., "Pharmacologic treatments for the behavioral symptoms associated with autism spectrum disorders across the lifespan," *Dialogues in clinical neuroscience* 14, 263–279 (2012).
- [5] Knorz, A. L. and Quante, A., "Alzheimer's Disease: Efficacy of Mono- and Combination Therapy. A Systematic Review," *Journal of geriatric psychiatry and neurology* 35, 475–486 (2022).
- [6] D. Tsiopela, A. Jimoyiannis, In: Mikropoulos, T. (eds) *Research on e-Learning and ICT in Education*. Springer, Cham, 381-395 (2018).

- [7] Adams, J. B., Audhya, T., Geis, E., Gehn, E., Fimbres, V., Pollard, E. L., Mitchell, J., Ingram, J., Hellmers, R., Laake, D., Matthews, J. S., Li, K., Naviaux, J. C., Naviaux, R. K., Adams, R. L., Coleman, D. M. and Quig, D. W., "Comprehensive Nutritional and Dietary Intervention for Autism Spectrum Disorder-A Randomized, Controlled 12-Month Trial," *Nutrients* 10, 369 (2018).
- [8] Thompson, C., McDonald, J., Kidd, T., Falkmer, T., Bölte, S. and Girdler, S., "I don't want to be a patient": Peer mentoring partnership fosters communication for autistic university students," *Scandinavian Journal of Occupational Therapy* 27, 625–640 (2020).
- [9] Fung, T. C., Olson, C. A. and Hsiao, E. Y., "Interactions between the microbiota, immune and nervous systems in health and disease," *Nature neuroscience* 20, 145–155 (2017).
- [10] Pedrazzi, J. F. C., Ferreira, F. R., Silva-Amaral, D., Lima, D. A., Hallak, J. E. C., Zuardi, A. W., Del-Bel, E. A., Guimarães, F. S., Costa, K. C. M., Campos, A. C., Crippa, A. C. S. and Crippa, J. A. S., "Cannabidiol for the treatment of autism spectrum disorder: hope or hype?," *Psychopharmacology* 239, 2713–2734 (2022).