Nutritional Reflection on Growth and Development among Intellectual Disabled Children

Marwa Nasr[1], Howaida H El Gebaly[2], Salah Mostafa[3]*, Rania Samy[4] and Mageda Ramzy[5]

[1]*Institute of environmental studies and research Ain Shams University, Egypt*

[2]*Professor of Pediatrics [Genetic], Dean of Faculty of Post Graduate Childhood Studies, Ain-Shams University, Egypt*

[3]*Professor of Preventive Medicine and Epidemiology, Faculty of Post Graduate Childhood Studies, Ain Shams University, Egypt*

[4]*Department of Medical Studies for Children, Faculty of Post Graduate Childhood Studies Ain Shams University, Egypt*

[5]*The National Institute of Nutrition, Egypt*

Corresponding Author*

Salah Mostafa
Department of Preventive Medicine and Epidemiology,
Ain Shams University, Egypt
E-mail: salahmost42@gmail.com
Tel: 00201111104775

Received: 24 Apr 2020; **Accepted:** 12 Jun 2020; **Published:** 18 Jun 2020

Abstract

Background: There are many factors contribute with process of CNS development, starting from fetus stage. Many studies revealed that there is a strong relationship between neurodevelopmental delay, neuro-disability, and malnutrition. Socioeconomic and demographic factors have an impact on children growth and development. This clinic-based study aimed to detect nutritional problems and its reflection on growth and mental development through determination of the nutritional profile among disabled children.

Methods: All subjects underwent specified inclusion and exclusion criteria. All subjects were exposed to the following clinical assessment: history taking include age, sex, onset and duration of disorder and family history.

Assessment of nutritional status using developmental nutritional questionnaire which includes: Demographic and socioeconomic data: age, gender. WHO anthropometric measurement protocol used: BMI were calculated as the weight in kg divided by the height square in meters (WHO, 1996) 24 hr dietary recalls were collected using the Multiple Pass Food Recall (MPR) method which is a 5 step approach, developed by the United State Department of Agriculture (USDA). Sheet of 24hour recalls were collected for each participant. Full clinical examination was carried out. Complete blood count with differential leucocytic count, IQ test: using Stanford-bennet 5th edition was carried out.

Results: Significant difference in the residential places between the two groups of lower and higher IQ. The birth order is significantly related to level of IQ in children. The gross motor development is delayed in the lower IQ group of children, increased hyperactivity tends to be more prevalent in higher IQ children. The TLC level is inversely proportional with IQ value. p=0.01 the correlation is highly significant. By applying food analysis there is significant difference in the elements they get between the two groups of children (of lower and higher IQ). Multiple analysis showed significant relationship between orientation and zinc intake with IQ of children.

Conclusion: Intellectual disability is more prevalent in rural and popular residential. As the birth order increase the percentage of lower IQ increase. The gross motor development is directly proportional with IQ. The total leukocytic count was higher value for low IQ children group. Dietary profile for Intellectual disabled children (of lower IQ) is regarded to be richer with dietary elements and vitamins than that for higher IQ children. According to the multiple analysis orientation and zinc intake are the most effective variables on the IQ scores.

Keywords: Intellectual disability • Nutritional factors • IQ level • Socioeconomic impacts

Introduction

Low socioeconomic level was highly related to some sorts of disabilities such as mental retardation, delayed language and behavior disorder, on the other side some studies revealed that there is significant association between cerebral palsy and severe preterm maternal hypertension, antepartum hemorrhage, and preterm uterine activity.

Many studies have revealed that there is Negative relationship between birth order and intelligence level. The explanation for this association is not well known, and several there are many suggested explanations. Such as that the relation is due to more-preferable family interaction and stimulation of low-birth-order children, whereas others claim that the effect is caused by prenatal gestational factors. We show that Intelligence Quotient (IQ) score levels among nearly 250,000 military conscripts were dependent on social rank in the family and not on birth order as such, providing support for a family interaction explanation [1].

Many studies were applied to assess the association between gross motor development and IQ level for children. The relationship between gross motor development and cognition is not strong enough to allow the use of one to predict the other [2].

Anemia is one of the probable health problems that appear in intellectual disabled children due to malnutrition, according to previous study it reaches 11.6%. The health impacts of anemia are usually noticed during infancy and early childhood as they are periods of significant growth and development of the central nervous system [3].

The human brain passes through consecutive changes in structure and functional connectivity throughout childhood and adolescence [4] so many studies were applied to detect the factors that influence cognitive function and brain health during development. Many studies revealed that Diets consumed by children plays an important role in the neurodevelopmental process, [5].

Although there were a lot of studies and intervention applied, anemia regarded to be one of the main nutritional deficiency disorders in the world today, as it is most prevalent in pregnant women and young children. previous studies have showed that anemia is prevalent among children at age of 5 or less in Southern Asia and Africa, which regarded to be developing countries. In developing countries about 30-80% of preschool children were anemic [6], according to a study applied on Chinese preschool children to detect the relationship between anemia and the development of these children. It revealed that children who were exposed to developmental delays at infancy exhibited behavioral anomalies, [7].

Anemia is defined as the condition of less than the normal quantity of blood hemoglobin (Hb) which has physiological and psychological impacts on health. Anemia has serious consequences as it causes decreases in oxygen level in the body, including tissues and major organs, such as the brain. As a result, there are many symptoms associated with anemia, including physiological symptoms, such as cerebrovascular infarction (stroke), and psychosocial symptoms, such as decreased cognitive abilities and adverse behavioral outcomes, because of impairments in normal brain functions [8].

Fat is one of the main constituents in infants and young children diet, as they need an extraordinary energy to compensate their limited dietary capacity. Moreover, essential fatty acids such as arachidonic acid, docosahexaenoic acid, and their metabolites which plays an important role in children growth and development and its deficiency may affect maturation of the central nervous system, visual development and intelligence [9].

Aim of the Study

To determine the nutritional profile among disabled children to detect nutritional problems and its reflection on growth and mental development

Methodology

Subjects

The study group of special need children age (3-6) years were recruited from the general pediatric clinic referred to center of children with special needs, faculty of post graduate childhood studies, in shams University.

A cross sectional study was carried out for 100 children (65 male and 35 female) aged 3 ye-6 years. Data on age, sex, weight, height, and severity of intellectual disability or global developmental delay were collected from medical records. Body Mass Index (BMI, weight/height^2) was calculated and overweight and obesity defined using standard international criteria.

Inclusion criteria

All children with special needs aged from 3-6 years.

Exclusion criteria

- Children with chronic diseases (such as: bronchial asthma that induces growth, chronic renal failure, hepatic disease, epilepsy that causes brain deterioration.

- Children treated with stimulant medication (Ritalin).

- Children treated with non-stimulant medication (Atomoxtine).

-Children with physical disabilities.

-Children with pica.

Method

Study design

It is cross sectional, observational clinic-based study

Phases of the study

Study were conducted on children with special needs aged from 3-6 year attending to pediatric clinic at center of children with special needs-faculty of post graduate childhood studies-Ain Shams University to receive medical treatment and follow up services in a period of 12 months. 100 children were collected (65 male and 35 female), their parents accompanying the child were informed about the aim of the study and the procedures. Those children fulfilled the above-mentioned criteria were subjected to: History taking includes age, sex, onset and duration of disorder and family history.

Assessment of nutritional status through develop nutritional questionnaire include: Demographic and socioeconomic data including age, gender.

WHO anthropometric measurement protocol will be used BMI will be calculated as the weight in kg divided by the height square in meters. Sheet of 24-hr dietary recalls will be collected using the Multiple Pass Food Recall (MPR) method which is a 5-step approach, developed by the United State Department of Agriculture (USDA). Two 24-hour recalls will be collected for each participant.

ESHA Research Food Processor SQL and ESHA Port SQL software version 10.3 were used to enter age, gender, and anthropometric information as well as every food item (portion, time, and meal), Food recipes and preparation information were collected for homemade food and amount consumed by each subject were estimated. Nutrient analysis was obtained. Assessment of anthropometric measures (weight and height).

Clinical examination: Full clinical examination was done including general examination and local examination to diagnose any chronic diseases (chest-abdomen-CNS-CVS) and exclude any other diseases then develop mental examination. The diagnosis was confirmed by the laboratory and radiological findings of the patients.

- Complete blood count with differential leucocytic count

- EEG was done by some patients to exclude epilepsy.

- **IQ test:** using Stanford –bennet 5th edition was carried out.

Statistical method

Collected data entered and analyzed Data were expressed as means ± standard deviation or frequencies (%). Using PC computer and presented using appropriate statistical tests by SPSS statistical data program.

Proper significant test was used according to type of data. After 12 month 102 patients were recruited, the data could not be completed for 2 patients, so the actual number of patients included in the study was 100 patients.

Statistical analysis was done by Statistical Package for Social Sciences (SPSS) version 21. Qualitative variables are presented as number and percent and quantitative variables as mean and standard deviation. The proportions were compared using x^2 test. In quantitative variables, comparison between two groups was done by t-test. P value less than 0.05 is significant level and less than 0.001 is highly significant level.

Limitation

- Loss of some cases as they were not cooperative complete their assessments

- We could not validate the data taken from the mothers

- We relied on the data reported by subjects

Results

In Table 1, showed the distribution of children according to their residential places as follow: rural area of 14%, popular area of 74.4% and non-popular area of 11.6%, on the other hand the distribution for the second group as follow: rural area of 10.5%, popular area of 56.1% and non-popular area 33.3% P=0.042 that less than 0.05 indicates significant difference between the two groups in the place of resident.

Table 1: The relation between IQ and the resident places.

Resident/IQ	Intellectual disabled	Developmentally delayed	X2	p
Rural: no	6	6		
:%	14.0%	10.5%		
Popular: no	32	32	6.331	0.042
:%	74.4%	56.1%		
Non popular: no	5	19		
:%	11.6%	33.3%		
Total: no	43	57		
:%	100%	100%		

Table 2: The relation between IQ and birth order.

Birth order		IQ test ≤ 75	IQ test >75	χ2	p
≤ 2	no	24	40	3.280	0.070
	%	55.8%	70.17%		
> 2	no	19	17		
	%	44.2%	29.83%		
total	no	43	57		
	%	100%	100%		

Table 2 showed that in the first group 55.8% of them their birth order was the first or second, versus 70.17% of the second group, the difference between the two groups is near to be significant as p=0.070.

Table 3: The relation between IQ and gross motor development.

Gross motor		IQ test ≤ 75	IQ test >75	χ2	p
Normal	No	31	54	9.857	0.002
	%	72.1%	94.7%		
Delayed	No	12	3		
	%	27.9%	5.3%		
total	no	43	57		
	%	100.0%	100.0%		

The prevalence of gross motor delayed cases among the intellectual disabled children (group of lower IQ) is 29.9% on the other hand this percentage decreases to 5.3% in case of higher IQ children (there IQ>75). There is significant variation between the two groups in the gross motor development as p=0.002 (Table 3).

Table 4: The relation between hyperactivity and IQ.

Hyperactivity		IQ test ≤ 75	IQ test >75	χ^2	p
Normal	no	37	40	3.486	0.062
	%	86.0%	70.2%		
hyperactive	no	6	17		
	%	14.0%	29.8%		
total	no	43	57		
	%	100.0%	100.0%		

Table 6 showed higher calories intake for the intellectual disabled (lower IQ children) with calculated P=0.008 which less than 0.01 so there is high significant difference between the two groups.

Also, carbohydrate intake regarded to higher for the lower IQ group with calculated P=0.028 which less than 0.05, so there is significant difference between the two groups.

Table 4 showed that in the first group 14% considered to be hyperactive versus 29.8% of the second group. The difference between the two groups is close to be significant as p=0.062.

Table 5: Distribution of lab data according IQ test.

Variable		IQ test ≤ 75	IQ test >75	Total	χ2	p
Hb	no	11.3	11.0	11.1	1.423	0.158
	%	1.3%	1.4%	1.3%		
TLC	no	7.6	6.2	6.8	2.560	0.012
	%	2.9%	2.3%	2.7%		
Platelets	no	275.3	261.3	267.6	1.166	0.246
	%	64.2%	55.9%	59.9%		

*data presented by mean (SD)

Table 5, showed that the total leukocytic count for the group of intellectual disabled children mean value is 7.6 decreases to 6.2 for the group of higher IQ level, the calculated P=0.012 which less than 0.05 and approximately equal 0.01 so there is highly significant difference between the two groups.

The Protein intake for the intellectual disabled children (group of lower IQ) have higher protein intake, the calculated p=0.029 which less than 0.05 so there is significant difference between the two groups. Also, Fat intake for the lower IQ group is higher than the group of higher IQ with calculated p=0.012 which regarded to be significant difference between the two groups. Higher fiber intake is recorded for the lower IQ group of children the p=0.022 which is less than 0.05 so there is significant difference between the two groups.

Sodium intake and Potassium intake are also recorded higher for the lower IQ group with calculated p=0.041 and p=0.002 which shows significant and highly significant difference between the two groups. Calcium and Iron intake are also higher for the low IQ group of children but the difference between the two groups is close to be significant. Zinc intake is higher for the group of intellectual disabled children p=0.039 which less than 0.05 so there is significant difference between the two groups.

The following independent variables (age, diagnosis, gross motor, height, birth order, orientation, hyperactivity, TLC, education, BMI, water, CHO, protein, fat, Na, K, Ca, Mg and Zn) affect 75% on the IQ score, multiple r=0.745, p=0.001.

Orientation is significantly related to the IQ of children by 48.7% and zinc intake affect IQ by 33.3%, in the presence of the other factors (Table 7).

Table 6: (Mean ± SD) of food analysis data according IQ test.

Variable	IQ test ≤ 75	IQ test >75	Total	t	p
	Mean ± SD	Mean ± SD	Mean ± SD		
Calories	1375.4 ± 547.3	1089.3 ± 410.7	1218.0 ± 495.6	-2.650	0.008

Carbohydrate	177.1 ± 77.4	143.9 ± 61.1	158.8 ± 70.5	-2.193	0.028
Protein	44.8 ± 22.3	+	39.6 ± 19.6	-2.186	0.029
Fat	54.1 ± 28.5	41.4 ± 21.8	47.1 ± 25.7	-2.512	0.012
Fiber	3.9 ± 1.8	3.1 ± 1.9	3.5 ± 1.9	-2.287	0.022
Sodium	1775.8 ± 1142.0	1365.6 ± 705.9	1550.2 ± 945.2	-2.047	0.041
Potassium	1566.6 ± 744.6	1113.6 ± 610.0	1317.5 ± 707.6	-3.101	0.002
Calcium	476.4 ± 45	357.3 ± 282.9	410.9 ± 375.8	-1.784	0.074
Phosphorus	534.0 ± 300.8	467.2 ± 253.3	497.3 ± 276.3	-1.646	0.1
Magnesium	78.2 ± 61.7	59.5 ± 38.9	68.1 ± 51.2	-1.736	0.083
Iron	7.0 ± 3.3	5.8 ± 2.9	6.3 ± 3.1	-1.777	0.076
Zinc	5.3 ± 2.4	4.4 ± 2.3	4.8 ± 2.4	-2.065	0.039
Cupper	0.5 ± 0.4	0.5 ± 0.4	0.5 ± 0.4	-0.792	0.429
Vitamin A	681.2 ± 2227.7	665.7 ± 2614.7	672.9 ± 2428.3	-0.902	0.367
Vitamin C	41.0 ± 80.2	29.1 ± 40.3	0.9 ± 1.1	-0.046	0.963
Vitamin B1	0.4 ± 0.3	0.4 ± 0.3	0.6 ± 0.8	-0.064	0.949
Vitamin B2	0.9 ± 1.1	0.6 ± 0.8	0.7 ± 1.0	-2.098	0.036

Table 7: Multiple analysis of the independent variables (age, diagnosis, gross motor, height, birth order, orientation, hyperactivity, TLC, education, BMI, water, CHO, protein, fat, Na, K, Ca, Mg and Zn) on IQ score.

Model	B	Std	Beta	t	Sig
Constant	67.441	24.676		2.733	0.008
Age	-0.119	0.231	-0.088	-0.516	0.607
Diagnosis	-0.117	0.921	-0.012	-0.127	0.899
Gross Motor	-4.44	5.593	-0.086	-0.794	0.43
Height	0.357	0.302	0.196	1.183	0.241
Birth Order	1.655	1.363	0.111	1.215	0.229
Orientation	-20.358	4.319	0.487	4.714	0
Hyperactivity	-2.356	3.866	0.055	0.609	0.544
TLC	-0.516	0.63	-0.077	0.819	0.415
Education	4.066	3.045	0.137	1.335	0.186
BMI	0.152	0.81	0.018	0.187	0.852
Water	-0.019	0.017	-0.254	1.134	0.26
CHO	0.015	0.033	0.056	0.442	0.66
Protein	-0.217	0.193	-0.232	1.125	0.264
Fat	-0.054	0.107	-0.078	-0.508	0.613
Na	-0.002	0.003	-0.127	-0.929	0.356

K	-0.001	0.005	-0.031	-0.165	0.869
Ca	0.003	0.01	0.066	0.324	0.747
Mg	0.001	0.071	0.002	0.012	0.99
Zn	2.838	1.343	0.333	2.113	0.038

Discussion

In the present study the distribution of children in the first group according to their residential places as follow: rural area of 14%, popular area of 74.4% and non-popular area of 11.6%. Rural areas and popular areas had higher ID prevalence rate than urban areas which matches with study by Lai, et al. 2011, which revealed that Rural areas had higher incidence than urban areas. On the other hand, it goes against the study applied on Indian children by Lakhan, et al. 2015 showed that the Intellectual disability prevalence rate in children is slightly higher in urban than rural areas. So, it needs further study.

In the present study the distribution of the group of lower IQ is higher percentage of birth order more than 2, according to the results of previous study IQ scores were negatively associated with both birth order and social order [1].

In the present study there is significant relationship between IQ and gross motor development, which goes with a study by Rintala and Loovis M. [6] that showed that intellectual disabled children have low gross motor skills on the other hand it is against previous study revealed that there is no significant association between cognition aspects and gross motor development [2].

In the present study there is significant association between IQ and hyperactivity as it regarded to be more prevalent among the higher IQ children, on the other side a previous study revealed that there is a weak association between IQ and hyperactivity. Jespsen, et al. [10] which needs further study.

In the present study there is significant difference between the two groups (lower and higher IQ) the total leukocytic count was higher value for low IQ children group which goes with a study by Strouse, et al. [11] Which revealed that elevated white blood cells is associated with lower IQ.

In the present study there is no significant difference in the Hb level between the two groups of lower and higher IQ, on the other hand a previous study showed that low hemoglobin level has negative effect on the children cognition [8] that needs further study.

In the present study showed no significant difference in platelets count and volume between two groups of children (of higher and lower IQ), in a previous study revealed that there is no significant difference in platelets count and volume between normal and autistic and schizophrenic children [12].

In the present study the water intake is inversely proportional with IQ level, a study by revealed that the concentration of fluoride in drinking water has direct effect on the IQ of children [13].

In the present study the caloric intake inversely proportional with IQ level, in previous study malnutrition has direct effect on child development [14].

In the present study the carbohydrate intake is inversely proportional with IQ level, and this correlation close to be significant. Previous study applied on Tehrani children aged 6-7 years gave evidence that indicating an inverse relationship between refined carbohydrate consumption and non-verbal intelligence.

In the present study there is a significant correlation between protein intake and IQ level of children, as the protein intake is inversely proportional with IQ, In previous study revealed that increased protein intake in the first weeks of life increase the mental development of new-born.

In the present study the fat intake is inversely proportional with IQ level with significant difference between the two groups of lower and higher IQ, which goes with a study by Theodore, et al. 2009 that applied on European children of age 305-7 years old revealed that eating margarine at least daily was associated with significantly lower IQ scores.

In the present study there is significant correlation between fiber intake and IQ level, on the other hand the fiber intake is inversely proportional with IQ level of children which goes against recent nutritional researchers have found that dietary fiber was directly related with cognitive development among prepubertal children fiber intake may has a significant effect on cognitive and brain health through immunomodulation and/or the gut-microbiota-brain system, [15] which needs further study.

In the present study there was significant correlation between sodium intakes with IQ, the sodium intake is inversely proportional with IQ level of children in previous study showed no relation between sodium intake and IQ level of children [16].

In the present study there is significant correlation between IQ and potassium intake, in which it is inversely proportional with IQ level of children, this results against a study by Ghazi, et al. [16] revealed that no relationship between IQ and potassium intake, which needs further study.

In the present study calcium and iron showed no significant correlation with IQ of children which goes with previous study by Ghazi, et al. [16] in the present study zinc and vitamin B2 intake showed significant correlation with IQ of children which goes against a study by Ghazi, et al. [16-18]. That showed no correlation between zinc and vitamin B2 intake and children IQ level, that needs further study.

Conclusion

Intellectual disability is more prevalent in rural and popular residential. As the birth order increase the percentage of lower IQ increase. The gross motor development is directly proportional with IQ. The total leukocytic count was higher value for low IQ children group. Dietary profile for Intellectual disabled children (of lower IQ) is regarded to be richer with dietary elements and vitamins than that for higher IQ children. According to the multiple analysis orientation is the most related variable and zinc intake is the most effective variable on the IQ scores.

Recommendations

-Screening for IQ among children in rural and popular area, assessment for intellectual disabled and developmentally delayed children, regular follow up for these children is a must.

-In case of higher birth order child (more than the second) IQ assessment must be carried out.

-Increase the nutritional awareness between parents, increase zinc intake for children from natural sources such as Meat which is an excellent source of zinc.

-Shellfish which regarded to be healthy, low-calorie sources of zinc, Legumes like chickpeas, lentils and beans that all contain substantial amounts of zinc, also Seeds, Nuts, Dairy, Eggs and Whole Grains.

References

1. Kristensen P., & Bjerkedal T., “Explaining the Relation Between Birth Order and Intelligence.” *Science* 316.5832 (2007): 1717.

2. Capute A., et al. “Cognitive-Motor Interactions: The Relationship of Infant Gross Motor Attainment to IQ at 3 Years.” SAGE J 24.12 (1985): 671-675.

3. Lozoff B., et al. "Long - lasting neural and behavioral effects of iron deficiency in infancy." *Nutr Rev* 64 (2006): S34-S43.
4. Luna B. "Developmental changes in cognitive control through adolescence." *Adv Child Dev Behav* 37 (2009): 233-278.
5. Krebs-Smith S., et al. " Americans do not meet federal dietary recommendations." *J Nutr* 140 (2010): 1832-1838.
6. Mason J., et al. "Recent trends in malnutrition in developing regions: vitamin A deficiency, anemia, iodine deficiency, and child underweight." *Food Nutr Bull* 26 (2005): 59-108.
7. Chang S.Y., et al. "Iron - deficiency anemia in infancy and social emotional development in preschool - aged Chinese children." *Pediatrics* 127 (2011): E927-E933.
8. Ai Y., et al. "Hemoglobin status associated with performance IQ but not verbal IQ in Chinese preschool children." *Pediatr Int J* 54.5 (2012): 669-675.
9. Hardya S. & Kleinman R. "Fat and cholesterol in the diet of infants and young children: Implications for growth, development, and long-term health." *J Pediatr* 125.5 (2007): S69-S77.
10. Jespsen J., et al. "Do attention deficit influence IQ assessment in children and adolescents with ADHD?" *J Atten Disord* 12.6 (2008): 551-562.
11. Strouse J., et al. "Inverse correlation between cerebral blood flow measured by continuous arterial spin-labeling (CASL) MRI and neurocognitive function in children with sickle cell anemia (SCA)." *Blood* 108.1 (2006): 379-381.
12. Geller E., et al. "Platelet size, number, and serotonin content in blood of autistic, childhood schizophrenic, and normal children." *J Autism Dev Disord* 18 (1988): 119-126.
13. Razdan P., et al. "Effect of Fluoride Concentration in Drinking Water on Intelligence Quotient of 12-14-Year-Old Children in Mathura District: A Cross-Sectional Study." *J Int Soc Prev Community Dent* 7.5 (2017): 252-258.
14. Sigman M., et al. "Relationship between nutrition and development in Kenyan toddlers." *J Pediatr* 115.3 (1989): 357-364.
15. Khan N., et al. "Dietary Fiber Is Positively Associated with Cognitive Control among Prepubertal Children." *J Nutr* 145.1 (2015): 143-149.
16. Ghazi H., et al. "Intelligence Quotient (IQ) Relationship with Energy Intake and Micronutrient Composition among Primary School Children in Baghdad City, Iraq." *Pak J Nutr* 12.2 (2013): 200-204.
17. Rintala P., & Loovis M. "Measuring Motor Skills in Finnish Children with Intellectual Disabilities." *Percept Mot Skills* 116.1 (2013): 294-303.
18. Theodore R., et al. "Dietary patterns and intelligence in early and middle childhood." *Intelligence* 37.5 (2009): 506-513.

Cite this article: Marwa Nasr, Howaida H El Gebaly, Salah Mostafa, Rania Samy, Mageda Ramzy. "Nutritional Reflection on Growth and Development among Intellectual Disabled Children". J Child Adolesc Behav, 2020,8(4), 1-6.