

FUNCTIONAL EEG ANALYZE IN AUTISM



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Preamble

- **Autism or Autistic Spectrum Disorders (ASD) is a mental developmental disorder, manifested in the early childhood and is characterized by qualitative functioning changes in three fields:
social relationships, communication and behavior.**
- **There are evidences that the spectrum affects the information processes in the nervous system altering the mechanism, how the neurons and their synapses are connected and organized.**
- **It is not yet clear the etiology and the physiological mechanisms of autism and the developmental pervasive disorders.**

Early recognition

- **The diagnosis of autism is rare before the age of 2 years [Simon Baron-Cohen].**
- **Required thorough assessment by a specialist and often by a team of specialists in various fields.**
- **Attwood noted that the ASD can be diagnosed in children in 18 months of age but practically it is difficult to achieve, partly because of the nature of the condition and partly due to lack of accurate instrumental methods.**
- **So far evaluation criteria are entirely behavioral and clinical psychological tests.**

Early detection

- **In the last years leading researchers from various scientific centers in the US and Europe offer new strategies for testing and early diagnosis of ASD using modern neuroimaging methods.**
- **There are hypotheses that by functional f EEG study in children with autistic disorder will present specific profile of physiological changes of the electrical biopotentials and one abnormal functional connectivity between the cortical areas.**
- **Here I will summarize recent findings in the field and compare it with my experience.**

Pervasive developmental disorders

ICD 10 (F-84)

- **This is one group disorders characterized by qualitative abnormalities in the social interaction and communication method, with limited, stereotyped, and repetitive interests and activities.**
- **This group is characterized by the development of individuals outside the norm in infancy, starting no later than the third year.**
- **To determine the disorder is important the atypical behavior comparing to the mental age.**
- **The most individuals in the group presenting general cognitive impairment.**

New diagnostic criteria of DSM-V

- **In the latest revision of the DSM-V is a completely new definition concerning the autistic spectrum.**
- **In DSM-IV, there are five distinct disorders: autism or classic autism, Asperger syndrome, pervasive developmental disorder indefinite elsewhere, Rett syndrome, disintegrating disorder in childhood.**
- **This classification still exists in the latest revision of the ICD 10, but in the new criteria of DSM-V they all in a single group - autistic spectrum disorders (ASD), exception of Rett syndrome, which is now a separate genetic condition.**

Prevalence:

The prevalence of autism increased to alarming levels, that the US Centers for Control and Prevention of Diseases (CDC) defines as "epidemic."

According to the latest data (2010.), one in every 68 children is affected.

Table of CDC 2010

Identified Prevalence of Autism Spectrum Disorder

ADDM Network 2000-2010
Combining Data from All Sites

Surveillance Year	Birth Year	Number of ADDM Sites Reporting	Prevalence per 1,000 Children (Range)	This is about 1 in X children...
2000	1992	6	6.7 (4.5 – 9.9)	1 in 150
2002	1994	14	6.6 (3.3 – 10.6)	1 in 150
2004	1996	8	8.0 (4.6 – 9.8)	1 in 125
2006	1998	11	9.0 (4.2 – 12.1)	1 in 110
2008	2000	14	11.3 (4.8 – 21.2)	1 in 88
2010	2002	11	14.7 (5.7 – 21.9)	1 in 68

Etiology and pathogenesis:

Hypothesis:

- 1. Genetic and chromosomal abnormalities**
- 2. Hormonal disorders**
- 3. Pre-, intra- and post-natal brain damage**
- 4. Infectious diseases and immune dysfunction**
- 5. Neuroanatomical factors**

Etiology and pathogenesis:

Neuroanatomical factors

- **Few researches detected cellular and structural changes in the nervous tissue of autistic people.**
- **Nuclear magnetic resonance shows that the brains of autistic people has different volume compared to control groups.**
- **There are non-specific changes in the hippocampus, thalamus, ventricles, and cerebellum.**
- **Changes in the neuromediation and biochemistry of the affected individuals.**

Functional changes of the nervous system in individuals with ASD

- **Electroencephalography (EEG), in particular a functional EEG, which measures neurophysiological changes associated with synaptic activity in the neocortex, is one proven powerful tool to analyze the complex neuropsychiatric disorders.**
- **EEG is a key method to characterize abnormal paroxysmal epileptiform activity by identifying typical patterns.**
- **EEG examinations in resting position shows 20 to 30% of people with ASD indicate epileptiform discharges, but not always with presence of seizures.**

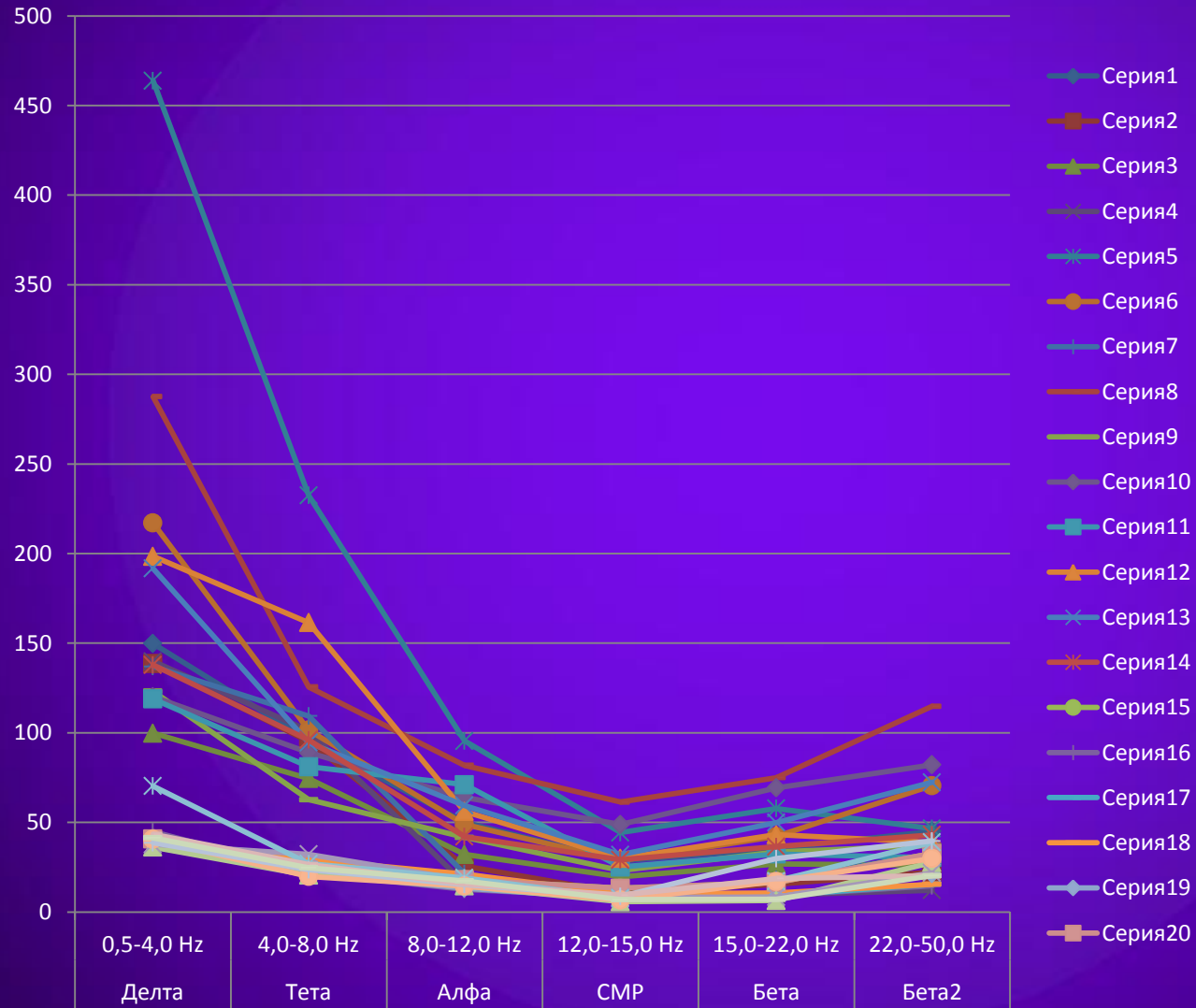
Functional changes of the nervous system in individuals with ASD

- **Functional EEG study is characterized by dividing the frequency of oscillating bars, which present certain physiological properties and information.**
- **The typical clinically significant frequency in fEEG are from 0.3 to 70 Hz. Here I will focus on six bands ranging from 0.5 to 50 Hz:**
 - **Delta (0,5 and 4Hz),**
 - **Theta (4 to 8 Hz),**
 - **Alpha (8 to 12 Hz),**
 - **Mu (SMR 12 to 15Hz),**
 - **Beta1 (15 to 22Hz), and**
 - **Beta 2 (range - 22 to 50Hz).**
- **These empirically determined frequencies are subject of rising interest in neuroscience and are mentioned to be responsible for specific cognitive processes.**

- **Delta waves dominate in deep sleep and presenting events of slow wave spectrum, responsible for healing processes in our body, alternating arousal and sleeping, etc.**
- **Theta- activities, most frequently associated with the processes of memory - the transfer of short-term memory to long term during the sleeping phases. Generate predominantly of the thalamus nuclei and hippocampus.**
- **Alpha waves presenting by awake individuals in the relaxed condition and are accurate indicator of sensory and cognitive inhibition.**
- **Beta1 waves associated with alertness, active engagement with tasks and generating motor responses.**
- **Beta 2 (gamma) waves are common in intensive processes of working memory and in a variety of early sensory responses. It is believed that facilitate specific functions in sensory processing, but also indicators of stressful arousal.**

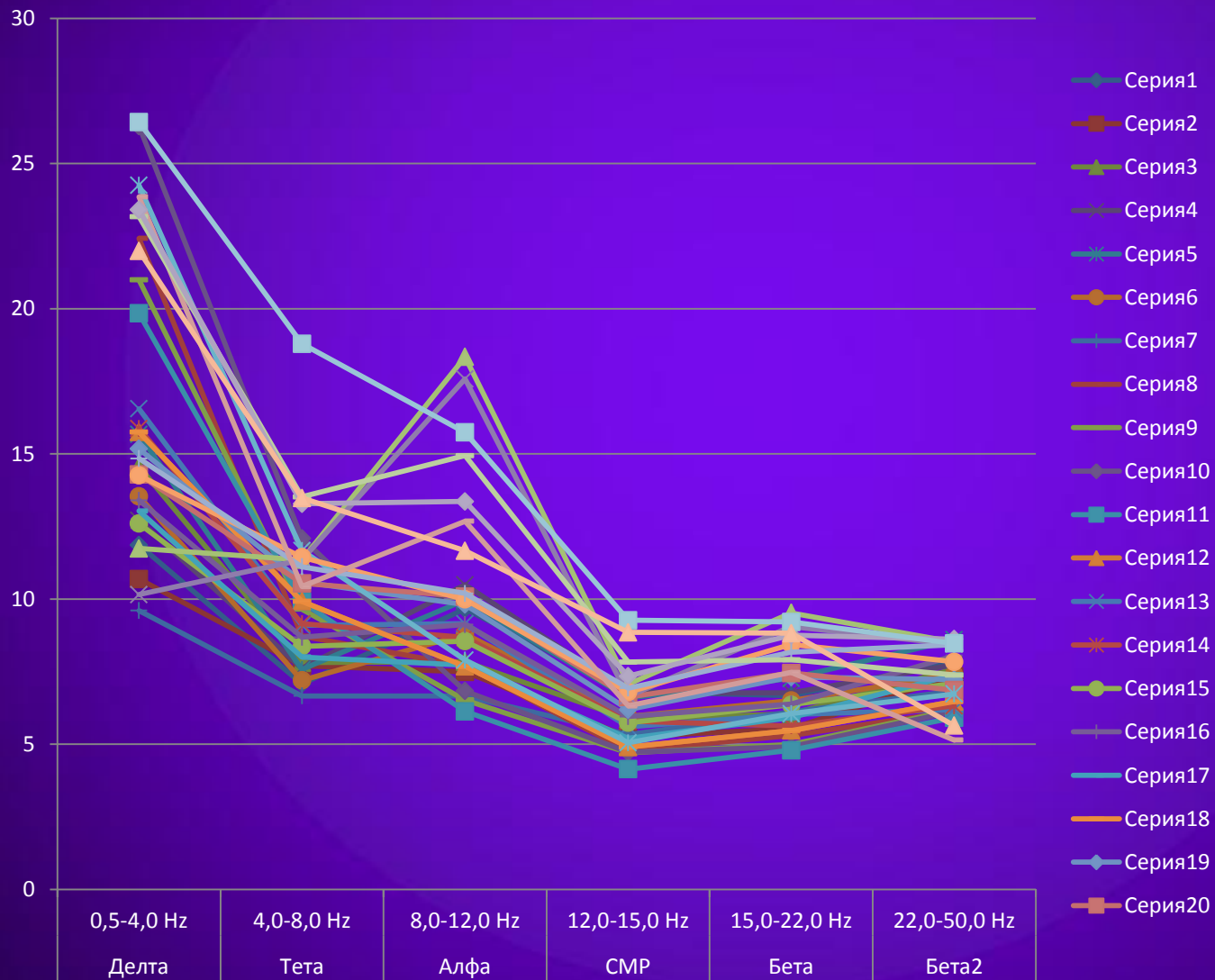
Results:

1. Total ASD



Results:

2. Total in norm



Results:

3. Total ASD - averages



Results:

4. Total rate - averaged



Conclusion:

- 1. The data analysis identified very close results comparing to the experience, shared by other investigators.**
- 2. These results are encouraging to develop one method for early screening and differential diagnosis.**
- 3. Functional EEG research is objective non-invasive method of application.**
- 4. The method is easy and convenient to use**

Benefits

- **Comparing to the MRI, f EEG is useful in a wider range of age groups to study the physiology of the brain and has a higher relative tolerance for involuntary movement, more easily applicable in clinical and outpatient settings.**
- **Allows data to be archived for repeated measurements.**
- **f EEG is non-invasive, unlike MRI, or positron emission tomography.**
- **The study of resting EEG doesn't require active participation of the patients.**
- **Functional EEG study offers promising opportunities as an approach for monitoring and tracking the outcomes of the treatment.**

Thank you for your attention!