

Serum Lactate, AST, ALT in Male Autistic Children in Bangladesh

Mahmuda Karim¹, Shelina Begum², Shorifa Shahjadi³

Abstract

Background: Mitochondrial dysfunction has been found associated with abnormal brain bioenergetics resulting in autistic spectrum disorder (ASD). **Objective:** To assess serum lactate, AST, ALT in order to observe the mitochondrial dysfunction in male children with autistic spectrum disorder. **Method:** This case-control study was conducted in the Department of Physiology of Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka from January, 2013 to December, 2013. Total 100 male children with age range 3-8 years were randomly selected, among which 50 were normal children and 50 were diagnosed autistic children. Autistic children were enrolled from the Parent's Forum for autistic children in Dhaka and the control subjects were selected from normal school. Serum lactate, Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) were estimated in all children by standard laboratory method. Independent sample 't' test was used for statistical analysis. **Results:** All these biochemical parameter were found significantly higher ($p < 0.001$) in ASD children. In addition, elevated levels of serum lactate, AST and ALT were found in 94%, 46%, and 30% of autistic children respectively. **Conclusion:** From the result of this study it can be concluded that mitochondrial dysfunction may occur in children with autistic spectrum disorder.

Key words: Autistic spectrum disorder, Mitochondrial dysfunction, Lactate, Aspartate aminotransferase, Alanine aminotransferase.

J Bangladesh Soc Physiol. 2015, December; 10(2): 56-60

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Introduction

Autistic spectrum disorders (ASDs) is a group of neuro developmental disorder associated with altered behavior of communication of a person.¹ The word spectrum refers to a wide range of disorders having different domains according to severity of features². It is a generalized term for a group of complex brain disorder having feature of impaired social interaction, verbal and non-verbal communication, repetitive and restricted behavior³. It usually appears within first three years of life¹ and males are more affected³.

Abnormal brain bioenergetics and dysfunction of mitochondria can cause autism⁴. Autistic spectrum disorders manifest disruption in multiple high energy organ system like central nervous system, muscular and gastrointestinal systems. So, mitochondrial dysfunction is important factor which lead to cellular function impairment. This may lead to cognitive impairment, language deficits and abnormal energy metabolism in autistic spectrum disorders⁵. A recent study revealed that 80% children with autistic spectrum disorder may have mitochondrial dysfunction⁶.

Received June 2015;

Accepted August 2015

Cerebral folate deficiency, vitamin B₆ or iron deficiency, genetic mutation, certain environmental toxin such as pesticides or heavy metals chemicals can impair mitochondrial activity^{7,8}. In mitochondrial dysfunction excess reactive oxygen species (ROS) are produced which deplete GSH store in cell. As a result cells are more vulnerable to oxidative stress and damage from mitochondrial ROS.⁹

The mitochondrial disorders are characterized by various clinical, biochemical, molecular and histological features. Biochemical parameters for mitochondrial dysfunction include increased serum lactate, aspartate aminotransferase (AST) and alanine aminotransferase (ALT)⁶

Autistic spectrum disorder children with mitochondrial dysfunction show impaired TCA cycle due to some enzyme deficiency, abnormal nutrients metabolism or nutritional deficiency. Impaired TCA cycle stops aerobic respiration which initiates anaerobic respiration causing increased level of lactate.¹⁰

Mitochondrial dysfunction causes loss of some cellular integrity of certain organ such as muscle and liver and enzymes of these organs come out of cell. So aspartate aminotransferase and alanine aminotransferase are released and serum level of these enzymes rises¹.

In USA, serum lactate, AST and ALT found increased in 76%, 36% and 52% of autistic spectrum disorders children.¹¹ In 2006, a study on mitochondrial dysfunction with autism, reported elevation of serum AST in 38% autistic children¹². Therefore, estimation of serum lactate, ALT, AST can be useful in evaluation of mitochondrial dysfunction in autistic spectrum disorder.¹³ This study aimed to observed levels of ALT, AST and lactate to evaluate mitochondrial dysfunction in autistic spectrum disorder (ASD).

Methods

This case control study was conducted in the Department of Physiology of Bangabandhu

Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka from January, to December, 2013. Total 100 male children with age range 3-8 years participated in this study. Fifty autistic children diagnosed by psychiatrist according to Childhood Autism Rating Scale (CARS)¹⁴ taken from the Parent's Forum, Directorate General of Health Service (DOHS), Mohakhali, Dhaka and fifty control children was selected from some normal school. After selection of the subject, thorough information was given to their parents about the objective and study procedure. Their parents were encouraged for voluntary participation with their children. When their parents agreed for participation then an informed written consent was obtained from their parents. The protocol of this study was approved by the Institutional Review Board of BSMMU. Children with epilepsy, turner syndrome, down syndrome and any kind of medication were excluded from this study. The parents of all subjects were requested to attend the Department of Physiology of BSMMU, Dhaka at 9:00 AM for examination of their children. Detail personal, medical, family, socioeconomic and dietary histories of the children were recorded in a data schedule. Thorough physical examinations of the subjects were done. Anthropometric measurement including height and weight were taken and BMI was calculated. Then under aseptic precaution, 5 ml of venous blood were collected from ante-cubital vein from each subject of both groups for biochemical test. Serum lactate level was measured in the laboratory of the Department of Biochemistry, BIRDEM General Hospital by colorimetric method. Serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) level were measured in the laboratory of the Department of Biochemistry, BSMMU by auto analyzer using kit from IFCC (International Federal Clinical Chemistry). Data were expressed as mean \pm SE and also in percentage. Statistical analysis was done by using SPSS for windows version 16. Independent samples 't' test were used as the tests of significance. P value <0.05 was accepted as significant.

Results

All the subjects of this study were similar for age and BMI. (Figure 1).

In this study mean values of serum lactate, AST and ALT levels were significantly higher ($p < 0.001$) in autistic children in comparison to that of normal children (Table I). Abnormally higher level¹⁵⁻¹⁶ of serum lactate, AST, ALT were found in 94%, 46% and 30% respectively in autistic children. No control children had elevated levels of these parameters (Table II).

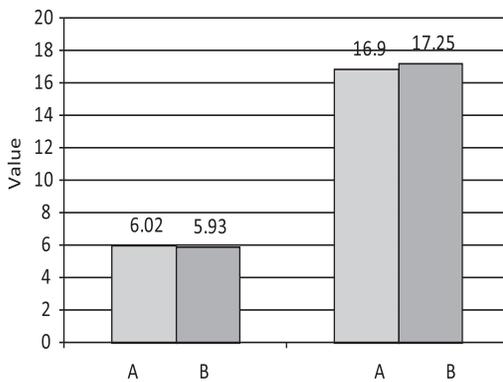


Figure 1: Mean Age (years) and Body mass index (BMI) (kg/m²) of study subjects. A=Control and B= Autistic children

Table I: Serum lactate, AST and ALT of both groups (n= 100)

Variables	Control (n=50)	Autistic (n=50)
Serum Lactate (mg/dl)	12.10 ±0.34 (8-17)	29.31±1.32*** (16-56)
Serum AST(U/L)	24.20 + 0.82 (15-35)	36.24+1.73*** (17-63)
Serum ALT (U/L)	37.14+ 1.48 (17 -56)	49.06+2.47*** (28 – 81)

Data are expressed as Mean ±SE. Independent sample 't' test was used for statistical analysis. Figures in parentheses indicate ranges. ***p < 0.000

Table II: Frequency by elevated levels of serum lactate, AST and ALT of study subjects.

Variables	Control (n=50)		Autistic (n=50)	
	No	(%)	No	(%)
Serum lactate	0	(0)	47	(94)
Serum AST	0	(0)	23	(46)
Serum ALT	0	(0)	15	(30)

Cut point⁽¹⁵⁻¹⁶⁾ for serum lactate >15mg , AST >35U/L, ALT>56U/L

Discussion

The present study was undertaken to observe some biochemical variables in male children with autistic spectrum disorders in order to evaluate their mitochondrial dysfunction. Mitochondrial dysfunction were assessed by estimating serum lactate, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) level in male children with autistic spectrum disorders. All these variables were also studied in apparently healthy age and BMI matched male children for comparison. In this study, mean values of all the biochemical variables of control children were within physiological limit and were almost similar to those reported by different investigators^{2,12,17-19}.

In this study, significantly higher level of serum lactate, AST and ALT in the autistic children was agreed to other investigators.^{2,12,13,19-23} Though higher lactate level were observed by some investigators^{2,6,24} but it was not significant.

Again, elevated serum lactate in 94%, AST in 46% and ALT in 30% of autistic children which was consistent with other investigators^{11, 12,17,18,24}.

It has been suggested that mitochondrial dysfunction causes TCA cycle abnormality leading to rise of serum lactate level¹⁰ Mitochondrial dysfunction also causes loss of some cellular integrity of muscle and liver and enzymes and serum aspartate aminotransferase and alanine aminotransferase level are rises¹.

Conclusion

From the result of this study, it may be concluded that mitochondrial dysfunction may occur in children with autistic spectrum disorder.

Conflict of interest: None

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