



**Libyan International Medical University**  
**Faculty of Basic Medical Science**



# **Characteristics of brain in Autism Spectrum Disorder**

Amani Mohammed

Supervised by: Dr.Abir Muftah

Assisted by: Sara Elmegerhi

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## **Abstract**

Autism spectrum disorder (ASD) is a highly prevalent neurodevelopmental disorder characterized by impaired social communication and restricted and repetitive behaviors (RRBs). Over the past decade, neuroimaging studies have provided considerable insights underlying neurobiological mechanisms of ASD. In this review, we introduce recent findings from brain imaging studies to characterize the brains of ASD across the human lifespan. Results of structural Magnetic Resonance Imaging (MRI) studies dealing with total brain volume, regional brain structure and cortical area are summarized. Using task-based functional MRI (fMRI), many studies have shown dysfunctional activation in critical areas of social communication and RRBs.

## **Introduction**

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficits in social communication and restricted repetitive behaviors (RRBs). The proportion of the adult population afflicted with ASD is estimated to be 2.4%–9.9% childhood autism is broadly defined by the presence of abnormal and impaired development, which manifests into a series of clinically relevant areas (or symptoms). Several diagnoses are combined into a single dimensional diagnosis, or ASD. Also, two criteria of poor ASD quality in social interaction and communication.

ASD affected nearly 1 in 68 children in the United States in 2014. In Korea, the prevalence of ASD was estimated to be 2.64% in school-age children with a male/female ratio of 3–4:1. Typically the onset of autism is before 36 months of age, Since Horwitz et al. reported linkage of ASD to abnormal brain activity using Positron Emission Tomography (PET). Numerous researchers have focused on ASD, but ASD treatment still remains challenging, as the etiology of ASD is poorly understood it is believed that ASD is a highly heritable disorder and that genetic susceptibility interacts with environmental factors in ASD etiology. Many brain imaging studies have been conducted and provided understanding the underlying neurobiological mechanisms of ASD. developmental perspective may help to understand some contradictory findings in ASD studies Therefore, it is meaningful to review about the ASD brain features depending on age<sup>1</sup>.The aim of this report is to

summarize recent findings from brain imaging researches and to show characteristics of ASD brains in terms of structure and function.

### **Materials and methods:**

The ability to perceive emotional facial expressions and represent common speech gestures is important for social interactions, and deficits in these abilities have been reported in previous fMRI studies in children with ASD. Urbain et al. A study was conducted on a group of children under the age of puberty using MRI<sup>2</sup>.

### **Results:**

Found that children with ASD showed lower activation of the right amygdala, right superior temporal sulcus (STS), and right inferior frontal gyrus (IFG) than typical development (TD) children when they stimulated with fearful face. For the happy face stimuli, children with ASD showed hypo-activation of the left insular cortex. They concluded that the deficits in social cognition of ASD children could be explained by the impairment of the capacity for visual analysis of emotional facial expressions, the subsequent inner imitation through mirror neuron system (MNS), and the ability of transmitting it to the limbic system and processing the transmitted emotion<sup>2</sup>.

### **Discussion:**

A-Brain structure in ASD Since neuroimaging approach is one of the few methods that enable to make direct observation of the brain in vivo, Magnetic Resonance Image (MRI) studies have provided many implications of neurodevelopmental characteristics underlying ASD<sup>2</sup>.

Total brain volume The most coherent finding is an accelerated total brain volume growth in early children with ASD from 2 to 4 years of age. Enlarged brain volume in younger individuals with ASD, However, decreased volume or no difference in older individuals with ASD compared to TDC (explain this abbreviation to the reader). Brain development during early childhood in ASD seems to be predominated by an enlarged brain volume of the frontal and temporal lobes<sup>2</sup>.

Regional brain structure the pathological mechanism that represents an ongoing enlargement of the brain is unclear. Recent progress has evidence that early

overgrowth of ASD brain is caused by an accelerated expansion of cortical surface area but not cortical thickness before the age of 2 years (Reference), thus, accelerated expansion of cortical surface area of the gray matter in ASD seems to be associated with impaired maturation of the cortical white matter. The constituent parts of the neural systems associated with clinical symptoms in ASD, for example, abnormalities in (IFG, Broca's area), (STS), and Wernicke's area might be related to defects in social language processing and social attention, in the frontal lobe, superior temporal cortex, parietal cortex, and amygdala might mediate impairments of social behaviors, and the orbitofrontal cortex (OFC) and caudate nucleus have been associated with RRBs of ASD<sup>2</sup>.

Cortical area Brain overgrowth in childhood of ASD mediates a significant difference in geometry of the brain, several neuroimaging studies have examined other aspects of the cerebral cortex, such as cortical shape and sulcal patterns, since cortical gyrification seems to be associated with an expansion of the outer cortical layers and atypical cortical folding in the brains of children with ASD have been observed, these findings suggest that there is remarkably enlarged gyrification of the frontal lobe in children and adolescents with ASD, regional cortical folding is increased in bilateral posterior brain regions in individuals with ASD during early adolescence and adulthood, and reduced local gyrification in the right inferior frontal and medial parieto-occipital cortices in children with ASD, these various findings imply that the specific pattern of cortical gyrification has been altered across the lifespan and that genetic and environmental factors contribute to aspects of cortical geometry<sup>2</sup>.

B-brain function in ASD At a neuroimaging level, functional MRI (fMRI) and magnetoencephalography (MEG) enable the exploration of atypical brain functions of ASD<sup>3</sup>.

Social communication and social interaction in children Language development is a critical neurobiological process to communicate each other. Delayed language development is one of the early warning signs of ASD, used fMRI to examine the neurobiological deficits in understanding irony in high-functioning children with ASD. In contrast to previous studies showing hypo-activation of regions involved in understanding the mental states of others, children with ASD showed hyper-activation than TD children in the right IFG as well as in bilateral temporal regions, and Deficits

in working memory are important aspects of ASD, as there are some studies suggesting relations between deficits in working memory and social communication impairments. Using MEG, Urbain et al. revealed significant correlation between hypo-activation in the anterior cingulate cortex (ACC) and increased social communication impairments in children with ASD<sup>3</sup>.

## **Conclusion**

Recent findings from neuroimaging studies have led to the understanding of structural and functional abnormalities of the brain development in individuals with ASD, These are also related to the neuronal development and microstructural makeup of cortical folding and the clinical diversity of ASD phenotype might be also reflected on the level of brain structure and function. In this regard, it is important to know about the relationship among the structure, function in the ASD brain.

## References:

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