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Nutritional Status, Nutritional Habit and Breakfast Intake in Relation to IQ among Primary School Children in Baghdad City, Iraq

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Abstract: Nutrition for children especially during the development stage is crucial. A lot of studies have been done to observe the effects of nutrition on child cognition development but the situation in Iraq is absolutely different. A cross-sectional study was carried out in Baghdad city, Iraq to assess the nutritional status and nutritional habit of primary school children and to relate it with their Intelligence Quotient (IQ) score using standardized tools. The prevalence of malnutrition was 12.1% among Iraqi children. Nutritional status, nutritional habit and breakfast intake were significantly associated with children intelligence (p = <0.001, <0.001, <0.001) respectively. Malnutrition among children is still to be a public health issue in Iraq and it is affecting the child cognitive function and academic performance at school.

Key words: Nutritional status, nutritional habit, breakfast intake, IQ, Baghdad

INTRODUCTION

There are a lot of studies observing the effect of nutrition on the cognitive development of children in different parts of the world, but the situation in Iraq is different because the environmental factors played a very important role in child development especially in the last 8 years after the last war and the following years of violence in the capital Baghdad. It particularly affects the daily living of most Iraqis families and their children.

Toga et al. (2006) stated that the cognitive structure in a child has come about through the interaction between the brain and the environment over the course of development. In the initial stages of the development of neural system in the fetus, the physical characteristics of the brain are determined by genetic factors, but, immediately, the environment starts to influence this structure. After birth, the variety of environmental factors increases, but nutrition continues to be important throughout life, particularly since it is now recognized that brain development occurs over a much longer portion of the life-span than originally thought.

The mechanism in which nutrition can affect brain development as Greenwood and Craig (1987) pointed out is that there are at least three important ways in which diet may affect the neurochemistry. First, the ingestion of food affects the availability of the precursors required for the synthesis of neurotransmitters. Second, food serves as the source of vitamins and minerals that are essential co-factors for the enzymes that synthesize neurotransmitters. Third, dietary fats alter the composition of the nerve cell membrane and myelin

sheath and that, in turn, influences neuronal function. Malnutrition alters brain development and intelligence by interfering with the overall health as well as with the child's energy level, and rate of motor development and growth. Poverty and deprivation exacerbate these negative effects, especially when mothers have lower schooling levels (Brown and Pollitt, 1996; Ivanovic et al., 2000).

Breakfast is the food eaten in the morning before going to school. Theoretically, there are two plausible biological mechanisms by which breakfast may affect brain function and cognitive test performance. One involves metabolic changes associated with an extended overnight fast to maintain the availability of fuel and other nutrients to the central nervous system. The other involves the long-term salutary changes that breakfast may have on nutrient intake and nutritional status, which in turn could affect cognition. For example, it is known that repletion of iron stores and rehabilitation from anemia result in improved school performance in tests of memory and visual attention (Lloyd et al., 1996). Skipping breakfast also influenced cognitive functions unrelated to memory.

The objectives of our study was to assess the nutritional status, nutritional habit and breakfast intake and their relationship with Intelligence Quotient (IQ) among primary school children.

MATERIALS AND METHODS

A total of 529 children were selected from 5 different primary schools in Baghdad city.

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These 5 schools represent 5 different living areas in Baghdad with different socio-economical status backgrounds. A list of all schools in Baghdad city was obtained from the Ministry of Education. Baghdad is divided into five educational areas in which one school was selected from each educational area for better representation. The selection of the five schools from the list was carried out using simple random sampling method. Subsequently, a complete list of student names in each selected school was obtained. A total of 106 children from each school were then identified by stratified random sampling according to grade.

Both questionnaire on food habit and breakfast intake with standardized measurements to measure the child IQ were used in this study. Self-administered questionnaires were distributed to the respondents' parents.

Raven's Colored Progressive Matrices (CPM) tool was used to obtain child IQ score, with the total score of 36 points.

Nutritional status in this study was defined by BMI-for-Age Z score calculated using WHO Anthroplus software. Nutritional habit was assessed by a semi-quantitative food frequency questionnaire. The total score of nutritional habit is 23, any score more than 11 points will be considered as good food habit. Breakfast intake was defined as food intake in the morning from 6 a.m. till 10 a.m. at home and assessed by how many times it is taken per week and what is the usual ingredients.

A pre-test was carried out where the questionnaires were distributed to 31 parents to answer for validation and scale reliability. Semi-quantitative food frequency questionnaire scale has a good internal consistency, with Cronbach's alpha coefficient of 0.695. This study was approved by the Research and Ethics Committee of Universiti Kebangsaan Malaysia Medical Centre.

Data was analyzed using SPSS version 16.0. Pearson chi square test was used in data analysis.

RESULTS

In this study, male are more predominant than female since 52.2% of the respondents were males. A total of 58.6% of the respondents are seven years old compared to 41.4% of eight years old. The second school grade is more predominant since 59.7% is in the 2nd grade as compared to 40.3% in the 3rd grade. Majority of the respondents' mothers took care of their children (91.7%) as compared to 2.6% and 5.7% for father and others, respectively.

The mean weight of children was 26.07 kilograms, with the minimum weight was 15.10 kilograms and the maximum weight was 45.30 kilograms. The average standing height of the respondents was 102.50 centimeters in which the minimum height was 80.50 centimeters and the maximum height was 145.50 centimeters.

Table 1: Type of food consumed by children at school

Types of food	Frequency	Percent (%)
Carbonated drinks		
Yes	316	59.7
No	213	40.3
Chips		
Yes	391	73.9
No	138	26.1
Chocolate bars		
Yes	312	59.0
No	217	41.0
Ice cream		
Yes	163	30.8
No	366	69.2
Sandwich		
Yes	173	32.7
No	356	67.3

Table 2: IQ score differences between children with different nutritional status and habits

Variables	N	Mean	SD	P value[a]
Nutritional status				
Malnourished	64	20.34	5.27	< 0.001*
Normal	465	27.66	5.064	
Nutritional habit				
Bad	395	25.96	5.699	< 0.001*
Good	134	29.17	4.612	
Breakfast intake				
No	123	23.17	6.755	< 0.001*
Yes	406	27.86	4.718	

a:Independent t test was performed
*level of significance at p<0.05

The IQ scores showed that 77.7% of the respondents have high intelligence level as they scored more than 75th percentile. Nutritional status of the respondents was good as 87.9% were normal compared to only 12.1% were malnourished of the total respondents. As for the nutritional habit of children during the school day, 56% of the parents said that sometimes their children used the school canteen, while only 23.4% said that their children never used the canteen.

About half of the respondents' parents (50.7%) reported that they never asked their children about what they ate at school. Only 42.5% of the parents concerned about their children eating at school reported sometimes they concern about the child's food nutritional value, the answer was the same between sometimes and never (39.1%).

About the take away meals per week, 58.6% of the parents reported that sometimes their children bought take away meals, while only 50.8% parents said that sometimes their children buy food from school.

Unfortunately, two third of the children had bad food habit (74.7%), only 25.3% of the children had good food habit. As for the breakfast habit of the children, 76.7% of the respondents take breakfast regularly at home, while 23.3% did not take breakfast. The maximum number of times having breakfast per week was 7, with the minimum of 0 and the average of 4.5 times per week.

Table 2 shows the difference in IQ score of the children according to their nutritional status, nutritional habit and breakfast intake.

Table 3: Relationship between nutritional status, nutritional habit and breakfast with children's IQ

| Variable | Intelligence quotation of children | | p valuea | POR | (95% Confidence |
| | Low IQ | High IQ | | | Interval |
	f (%)	f (%)			
Nutritional status					
Malnourished	44 (68.8)	20 (31.2)	<0.001*	11.62	(6.48-20.84)
Normal	74 (15.9)	391 (84.1)			
Nutritional habits					
Bad habits	105 (26.6)	290 (73.4)	<0.001*	3.37	(1.84-6.22)
Good habits	13 (9.7)	121 (90.3)			
Breakfast intake					
No	65 (52.8)	58 (47.2)	<0.001*	7.46	(4.72-11.78)
Yes	53 (13.1)	353 (86.9)			

aPearson chi square test was performed, *level of significance at $p < 0.05$, POR = prevalence odds ratio

Table 3 shows the relationship between nutritional status, habits and breakfast with children's IQ. There was a strong relationship between nutritional status, habits and breakfast and intelligence quotient of children with p value of <0.001, <0.001, <0.001 and prevalence odds ratio of 11.62, 3.37 and 7.464 respectively.

DISCUSSION
The results of our study showed that the nutritional status of the children especially in a situation like Iraq after 13 years of economic sanctions followed by 2003 war and after that 8 years of unstable security situation in the capital city of Baghdad is not good, especially the food habit with almost two third of the children had a bad food habit, that means in every 3 children, 2 of them have bad food habit.

Malnourished children have 11.6 times more risk to have low intelligence compared to normal children, also children skipping breakfast in the morning have 7.4 more risk to have low intelligence compared to those who take breakfast every day.

Many studies suggested that poor nutritional status can indeed adversely affect brain function and impact on cognition and behavior. To a certain extent, appropriate correction of nutrient deficiencies can indeed lead to measurable improvement Moreover, recent findings suggested that even in situations of adequate nutritional status, the brain can actually be sensitive to short term variation of glucose availability (France Bellisle, 2004).

Three studies of children with no breakfast reported lower performance in visual discrimination of competing stimuli. The no-breakfast condition was also associated with a decline in performance on verbal fluency test (Simeon, 1998; Grantham-McGregor et al., 1998; Pollitt et al., 1998).

Pollitt et al. (1998) stated that: 'No definitive conclusions can be drawn from the existing data on either the long and short-term benefits of breakfast on cognition and school learning or the mechanisms that mediate this relation'. It was stressed that although omitting breakfast often interfered with cognition and learning, this effect was more pronounced in nutritionally at-risk children than in well-nourished children.

Although no one can deny the important role of nutrition during the early years of child development, but we should not neglect the environmental role which play crucial role in modulate the effects of good nutrition. The academic achievement in school depends on a lot of variables including nutrition, family and school itself. It is unquestionable that nutrition can play an important role in the success of young people in the academic performance at school.

Conclusion: Nutrition is still found to be one of the important and crucial factors in the cognition development of children. The situation in Iraq especially in Baghdad city through the results of this study is not promising for a good future of children. Although the prevalence of malnutrition was only 12% but it is still considered as a high rate to a very wealthy country like Iraq.

There was 7.3 points decrement in IQ score if the child's is malnourished, 4.7 points decrement if the child skip breakfast and 3.2 points decrement if the child nutritional habit was bad.

It is obvious that nutritional factors play crucial roles during child cognitive development.

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