Assessment of zinc nutritional status in preschool children

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Abstract

The aim of this study is to assess zinc nutritional status for preschool children. A sample of 50 pre-scholars age 4 -6 years from tow different types of kindergarten from Cairo. The interview method was used for data collection from the mothers and recorded using a diet history sheet as well as 24 hour recall for three following days to obtain detailed information on food and beverages consumed. The daily data were analyzed using the food composition tables to estimate the nutrients and zinc content of the daily diet, and compare with the recommended dietary allowance (RDA). Demographic data was collected. The anthropometric measurements of children were assist as described by the height (Ht), weight (Wt), triceps skin fold (TSF) and arm circumference (AC) measurements were compared to the 50th percentile. Laboratory analysis for hair and nails samples to determinate zinc content .Statistical analysis were processed by IBM-PC computer using SPSS soft ware program 2000 . The results showed decrease in zinc intake among the high percentage in the sample (96%) . Nutritional assessment indicated that adequacy of zinc intake was related to adequacy of some nutrients as animal and plant protein, animal iron, vitaminB2 and niacin. There were no significant differences between age group, school type ,zinc level in nails and hair and daily zinc intake .There were a significant differences between daily zinc intake and education level of mothers, weight / height, and height / age indicating the importance of zinc on their growth development .

Introduction

Zinc is essential trace element which affects growth by promoting DNA and RNA synthesis and cell division (Siklar et al., 2003).Zinc deficiency causes growth retardation and its frequency is high in developing countries (Ince et al.,2006) . Although it is clear that sufficient dietary amounts of minerals are essential for normal growth and development little is known about the adequacy of usual minerals intake by children internationally (Murphy et al.,1992).Zinc metabolism of children differs due to the diet and this can affect zinc requirement (Chen et al., 1998). Malnutrition involves deficiencies not only of

macronutrients but also in micronutrients. In developing countries, it has been estimated that ~12 million children <5 y old die annually due to infection and malnutrition, with malnutrition contributing to half of the mortality (Prasad ; 1991). During the last decade, however, several randomized controlled trials have provided evidence that zinc deficiency, which can be reversed by zinc supplementation, contributes to stunting children in both developing and developed countries (Salgueiro et al., 2002). In recent years, since the discovery that this mineral is becoming less available in our soil and thus in our food chain, zinc has been given more attention, and increased research has produced much new information (Tamura et al.,2003). (Brown et al.,2002) mentioned that zinc is needed in probably more than 100 enzymes and is probably involved in more body functions than any other mineral. It is important in normal growth and development, the maintenance of body tissues, sexual function, the immune system, and detoxification of chemicals and metabolic irritants (Zemel et al., 2004). Therefore, this study was carried out to determine the relationship between zinc intake for pre-school children and their nutritional status .

Methodology

A random sample of 50 kindergarten children from tow different types of kindergarten was selected from Cairo(high level from Nasr city and low level from Shobra). The ages of the children ranged between 4-6 years . The interview method was used for data collection from the mothers and recorded using a diet history sheet as well as 24 hour recall for three following days to obtain detailed information of food and beverages consumed. The daily data were analyzed using the food composition tables (National Nutrition Institute. 1996) to estimate the nutrients and zinc content of the daily diet. Daily intake were compared with the recommended dietary allowance (RDA) published by (RNI 1998). The demographic data including ages and mother education level . The anthropometric measurements of children were collected as described by (Gibson. 1990).The height (Ht), weight (Wt), triceps skin fold (TSF) and arm circumference (AC) measurements were compared to the 50th percentile established by (NCHS.1979)and (Frisancho, 1974) respectively .

Laboratory analysis for hair and nails samples were determined for zinc content by atomic absorption (GBC 932/933) according to method of (G.O.A.E.F. 1996).

Statistical analysis were processed by IBM-PC computer using SPSS soft ware program 2000 . Means and standard deviation (SD) were calculated

for the majority of variables. Qualitative variables expressed as percentage were compared to different groups. T test and F test were also used to know if there were any significant differences between two groups. Correlation coefficient was used for some variables .

Results and discussion

Table (1) presents the correlation between zinc intake and other nutrients intake in the study sample. From this table it is clear that many nutrients intake as plant protein, vitamin B2 and animal iron had significant correlation with zinc intake.

However, other nutrients as animal protein, and niacin were highly significant with zinc intake. This result means that when increasing the intake of animal and plant protein, vitamin B2, animal iron and niacin increase directly the zinc intake according to the food source.(Sunanda et al.,1995) reported that dietary zinc intake is influenced by protein content and source of protein in the diet in addition to zinc levels of the diet.

Table (2) shows comparison of the daily zinc intake in children receiving low and adequate RDA of protein. From this table it is observed that one subject only in the study sample was receiving low protein intake (< 28.5 gm/ day) and following low zinc intake (6.7± 1.6 mg) .

Table(3) shows the comparison of daily zinc intake in children according to age group. From this table it is clear that no significant differences between zinc daily intake and age group was formed in the study sample(four years, five years and six years) P=0.24.

Table (4) shows a comparison of daily zinc intake according to mother education level . From this table it is observed that there were significant differences between mother education levels (primary, moderate and high education level) and daily zinc intake . The present results were in agreement with (National Nutrition Institute 2000). Decrease in the quality of food item deficiency of some nutrients were widely prevalent in low education level . Education is one factor that appears to have a fundamental influence on population food choice.(Galobardes et al., 2001).

Table (5) shows a comparison of daily zinc intake according to school type. From this table it is clear that no significant difference between school type (high level 6.7 ± 1.4 and low level 6.8 ± 2.0) and daily zinc intake.

Table (6) shows the comparison of anthropometric measurements of children according to school type. From this table it is clear that no significant

difference was found between anthropometric measurements and daily zinc intake in high level school type weight/height-percentile (W/HP) and height / age-percentile (H/AP) were (5.8±30 and 80.0±23.0) respectively.

While, in low level school type weight/height-percentile (W/HP) and height / age-percentile (H/AP) were (56.9±32.0 and 72.3±23.0) respectively .

Table (7) shows the correlation between daily zinc intake and the anthropometric measurements in the study sample. From this table it is observed that no significant differences were found between weight / age percentile(W/AP), triceps skin fold (TSF) and arm circumference (AC) and daily zinc intake . On the other hand, there were significant differences between height/age percentile (P= 0.04), weight/ height percentile (P=0.05) and daily zinc intake in the sample subjects. These results were in agreement with (Takyi et al., 1999) where low zinc intake of sheltered children (9%) of them were in the 5th of height for weight reflecting the effect of zinc nutritive value on their stature. In addition , (Coven et al.,1993) Confirmed that, zinc status of children in Guatemala influenced their growth pattern and body composition specifically children with low zinc intake which were shorter but heavier and fatter than their counterparts with adequate zinc status .

Table (8) shows the correlation between zinc level in nails and in hair . From this table it is observed that there were highly significant differences between zinc in nails and hair (P=0.00) . From this result it is observed that there was an increase in zinc level in nails followed by increasing of level zinc in hair . This result agree with (Helio Vannucchi et al., 1995) .

Table (9) shows the comparison of low (<10 mg/day) and adequate zinc intake (> = 10 mg/day) according to hair zinc and nails zinc levels . From this table it is clear that highly percent of the study sample (96%) suffered from decrease in daily zinc intake (<10 mg/day) . (Murphy et al., 1992) Studied minerals intake of toddlers living in villages in Egypt, Kenya and Mexico, they found inadequate zinc intake in 35.6%, 90.2%, 67.7% of the children in Egypt, Kenya and Mexico respectively.

Furthermore, zinc intake of the American children ages 2-10 years was below67%of RDA in 29.9%of the sample(Albertson et al.,1992).

On the other hand , from the same table it is observed too that no significant differences between low and adequate zinc intake and content of hair and nails from zinc were found(0.63±3.0, 0.50±2.0, 0.45±3.0 and 0.20±0.1) respectively.

Conclusion : Adequate of daily zinc intake is associated with normal growth and development of preschool children .Finally, recommendations for improving the zinc status for preschool children though the nutritional awareness programs and supplementing of some food products with zinc especially for preschooler .

Table (1):Correlation coefficient "r", "F" statistics and "p" value of the correlation between zinc intake and other nutrients intake in the study sample.

Type of nutritional intake	Value of "r"	Value of "r^2"	Value of "F"	Value of "p"
Animal proteins	0.38	0.15	8.16	0.006**
Plant proteins	-0.28	0.08	4.2	0.04*
Total proteins	0.24	0.06	2.9	0.09
Animal fats	-0.01	0.00	0.01	> 0.05
Plant fats	-0.14	0.02	1.0	> 0.05
Total fats	-0.04	0.00	0.08	> 0.05
Carbohydrates	-0.13	0.02	0.85	> 0.05
Calories	-0.07	0.00	0.21	> 0.05
Calcium	-0.03	0.00	0.05	> 0.05
Phosphorus	0.23	0.05	2.71	> 0.05
Animal iron	0.31	0.10	5.3	0.02*
Plant iron	0.03	0.00	0.03	> 0.05
Total iron	0.19	0.04	1.74	> 0.05
Vitamin B1	0.03	0.00	0.05	> 0.05
Vitamin B2	0.29	0.09	4.4	0.04*
Niacin	0.38	0.14	7.95	0.007**
Vitamin C	0.03	0.00	0.04	> 0.05
Sodium	-0.21	0.04	2.12	> 0.05
Potassium	0.07	0.00	0.21	> 0.05

Table (2):Comparison of daily zinc intake in children receiving low and children receiving adequate RDA of proteins.

Protein intake	Low protein intake (<28.5 gm/day)		Adequate protein intake (=> 28.5 gm/day)		t	p
	No. of children	Means±Sd	No. of children	Means±Sd		
Zinc intake/ day	1	6.7±1.6	49	10.9±0.0	2.4	0.01*

Table (3):Comparison of daily zinc intake in children according to age groups.

Age groups	Four years		Five years		Six years		F	p
	No.	Means±Sd	No.	Means±Sd	No.	Means±Sd		
Zinc intake/ day	13	6.2±1.5	26	7.2±2.0	11	6.5±1.2	1.4	0.24

Table (4):Comparison of daily zinc intake according to mother educational level.

Mother education	Primary		Moderate		High		F	P
	No.	Means±Sd	No.	Means±Sd	No.	Means±Sd		
Zinc intake/day	30	5.22±1.7	13	6.18±1.4	7	7.9±2.2	4.1	0.04*

Table (5):Comparison of daily zinc intake in children according to school type.

School type	High level		Low level		t	p
	No. of children	Means±Sd	No. of children	Means±Sd		
Zinc intake/day	27	6.7±1.4	23	6.8±2.0	1.14	> 0.05

Table (6):Comparison of anthropometric measurements in children according to school type.

School type	High level		Low level		t	p
	No. of children	Means±Sd	No. of children	Means±Sd		
WHP	27	58.4±30	23	56.9±32	0.17	> 0.05
HAP	27	80.0±23	23	72.3±23	1.14	> 0.05

Table (7):Correlation coefficient "r", "F" statistics and "p" value of the correlation between zinc intake and anthropometric measurements in the study sample.

Type of anthropometry	Value of "r"	Value of "r^2"	Value of "F"	Value of "p"
W/AP	0.15	0.02	1.17	> 0.05
H/AP	-0.28	0.08	3.9	0.04*
TSF	0.23	0.05	2.68	> 0.05
AC	0.12	0.01	0.73	> 0.05
W/HP	0.21	0.05	2.29	0.05*

Table (8):Correlation coefficient "r", "F" statistics and "p" value of the correlation between zinc level in nail and zinc level in hair.

Zinc level	Value of "r"	Value of "r^2"	Value of "F"	Value of "p"
	0.58	0.34	24.5	0.000

Table (9):Comparison of low (< 10 mg/day) and adequate zinc intake (>= 10mg/day) according to hair zinc and nail zinc levels.

Zinc intake	Low zinc intake		High zinc intake		t	p
	No. of children	Means±Sd	No. of children	Means±Sd		
Hair zinc	48	0.63±3	2	0.45±3	0.76	> 0.05
Nail zinc	48	0.50±2	2	0.20±0.1	1.4	> 0.05

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تقييم الحالة الغذائية للزنك فى الأطفال ما قبل سن المدرسة

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الملخص العربى

تهدف الدراسة الى تقييم الحالة الغذائية للأطفال قبل سن المدرسة و تتكون العينة من٥٠ طفل تتراوح أعمارهم بين ٤- ٦ سنوات من نوعين مختلفين من الحضانات (ذات مستوى اجتماعى عالى فى مدينة نصر و ذات مستوى اجتماعى منخفض فى شبرا) و قد تم تجميع البيانات عن طريق الأمهات و تسجيلها من بأستخدام أستمارة أسترجاع ٢٤ ساعة لمدة ثلاثة أيام و مقارنتها بالأحتياجات الغذائية، كما تم تجميع البيانات الشخصية و المقاييس الجسمية كالوزن و الطول و محيط الزراع و سمك طبقة الدهن تحت الجلد ،و كذلك تجميع عينات الشعر و الأظافر لتحليلها معمليا" و تقدير محتواها من الزنك .

و قد أظهرت النتائج أن نسبة كبيرة من عينة الأطفال (٩٦٪) يتناولون أقل من أحتياجاتهم الغذائية من الزنك و أشارت الدراسة الى أرتباط الزنك المتناول بعدد من العناصر الغذائية و هى : البروتين الحيوانى و النباتى و فيتامين (ب٢) و النياسين كما لم تظهرأى فروق معنوية بين الزنك المتناول و مستوى الحضانة أو محتوى الزنك فى الشعر و الأظافر بينما كانت هناك فروق معنوية و اضحة بين الزنك المتناول يوميا" و مستوى تعليم الأمهات و كذلك بينه و بين المقاييس الجسمية و كان أكثرها تأثرالوزن بالنسبة للطول و الطول بالنسبة للعمر مما يدل على أهمية تناول الطفل لكفايته الغذائية من الزنك من أجل الحفاظ على معدلات النمو الجيدة .