Tabatadze T., Kherkheulidze M., Chkhaidze I., Ivanashvili T., Kandelaki E.

INFLUENCE OF MICROELEMENT'S MISBALANCE ON CHILDREN'S BEHAVIORAL PROBLEMS M. IASHVILI CHILDREN'S CENTRAL HOSPITAL, CHILD DEVELOPMENT CENTER; IV.JAVAKHISHVILI TBILISI STATE UNIVERSITY

The role of microelements in children's global development is usually assessed by the response to supplementation in populations thought to be microelements deficiency [1,2,4,5,6,8,10,11,12,18,19,20]. The most of researches that link single microelements to child behavioral development do not address the possibility of interactions with other micronutrient deficiencies or excess [3, 13, 14, 15, 16, 17, 18]. This highlights the need for studies that address comorbidity and interrelationships among microelements in regard of child behavior and development. Therefore, identification of the microelement's imbalance and its correction at the early stage of child's development is on particular significance.

Aim

The aim of our study was to assess hair elemental status (27elements, among them trace and toxic elements) in children with behavioral problems (such as anger, aggression, excessive activity, emotional instability) determine microelemental imbalances and heavy metal concentrations and its impact on child behavior.

Material and Methods

Casecontrol study was conducted at Child Development Center of Iashvili Children's Central Hospital .We studied 4 to 5 years old95 children. The target group involved 45 children with behavioral problem, among them children with conduct disorder (with symptoms such as anger, aggression)and with hyperkinetic syndrome (with symptoms as excessive activity, emotional instability). The first part of the survey package include parents interview to obtain information about factors which may influence the behavioral status of children, including the child's birth and medical history (difficult pregnancies, premature birth, low birth weight, neurodevelopmental delay and etc..), family characteristics (leave with one parent, parents education, teenager mother and etc…), social status, and housing factors. It was important to rule out acute and chronic stressors that might be disrupting the child's behavior. For control were assessed 50 children of same age with normal behavioral and physical development. The control group demographic and family characteristics were similar with target group. There was equal representation across the diagnostic and control groups in regards to annual family income. In the target group all participant's behavior were assessed with behavior symptom checklist and the 6 months followup assessment and met the criteria for disruptive behavior disorders in the DSM V (Diagnostic and Statistical Manual of Mental Disorders from the American Psychiatric Association). For determining target group we also used PEDS (Parents Evaluation of Developmental Status) and ASQ (Ages & Stages Questionnaires for parents).The final diagnostic were performed by psychologist

evaluation. Child microelemental status was detected in the hair, with roentgen-fluorescence spectrometer method(Method MBÈ 081/12-4502-000, Apparatus ALVAXCIP, USA-UKRAIN) [7,9].The study was statistically analyzed using computer program SPSS 19(Statistical Package for the Social Science 19).

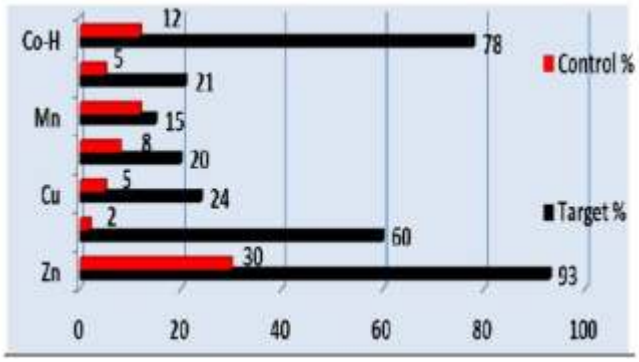
Results

The results of study revealed deficiency of major elements (Zn,Fe, Cu,Mn, Co,Se) that was presented in both (target and control) groups. Our research didn't reveal significant changes in other 17 elements level (K, Cr, S , Cl,, Ag,V, Ni, Rb, Sr, Mo, Sr,, Ba, As, Zr, Sb, Sn, Cd). So further we discuss only the microelements which show significant imbalances. As shown on diagram I, deficiencies of the microelements is seen in both groups, but significant difference was revealed (between control and studied groups) in case ofZn (zinc), Fe (iron), Co (cobalt),Cu (cooper), Se(selenium)(table2).Our study didn't reveal significant dif- (conduct disorder group and hyperkinetic syndrome group), the only exception was cobalt with high percent of deficiency in hyperkinetic subgroup(Co deficiency in conduct disorder subgroup revealed in 5 children(21 %) and in hyperkinetic syndrome subgroup – in 20 children (78%).The study revealed in both groups contamination with heavy metals such as Pb (lead), Hg(mercury), Ti(titanium) and toxic concentration of bromine(Br) (diagram II), but especially high percent was revealed in case of Pb (lead), Hg(mercury) and Br (bromine). In target group lead was detected in 100% of cases(45 children).In 40% of cases (18 children) the content of lead was above socalled minimal allowed level(5,0 ppm <Pb >2,0 ppm) and in 60 % (27 children) the content of lead in the hair was above socalled maximal allowed level (Pb > 5,0 ppm).In the control group lead in the hair was detected in 10 % (5 children) of cases, though the concentration was only in 4 % of cases (2 children),higher than so called maximum allowed level and in 6% (3 children) of cases minimal lead concentrations were detected (diagram 2).Mercury (Hg) detection was conducted in both, target (29%) and control group (13%), bromine (Br) content – 33% & 5% and titan (Ti) content 20% & 10% in the study and control groups respectively. _ _

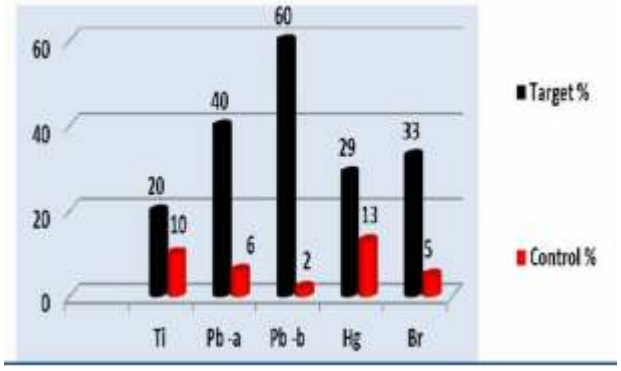
Conclusions

Study results clearly indicated deficiency of essential trace elements, especially zinc, iron and cobalt and high levels of toxic elements such as lead and mercury and toxic concentration of bromine in children with behavioral problems. Lead invasion patterns was clearly seen in both (control and target) groups and subgroups (Pb-a-minimal lead content group and Pb-b- maximum lead content group).So, no level of lead exposure appears to be 'safe' and even the current 'low' levels of exposure in children are associated with neurobehavioral deficits.So,detection of essential trace elements, toxic elements and heavy metals concentrationsin hair as well as in blood and analyzing its influence on health and development have great importance especially during early years, in the period

of most active growth and development. Diagram I



Percentage of Microelements Deficiency in Target and Control Groups Co-H - cobalt deficiency as a percentage in hyperkinetic group. Co-C - cobalt deficiency as a percentage in conduct disorder group.



Percentage of Toxic Elements Concentrations in Target and Control Groups 1.Pba-5,0ppm<Pb> 2,0 ppm ; the percentage number of participants with content of lead above so-called minimum(Pb<5,0 ppm) allowed level. 2. Pb b > 5,0ppm -The percentage of participants with the content of lead above socalled maximum allowed level. 3. ppm - this is a way of expressing very dilute concentrations of a million. One ppm is equal to 0.0001%.

Table 1

Statistical Significance of Study Results		
ESSENTIAL ELEMENT	PIRSON CHI-SQUARE	KRAMER'S V
Zn	Sig 0,000 (p<0,05)	0,657 –high association
Fe	Sig 0,000 (p<0,05)	0,449 –medium association
Cu	Sig 0,013 (p>0,05)	0, 270 –low association

Se	Sig 0,09 (p>0,05)	0,179 –low association
Mn	Sig 0,167 (p>0,05)	0,150 –low association
Co-H	Sig 0,000 (p<0,05)	0,596 –high association
Co-C	Sig 0,557 (p>0,05)	0,07 –low association
TOXIC ELEMENTS		
Pb-b	Sig 0,000 (p<0,05)	0,523 -– high association
Pb-a	Sig 0,000 (p<0,05)	0,376—medium association
Ti	Sig 0,201 (p>0,05)	0,139 –low association
Hg	Sig 0,000 (p<0,05)	0,552 –high association
Br	Sig 0,01 (p<0,05)	0,354 – medium association

References:

1. Anderson Karie.N., Micronutrients and brain function. Mineral Resources Intarnational,Inc.. August 2015.

2. Beard John, Neurocognitive Function and Trace Elements,J. Nutr. 133: 1468S–1472S, 2003

3. Kozielec T, Starobrat-HermelinB, Kotkowiak L. Deficiency of certain trace elements in children with hyperactivity. Psychiatry Pol. 1994 May-Jun;28(3):345-53.

4. Kracke KR: Biochemical bases for behavior disorders in children. Journal of Orthomolecular Psychiatry, 1982; 11: 289-296

5. Mendelson AL, Dreyer BP, et al. Low level lead level exposure and behavior in early childhood. Pediatrics 1998, 101 (3):E10.

6. Oberleas D, Caldwell DF, Prasad AS. Behavioral deficit with zinc deficiency Psykhoharmacol Bull. 1971; 7:35.

7. Passwater and Cranton, Trace Elements Hair Analysis and Nutrition,1983.

8. Prasad AS. Zinc deficiency in human subjects. Prog Clin Biol Res. 1981;77:165–177. [PubMed]

9. Roentgen-fluorescence spectrometer method. Method MBÈ081/12-4502-000, Apparatus ALVAX- CIP, USAUKRAIN).

10. Liu J[1] , Hanlon A[2] , Ma C[3], Zhao SR[4] , Cao S[5], Compher C[6] , Low blood zinc, iron, and other socio-demographic factors associated with behavior problems in preschoolers.

11. Monica Juneja; Rahul Jain; Vikrant Singh; Mallika, V. Iron deficiency in Indian children with attention deficit hyperactivity disorder. Journal Indian Pediatrics 2010 Vol. 47 No. 11 pp. 955-958

12. BenerA[1], Kamal M[2], Bener H[3], Bhugra D[4]. Higher prevalence of iron deficiency as strong predictor of attention deficit hyperactivity disorder in children. Ann Med Health Sci Res. 2014 Sep; 4 (Suppl 3): S291-7. doi: 10.4103/ 2141-9248.141974.

13. Bhatnagar S[1], Taneja S. Zinc and cognitive development. Br J Nutr. 2001 May; 85 Suppl 2:S139-45.

14. Yeiser EC, Vanlandingham JW, Levenson CW: Moderate zinc deficiency increases cell death after brain injury in the rat. Nutr Neurosci 5:345–352, 2002.

15. Sandstead HH, Penland JG, Alcock NW, Dayal HH, Chen XC, Li JS, Zhao F, Yang JJ: Effects of repletion with zinc and other micronutrients on neuropsychologic performance and growth of Chinese children. Am J ClinNutr 68:470S–475S, 1998.

16. Lozoff B[1] , Castillo M[2] , Clark KM[3] , Smith JB[4] , Sturza J. Iron supplementation in infancy contributes to more adaptive behavior at 10 years of age.

17. Oulhote Y[1] , Mergler D, Barbeau B, Bellinger DC, Bouffard T, Brodeur MÈ, Saint-Amour D, Legrand M, Sauvé S, Bouchard MF. Neurobehavioral function in school-age children exposed to manganese in drinking water. Environ Health Perspect.2014 Dec;122(12):1343-50. doi: 10.1289/ ehp.1307918. Epub 2014 Sep 26.

18. Zamora J[1], Velásquez A, Troncoso L, Barra P, Guajardo K, Castillo-Duran C. Zinc in the therapy of the attentiondeficit/hyperactivity disorder in children. A preliminar randomized controlled trial. Arch LatinoamNutr. 2011 Sep;61(3):242-6.

19. Huss M[1], Völp A, Stauss-Grabo M. Supplementation of polyunsaturated fatty acids, magnesium and zinc in children seeking medical advice for attention-deficit/hyperactivity problems - an observational cohort study. Lipids Health Dis. 2010 Sep 24;9:105. doi: 10.1186/1476-511X-9-105.

20. Lozoff B[1] , Castillo M[2] , Clark KM[3], Smith JB[4] , Sturza J. Iron supplementation in infancy contributes to more adaptive behavior at 10 years of age. J Nutr. 2014 Jun;144(6):83845. doi: 10.3945/jn.113.182048. Epub 2014 Apr 9.

ტაბატაძე თ., ხერხეულიძე, მ. ჩხაიძე ი., ივანაშვილი თ., კანდელაკი ე.

მიკროელემენტების დისბალანსის გავლენა ბავშვის ქცევით დარღვევებზე

თსმუ; მ.იაშვილის ბავშვთა ცენტრალური საავადმყოფო; ბავშვის განვითარების ხელშეწყობის ცენტრი

მასალა და მეთოდები: შემთხვევა - კონტროლის ტიპის კვლევა მოიცავდა ქცევითი პრობლემების მქონე 4-დან 5 წლამდე ასაკის 95 ბავშვს, აქედან 20-ს აღენიშნებოდა ქცევის აშლილობა (სიბრაზე, აგრესია), ხოლო 25-ს კი-ჰიპერკინეტიკული სინდრომი (მოჭარბებული აქტივობა, ემოციური არასტაბილურობა).საკონტროლო ჯგუფს შეადგენდა იმავე ასაკის, ნორმალური ფიზიკური და ქცევითი განვითარების 50 ბავშვი. თმის ელემენტური სტატუსის შესწავლა ხდებოდა რენტგენო-ფლუორესცენტული სპექტრომეტრიის მეთოდით. კვლევის სტატისტიკური ანალიზი ჩატარდა კომპიუტერული პროგრამა SPSS19-ის საშუალებით.

მიზანი: კვლევის მიზანს წარმოადგენდა თმის ელემენტური სტატუსის (27 ელემენტი, მათ შორის ესენციური მიკროელემენტები და ტოქსიური ელემენტები) შესწავლა ქცევითი დარღვევების მქონე ბავშვებში, თმაში მიკროელემენტური დისბალანსისა და მძიმე მეტალების კონცენტრაციის დეტექცია და მათი გავლენის შეფასება ბავშვის ქცევასა და განვითარებაზე.

შედეგები: კვლევის შედეგების სტატისტიკური დამუშავების შედეგად გამოკვეთა ესენციური მიკროელემენტების, განსაკუთრებით კი თუთიის, რკინისა და კობალტის დეფიციტი, მძიმე მეტალების (ტყვია და ვერცხლისწყალი) შემცველობის მაღალი დონე და ბრომის ტოქსიური კონცენტრაცია ქცევითი პრობლემების მქონე ბავშვებში.