Energy and Nutrients Intake among Children Aged 2-5 Years in Upper Egypt Governorates

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Abstract: The present study was carried out among children aged 2-5 years in Upper Egypt governorates (Menia, Assiut, Sohag and Qena) to assessment their nutritional status. The participants were recruited from 4 Egyptian governorates grand total (1131) mainly in Upper Egypt. The children were selected randomly from each governorate according to these numbers were Menia (161 boys and 161 girls), Assiut (169 boys and 138 girls), Sohag (182 boys and 137girls) and Qena (100 boys and 83) girls. Weight and height was documented affording to the standardized systems. Height for age was used as indicator of stunting It is characterized as: Normal (-2 to +2SD), Short stature <-2SD, and Tall if >+2SD. BMI was characterized as: Normal (>-2 to <+1), Over weight (>+1 SD), Obese (>+2SD) and Thinness (<-2 SD). Data on nutritional standing had been collected using specially designed questionnaires to cover essential data on: Food intake (24 hours recall), and Dietary pattern "Food frequency" for selected items. The energy and nutrient content of the 24 hour was computed within the accumulated food composition tables of the NNI (National Nutrition Institute). All analyses were conducted using SPSS. The results demonstrated that the rate of underweight was higher between girls (underweight = 35.1%) in comparison with boys (underweight = 26.5 %,) and the overall rate of underweight was 31%. Also, there were no significant difference in energy intake between boys and girls in all governorates. Data obtained from the study illustrated that the mean protein intake in Menia governorate was also the least. However, it was nearly the same in the other three governorates. The results showed that the highest intake of vitamin A among girls was 177 μg/RE in Sohag while the least intake was 136 μg/RE among boys in Qena. **Conclusion:** There is an disproportion in healthy eating, dietary ingestion and nutrition education programs necessity to be developed as a part of an intervention program for young children in Upper Egypt governorates.

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1. Introduction

Malnutrition in Egypt is in a state of "Silent Emergency" and there it demand greater priority than ever before (EDHS, 2014). Egyptian National Nutrition Institute and other research centres recently reported that malnutrition was remain a main health problem in Egyptian community between different age sets and within different socio-economic classes (Emam, et al.,2005). Initial infantile is a period of fast development, concomitant with changing in the physiologic and nutritional requirements. Nowadays, there is increasing indications proposing that early childhood is a serious phase during which vulnerability to several chronic diseases is recognized (Bouret, 2010). Nutrition is very essential during the different developmental stages of infants and the penalties of under and/or over nutrition in early life have been well established (Martorell et al., 2001). The valuation of dietary eating is hence critical for observing the nutritional Status of preschool child residents, as well as for directing epidemiologic research on the relationship between diet and health in different age groups (Serdula et al., 2001). One of the main trace element must be available in the diet of children is the zinc (Zn) which play an important role in the growth and development (Brown et al., 2002).

In addition, phytic acid (PA), a composite absolutely present in plants, which documented that it plays a chief role particularly during restriction of Zn and Fe bioavailability (Lott et al., 2000). From the past decades the importance of Fe and Zn is well documented and their deficiency can coexist (Lind et al., 2003). In China, a survey was carried out in a socioeconomically poor area in which they compared the growth of children less than 5 years of age to World Health Organization Child Growth Standards (WHO CGS), they found that the frequency of stunting, underweight, and wasting was 30.2%, 10.2%, and 2.9%, respectively, while 4.1% of children were obese, and 16.8% were at risk for overweight (Wang et al., 2009). In developing nations, children denote a vulnerable people who may have numerous microelements deficits, particularly preschool children, due to the same relevant factors that are accountable for the inadequacy of more than one important microelements. Deficiency in micronutrient can lead to undesirable health problems, like, an retard in growth, reduction in the immune system, and neurobehavioral malfunctions (Viteri et al., 2002), in addition to the mentioned before, the micronutrients are paying an important role in the transmission and dissemination of infectious diseases, which leads to increasing the rates of morbidity and mortality, and reductions in intelligent prospective (Luabeya et al., 2007).

Recently the impact of zinc deficiency not restricted to the younger ages but can affect all ages such as babies, adolescents; older people are perhaps at a higher risk of zinc deficiency (Gibson and Heath, 2011). There are many vital functions and roles for Zn in the body such as a vital nutrient for the structure and function of the brain (Georgieff, 2007); plays a role in maturation, neurogenesis, and migration of neurons and in synapse formation (Bryan et al., 2004). In addition, Zn is found in higher concentrations in synaptic vesicles of hippocampal neurons (essential for learning and memory) (Levenson, 2006). With respect to iron deficiency either in developing or developed countries, a considerable articles has been published on the likage between iron status and cognitive development in children or with induction of anaemia (Grantham-McGregor and Ani, 2001). Generally, intake of fruits and vegetables (FV) has been established that it diminished the incidence of chronic diseases, such as cardiovascular disorder, cancer and diabetic conditions (Feldeisen et al.,2007). In addition to the previous benefits from intake of fruits and vegetables during the meals, it helps individuals to maintain a healthy weight and/or prevent over weight (obesity) due to its low energy content and high nutrient density of most FV, FV (Bazzano, 2006). Therefore, depending on the previous data there is strong confirmation that FV intake can assist as an effective strategy for improving dietary intakes as well as preventing.

2. Subjects and Methods

The study was a cross-sectional observational study, the participants were recruited from 4 Egyptian governorate grand total (1131) mainly in Upper Egypt. The children were selected randomly from each governorate according to these numbers were Menia (161 boys and 161 girls), Assiut (169 boys and 138 girls), Sohag (182 boys and 137girls) and Qena (100 boys and 83) girls.

Methods:

All the children were subjected to anthropometric assessment and dietary assessments.

Anthropometric Measurements:

Weight and height was recorded according to the standardized methods (WHO. 2006) Height for age was used as indicator of stunting It is categorized as: Normal (-2 to +2SD), Short stature <-2SD, and Tall if >+2SD.

Assessment of Body Mass Index for age:

For age from 2-5 years old, the Z score body mass index was used for boys and girls. The following categories of weight status were determined according to WHO Z score body mass index growth chart reference for children (2-5-years old) released by (WHO.,2006). BMI was categorized as: Normal (>-2 to <+1), Over weight (>+1 SD), Obese (>+2SD) and Thinness (<-2 SD).

Dietary assessment:

Data on nutritional status had been collected using specially designed questionnaires to cover required information on: Food intake (24 hours recall), and Dietary pattern "Food frequency" for selected items. The energy and nutrient content of the 24 hour was computed through the compiled food composition tables of the NNI (2006).

The nutritional value of foods items consumed was compared to the:

Dietary adequacy

Recommended dietary allowances "RDAs" of (FAO/WHO/UNU., 2004). Iron estimation was based on its bioavailability according to the daily diet content of heam iron source in grams (meat, poultry and fish) or ascorbic acid (mg) as follows: Low bioavailability:<30gm of heam iron source or<25 mg of ascorbic, Intermediate bioavailability: 30-90 gm of heam iron source or 25-75mgof ascorbic acid and High bioavailability:>90gm of heam iron source or>75mg ascorbic acid (Sight and life /Newsletter/ 2002).

Statistical Analysis

Estimated energy requirement (EER) was calculated for each individual using their age, sex, height, and weight according to the Institute of Medicine Dietary Reference Intake equations. Given anecdotal evidence that suggests that the majority of subjects with stunting participate in limited physical activity outside the home, EER was estimated based on a sedentary lifestyle activity coefficient of 1.0. Percentage of EER was calculated as %EER (kcal/EER). Analyses of continuous variables were summarized as means with standard deviations and categorical variables were summarized as numbers and percentages. All inferences are based on two tailed tests with a threshold of <0.05 for declaring significance. Intake was categorized to < 50%, 50-74%, 75-99% and ≥ 100%. Chi square, Fisher's exact, one sample t test, Student's T test and one way ANOVA test were used to compare intake between sex, Ht Z score and Wt Z score categories. All analyses were conducted using SPSS version (SPSS, 2008).

3. Results and Discussion

Table (1) stated that underweight was high in Qena governorate and mostly affected in comparing to others governorates. Also, the same table showed that boys were more suffering from underweight than girls and Qena had the lowest percent in normal weight. our result in different with the finding obtained by (Bose et al., 2007) who indicated that the rate of underweight was higher (35.1%)in girls in comparison with that in boys (26.5%) and the overall rate of underweight was reached 31%.The total percentages of moderate and severe malnutrition were averaged 44.89% in boys and 38.33% in girls. Other investigators (Jai Prabhakar and Gangadhar,2009) found that 45.2% of children were moderately malnourished concerning weight for age, while 4.4% were normal and outstanding children had mild and severe form of undernourishment. So, the current work pointed to a much higher percentage of normal children.

Table (1) Percent distribution of children aged 2-5 years by age & gender in the studiedgovernorates in Upper Egypt according to Weight/Age Z-Score.

Governorates	Gender	Underweight		Normal		Overweight		Total		P –value
		No.	%	No.	%	No.	%	No.	%	
Menia	Boys	10	6.3	149	92.5	2	1.2	161	50.0	0.69
	Girls	13	8.1	147	91.3	1	0.6	161	50.0	
Assiut	Boys	12	7.1	157	92.9	-	-	169	55.05	0.80
	Girls	9	6.5	129	93.5	-	-	138	44.95	
Sohag	Boys	15	8.3	164	90.1	3	1.6	182	57.1	0.1
	Girls	6	4.4	131	95.6	0	-	137	42.9	
Qena	Boys	35	35	62	62	3	3	100	54.64	0.10
	Girls	22	26.5	60	72.3	1	1.20	83	45.36	

Data obtained from table (2) showed that, the most suffering children from stunted were in Menia governorate in both sexes (boys and girls) nearly one third of the children, followed by Qena, Assiut and Sohag governorate, respectively. The investigation carried by (Jai Prabhakar and Gangadhar, 2009) demonstrated that about 41.5% of mild (-2 to -1 SD) malnutrition was found in all age and gender groups, while, the percentage of moderate malnutrition was (39.3%), also, (6.7%) of children was suffering from severe malnutrition. Another study which done by (Nyaruhucha et al., 2006) concerning with association between age and weight or height, they reported that 31.2%;6.0%; 3.2% and 14% of the children were underweight; severely underweight; severely stunted and moderately stunted, respectively. Moreover, Chowdhury et al. (2008) reported that the prevalence of under nutrition between Santal children was (17.9%) stunting growth and (33.7%) underweight, whereas, 4.98% and 7.92% of children were affected by severe stunting and underweight, respectively.

Table (2) Percent distribution of children aged 2 – 5 years by age & gender in the studied governorates in Upper Egypt according to Height/Age Z-Score.

Governorates	Gender	Stunted		Normal		Tall		Total		P –value
		No.	%	No.	%	No.	%	No.	%	
Menia	Boys	55	34.2	106	65.8	-	--	161	50	0.32
	Girls	58	36.0	103	64	-		161	50	
Assiut	Boys	35	20.7	133	78.7	1	0.6	169	55.05	0.4
	Girls	45	32.6	93	67.4	-	-	138	44.95	
Sohag	Boys	43	23.6	139	76.4	-	-	182	57.1	0.4
	Girls	26	19.0	111	81.0	-	-	137	42.9	
Qena	Boys	32	32.0	67	67.0	1	1.0	100	54.64	1.0
	Girls	20	24.1	62	74.7	1	1.2	83	45.36	

Nutrition in early infantile stage plays a vital role in growth and development (Walker et al., 2011). Table (3) indicated that Assiut had the highest energy intake in both sexes (boys and girls) followed by Sohag. Qena and the least energy consumption was in Menia governorate. Also, there were no significant difference in energy intake between boys and girls in all governorates. Data obtained from the same table illustrated that the mean protein intake in Menia governorate was also the least. However, it was nearly the same in the other three governorates. Presence of proteins in the consumed diet is essential for the reason that it supply the body with essential amino acids needed for synthesis of protein, which are urgent for development and normal growth. When the protein or amino acids not given with adequate amounts may retard the growth during the childhood period (Michaelsen KF., 2014). According to data from the table Children in Menia had the least carbohydrate intake as compared to the other governorates. The table also showed that the mean fat intake was ranged from 20 up to 26 gram per day. The two sexes were almost equal and the least fat intake was in Menia governorate.

Table (3) Macronutrients daily intake of children aged 2-5 years in the studied governorates in Upper Egypt.

Governorates	Gender	Energy (kcal)	P-value	Protein (gm)	P-value	Carbohydrates (gm)	P-value	Fat (gm)	P – value
Menia	**Boys** **Girls**	848±318 849±407	0.5	47.9±34.4 46.1±35.1	0.4	116.8±38.2 121.2±39.1	0.4	20.8±11.3 20.2±11.5	0.4
Assiut	**Boys** **Girls**	1113 ± 378 1070 ± 350	0.3	55 ± 35 51 ± 34	0.3	163.8 ± 60 159 ± 57	0.4	26.4 ± 11.7 25.5 ± 11.3	0.5
Sohag	**Boys** **Girls**	1043 ± 329 1008 ± 311	0.08	61 ± 39 65 ± 41	0.4	146.6 ± 44 129.8 ± 39	1.6	23.6 ± 10 25.4 ± 11.7	0.1
Qena	**Boys** **Girls**	886 ± 260 934 ± 308	0.3	50 ± 34 52 ± 35	0.8	121 ± 38 133.5± 41	1.2	22.3 ± 11 21.3 ± 10.5	0.5

Table (4) Micronutrients (calcium, iron, zinc) daily intake of children aged 2-5 years in the studied governorates in Upper Egypt.

Governorates	Gender	Calcium (gm)	P-value	Iron (mg)	P-value	Zinc (mg)	P-value
Menia	Boys Girls	305±193 290±210	0.2	6.1±2.5 6.3±2.7	0.5	4.1±1.7 4.0±1.7	0.5
Assiut	Boys Girls	394 ± 88 402 ± 89	0.5	6.8 ± 2.8 6.7 ± 2.9	0.6	4.1 ±2 3.6 ±1.7	0.03
Sohag	Boys Girls	422 ± 89 423 ± 100	0.9	5.9 ± 2.1 6.1 ± 2.4	0.4	6.9±2.9 5.3±3.3	0.9
Qena	Boys Girls	416 ± 87 409 ± 90	0.6	5.3 ± 1.9 5.5 ± 2.1	0.5	4 ±1.4 4.1 ±1.5	0.8

Table (4) indicated that mean intake of calcium among studied children was ranged from 290 up to 423 mg/ day with no significant difference among boys and girls in all governorates. The least intake was among children in Menia Governorate. The most intake was among children in Sohag governorate. On the other hand the same table showed that the mean intake of iron was 5.3 up to 6.8mg/day and nearly the same in Menia, Assiut and Sohag while the least intake was among children in Qena. The deficiency of iron in the diet will reflect on the health of children and the even for the youth, where the behavioral, health status, and economic liabilities are affected due to iron deficiency. Iron deficiency either due to low contents in the diet or due to decrease in the absorption from gastrointestinal tract (GIT) can leads to delayed cognitive functioning, inhibition in the immune system, and reduced physical performance and productivity (Zimmermann and Hurrell., 2007). Also, data in the table indicated that the mean intake of zinc was nearly 4mg/ day, the least intake was in Assiut. With respect to the trace elements Zn and copper (Cu) which are essential for healthy neurological functioning, cognitive improvement, and detoxification of heavy metals (Bjørklund 2013; Böckerman et al. 2015). Indeed, iron-deficiency anemia remain affects about 40% to 60% of children in most developing countries, as stated by (UNICEF, 2007) and the global objective of reducing ‘‘by one-third the incidence of iron-deficiency anemia between children and women by 2010’’ is doubtful to be happened.

Table (5) Vitamins (C, A, D) daily intake of children aged 2-5 years in the studied governorates in Upper Egypt

Governorates	Gender	Vitamin C (mg)	P-value	Vitamin A (µg) RE	P-value	Vitamin D (µg)	P-value
Menia	Boys Girls	24.9±13.8 23.8±13.7	0.2	155±188 162±259	0.6	2.7±3.5 3.0±3.5	0.3
Assiut	Boys Girls	30.2 ± 10.6 31.1 ± 10.3	0.5	146 ± 262 142 ± 341	0.9	2.5 ± 3.4 3.0 ± 3.7	0.2
Sohag	Boys Girls	30.5 ± 10.8 29.6 ± 10.4	0.4	166 ± 196 177 ± 284	0.1	2.8 ± 3.3 2.8 ± 3.5	0.9
Qena	Boys Girls	33.6 ± 9.7 32.7 ± 9.4	0.5	136 ± 122 178 ± 297	0.2	2.7 ± 3.5 3.3 ± 0.4	0.6

Table (5) indicated that the mean intake of vitamin C among the studied children was 29 mg/day. Menia showed the least intake and the highest intake was in Qena. In Europe, folic acid vitamin D, vitamin C, selenium, calcium, and iodine were these elements display a higher incidence of insufficient intakes (Roman Viñas, 2011). Eastern Mediterranean Region Dietary intake data also show micronutrient inadequacies of calcium, zinc, iron, folic acid, vitamin A, and vitamin D in both children younger than 5 years and school-aged children (Lara Nasreddine,2018). The results in the table showed that the highest intake of vitamin A among girls was 177 µg/RE in Sohag while the least intake was 136 µg/RE among boys in Qena. The table cleared that the mean intake of vitamin D among boys was 2.7 µg/day and 3 µg /day among girls. It is well known that young children have high nutritional requirements and that a balanced diet is very essential during childhood stage for obtaining maximum growth and development (Glynn et al., 2005).

Table (6) percent adequacy of energy and protein consumed among children aged 2-5 years in the studied governorates in Upper Egypt.

Governorates	% RDA	Energy		Protein	
		% Boys	% Girls	% Boys	% Girls
Menia	50>	22.4	16.1	6.2	7.5
	50-	36.5	39.8	0.6	1.2
	75-	28.6	24.8	0.0	4.3
	100≤-	12.5	19.3	93.2	87
Assiut	50>	13.1	9.4	1.8	2.9
	50-	26.8	31.2	6.0	5.1
	75-	38.7	34.0	10.0	14.5
	100≤-	21.4	25.4	82.1	77.5
Sohag	50>	20.3	12.4	2.2	1.5
	50-	50	38.7	7.7	5.8
	75-	21.4	29.9	11	0.2
	100≤-	8.3	19.0	79.1	82.5
Qena	50>	27	18	2	2.4
	50-	49	42.2	11	8.4
	75-	19	26.5	11	12.1
	100≤-	5	13.3	76	77.1

RDA: Recommended Dietary Allowances

Table (6) showed the percent adequacy of energy and protein intake among preschooler, the data indicated that the highest percent of low energy intake was in Qena governorate in both sexes (boys and girls) which indicated that 27% of boys and 18% of girls intake was lower than 50% of their RDA, While the same table illustrate that percent adequacy of protein was good between boys and girls in all governorates.

Table (7) percent adequacy of micronutrients (Ca, Fe, Zn, vit. A, vit. C and vit. B2) consumed among children aged 2-5 years in the studied governorates in Upper Egypt.

Gov	% RDA	Ca		Fe		Zn		Vit A		Vit C		Vit B2	
		% B	% G	% B	% G	% B	% G	% B	% G	% B	% G	% B	% G
Menia	50>	100	99.4	7.5	8.7	9.9	11.8	88.2	90.1	43.5	41.6	98.2	97.6
	50-	0.0	0.0	23.0	19.3	22.4	16.1	7.5	7.5	34.2	35.4	1.2	1.2
	75-	0.0	0.0	21.1	23.0	24.2	27.3	0.6	0.6	8.7	11.2	0.6	0.0
	100≤-	0.0	0.6	48.4	49.0	43.5	44.8	3.7	1. 8	13.6	11.8	0.0	1.2
Assiut	50>	0.0	0.0	10.7	11.6	15.5	18.8	82.7	84.1	3.0	2.9	11.3	16.7
	50-	39.3	34.7	19.6	25.4	17.3	23.2	9.5	6.5	40.5	35.5	14.3	20.3
	75-	46.4	48.6	14.5	19.6	19.6	23.2	1.8	4.3	3.5	5.8	19.0	13.8
	100≤-	14.3	16.7	45.2	43.4	47.6	34.8	6.0	5.1	53.0	55.8	55.4	49.2
Sohag	50>	0	0	11.5	12.4	7.7	7.3	72	74.4	3.9	3.6	11	11
	50-	26.4	26.3	29.7	27	18.7	14.6	14.3	8.8	37.9	44.5	14.3	12.4
	75-	48.3	49.6	28.6	23.4	27.5	28.5	9.3	8	2.7	2.3	14.3	18.2
	100≤-	25.3	24.1	30.2	37.2	46.1	49.6	4.4	8.8	55.5	49.6	60.4	58.4
Qena	50>	0	0	18	18.1	5	3.6	72	73.5	2.0	2.4	16	15.7
	50-	25.0	31.3	34	30.1	21	21.7	20	12	26.0	24.1	10	14.5
	75-	51.0	49.4	27	28.9	30	31.3	3	6	3.0	9.6	18	15.7
	100≤-	24.0	19.3	21	22.9	44	43.4	5	8.5	69.0	63.9	56	54.1

Gov: governorate, RDA: Recommended Dietary Allowances, B: Boys, G: Girls, vit: Vitamin.

Data obtained from table (7) revealed that the least percent adequacy of calcium was in Menia. The percent was 100% of boys and 99.4%of girls intake lower than 50% of their RDA, the same table showed that percent adequacy of vitamin A was more than 70% of children (boys and girls) had lower than 50% of their RDA. Globally, in many developing countries, young children are at a high risk of iron and vitamin A deficiency. Vitamin A deficiency distresses about 253 million preschool children worldwide (UNICEF, 1998). The magnitudes of deficiency in vitamin A comprise retardation in growth, depressed in the immune system function, and higher risk of anemia, xerophthalmia and blindness, and subsequently elevate the percentage of morbidity and mortality as a result from some infectious diseases (Semba and Bloem 2002). Also, results in the table indicated that 40% of all studied children had percent adequacy of iron and zinc was 100≤ of their RDA except Qena governorate was 21% of boys and 22.9% of girls had 100≤ of their RDA from iron. 50% up to 60% of both sexes in Assiut, Sohag and Qena governorates had 100≤ of vitamin B2 from their RDA, while 98.2% of boys and 97.6 %of girls had 50 %< of their RDA of vitamin B2 in Menia governorate. On the other hand our results showed that Qena had the highest percent adequacy of vitamin C in compared to other governorates.

Conclusion

There is an imbalance in dietary intake; healthy foods and nutrition education programs in urgent need to be developed as a part of an intervention program for young children in Upper Egypt governorates. Optimizing dietary consumption via nutrient dense foods and proper use of food additives or supplements where necessity is indicated.

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