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ASSESSMENT OF THE NUTRITIONAL STATUS FOR PRESCHOOL CHILDREN IN JORDAN

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ABSTRACT

One hundred ninety four preschool children (106 boys and 88 girls) aged 63.5 (62-65) months from Al-karak and Assalt cities in Jordan participated in this study. The nutritional status of the children was assessed using anthropometry and dietary methods and compared with the available references. Four anthropometrics indices were calculated based on median of US- NCHS standard for attached age. Intakes of energy, macro and micro-nutrients by the children were measured and compared with DRIs. The four Z score anthropometric indices are: height/age (ht/age Z score), weight/height(wt/ht Z score), weight/age (wt/age Z score) and BMI/age Z score used to assess stunting, wasting, underweight and undernutrition statuses, respectively. The boys had higher indices and dietary intake than girls. The % of stunted children was about 17 %(15 % for boys, 18 %for girls), that of wasted children was about 15% (12 % for boys, 17 %for girls), of underweighted children was about 22 %(20 %for boys, 24 % for girls), and of undernourished children was about 12 % (10 % for boys, 13 %for girls). The children consumed inadequate diet. The deficiency in their diet was about - 24 % (-24.1 % for boys, - 24.2 % for girls) for energy; -37 % (-34.7% for boys, -39.0% for girls) for protein; -33% (-29.3% for boys, -36.3 % for girls) for seven vitamins (A, C, thiamin, riboflavin, niacin, folate, B12); and -36 % (-33.8% for boys, -38.4% for girls) for four minerals (calcium, iron, zinc, iodine). The deficit in vitamins intake ranged from -25.8% for Folate to -40.8% for C, and in minerals intake from -30.5% for iron to - 40% for zinc. The children received adequate dietary vitamin E, 6.9 mg (about 99% of DRI).

***Key words:** anthropometry, nutritional status, preschool children*

1. INTRODUCTION

Good nutrition is critical for the well-being of individuals. Food variety, quality, quantity and accessibility can deeply affect health. Early malnutrition, especially inadequate intake of protein, vitamins and minerals may lead to linear growth retardation, a state that is associated with increased morbidity and mortality (Hennart *et al.*, 1987; Golden and Golden, 1991; Prentice and Bates, 1994 and Idohou-Dossou *et al.*, 2003) , and has subsequent consequences on motor performance and coordination (Benefice *et al.*, 1999), cognitive function (Grantham-McGregor, 1984), time of menarche and normal reproductive performance (Galler *et al.*, 1987), and adequate immune reactions and resistance to infections (Martorell *et al.*, 1994). Growth retardation is highly prevalent in developing countries (De Onis *et al.*, 1993; Martorell, 1995). Inadequate intakes of dietary energy and protein and frequent infections are causes of growth retardation (Rivera and Martorell, 1988; Habicht *et al.*, 1995; Rivera *et al.*, 2003). The final height was positively correlated with the height at the age of five years, but some degree of catch-up growth occurred. However, children who continue to live in the same environment in which they became stunted experience little or no catch-up in their growth later in life (Satyanarayana *et al.*, 1980 and 1981, and Simondon *et al.*, 1998).

The period from one to six years of age is marked by vast development and the acquisition of skills. During these years the appetite decreases and the children have a decreased interest in food and an increased interest in the world around them. They develop food jags during this time. The prevalence of stunting, wasting and underweight among preschool children differed in the various regions of the world, with the lowest prevalence in Latin America and the highest in Asia (Victora, 1992; De Onis *et al.*, 1993 and Frongillo *et al.*, 1997).

Studies on growth and nutritional status have been well documented in the developed countries whereas there is hardly any large scale data in many developing countries where the malnutrition is prevalent (Gupta and Saxena, 1977 and Nwokoro *et al.*, 2006). Nutritional assessment is feasible through studying the food habits of persons, determining the insufficiencies, and then being able to propose the best solutions to get the best results (Davis and Stegman, 1998, and Pourhashemi *et al.*, 2007). Nutritional assessment involves the gathering and evaluation of data of person's nutritional status. This area consists of anthropometric, biochemical (laboratory), clinical and dietary measurements and nutritional indices.

In the present study, two methods were used to assess the nutritional status of preschool children, these are anthropometric and dietary measurements. The aim of this study was to evaluate the nutritional status of children in Al-Karak and Assalt cities and to provide baseline data for future research.

2. MATERIALS AND METHODS

The present study was carried out between September 2008 and March 2009. The data were collected from seven kindergartens (KG). Five KG located in Al-Karak city (118 Km south of Amman, the capital city of Jordan; longitude: 35 degree, 42 min and 18 sec east; latitude: 31 degree, 11 min and 8 sec north) and 2 KG located in Assalt city (29 Km north east of Amman city; longitude: 35 degree, 43 min and 25 sec east; latitude: 32 degree, 2 min and 35 sec north). At the beginning, a Food Frequency Questionnaire (FFQ) and a letter about the importance of the study were sent with children to their parents, and the repeated 24-hour recall of diet and anthropometric measurements were recorded for children that filled their FFQ. A total of 194 preschool children (106 boys and 88 girls) aged 61–64 months participated in the study. The study participants were selected from 221 children who received FFQ and reported the repeated 24 hour diet recall.

Anthropometry is a quantitative method that is highly sensitive to the nutritional status, and it can be a practical indicator of health, growth and development of infants and children (WHO, 1995, and Amuta and Houmsou, 2009). The following measurements were recorded for each child: body weight without shoes and in light clothing using a common health balance to the nearest 0.1 Kg; height was measured of the bare footed standing subjects to the nearest 0.5 cm using a Physician scale. Anthropometric measurements were taken according to Lohman *et al.* (1988). Body Mass Index (BMI) was calculated as weight in Kg divided by height in m^2. The U.S. National Center for Health Statistics (NCHS) standard for the classification of malnutrition was widely accepted and recommended by the World Health Organization (WHO, 1986). The following anthropometric indices using Z score criteria relative to the NCHS references were calculated: height-for- age (ht/age) Z score for stunting status, weight- for-height (wt/ht) Z score for wasting status, and weight for age (wt/age) Z score for undernutrition status. Children statuses were classified as severe, moderate, normal or above status if the Z score was -3 or less, > -3 to -2, > -2 to +2, or +2 or more, respectively.

Macro and micro intakes were obtained from repeated 24-hour diet recall written by children parents. They recorded their children food intake for three consecutive days, two week days (Monday and Wednesday) and one weekend day (Friday).The average daily food intakes were calculated and the nutrients [namely,carbohydrates, proteins, total fats, saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA), vitamins (A, E, C, thiamine, riboflavin, niacin, folate and B12)] and minerals (calcium, iron, zinc and iodine) were determined using Food Composition Tables (Pellet and Shadarvian, 1970, and HNIS, 1988). Energy content of daily food was calculated by multiplying the daily eaten carbohydrates, proteins and fats (grams) by 4, 4 and 9 Kcal (Williams, 1985). Nutrient intakes were compared with Dietary References Intake values (FNB, 1997; 1998;2000;2001 and 2002).

Statistical analysis was performed using Systat 8.0 (SPSS Inc., Chicago, IL, USA) to compute the means, standard deviations (SD), Z score for ht/ age, wt/ ht, wt/ age and BMI/ age. For calculation the of mentioned Z scores, the medians and SD of WHO/ NCHS standards were used. Student *t*-test was done in two directions at a significance level of 0.05, and any difference between two means was considered statistically significant if P value < 0.05.

3. RESULTS

Table (1) shows the means and SD of height, weight and BMI of 106 boys and 88 girls and the comparison between these measurements and match median for age of NCHS standards. Data showed that the boys had significantly higher weight and insignificantly higher height and BMI than girls. Compared with NCHS, the boys and girls attained 93.9% and 94.2% for height, 85.9% and 85.4% for weight and 99.3% and 98.7% for BMI.

Data on the percentage distribution of boys and girls according to NCHS standards for ht / age (stunting), wt /ht (wasting), wt/ age (underweight), and BMI/age (undernutrition) are given in Table (2). It showed that the girls had high, moderate and lower normal results than the results of boys. The overall (severe and moderate) prevalence of stunting was about 15% and 18%, of wasting was about 12% and 17 %, of wt/age was about 20% and 24%, and of BMI/age was about 10% and 13% for boys and girls, respectively. Data also showed that about 2% of boys and 3% of the girls met the criterion of overweight (BMI/age Z score>2).

Table (1): Means of height (m), weight (Kg) and body mass index (BMI)* of preschool children.

	Actual (A) **	References (R) ***	% of + or – of A over R
Height			
Boys	1.043 ± 0.16	1.11	-6.1
Girls	1.027 ± 0.12	1.09	-5.9
Weight			
Boys	16.5 ± 0.20	19.2	-14.1
Girls	15.8 ± 0.60	18.5	-14.6
BMI			
Boys	15.2 ± 0.32	15.3	-0.7
Girls	15.0 ± 0.40	15.2	-1.3

*The Outlet's index– actual weight (kg)/ height in meters squared (Lee and Nieman, 2003).

** Mean weight of boys was significantly higher than that of girls: *P*-value < 0.05.

*** References of height (m), weight (Kg) and BMI for age (NCHS Standards).

Energy and protein intakes and requirements are presented in Table 3. This table shows that boys received significantly more energy and protein than girls. Both sexes consumed low energy and protein on the base of DRI recommendations and on the base of their calculated requirements. The boys and girls consumed 1323 Kcal and 1244 Kcal of energy and 12.4 g and 11.6 g of protein. The energy intake was about of DRI recommendations (for boys and girls), 85% for boys and 81% for girls calculated energy requirements. The percentage of protein intake for boys and girls was about 65% and 61% based on DRI recommendations, and about 79% and 77% on the base of calculated protein requirements.

Macronutrients intakes and their relative energy contribution (REC %) in the total energy intake of children are given in Table (4). Data show that boys consumed more grams of carbohydrates (205), total fats (48.5) and protein (12.4) than girls (194, 46.7 and 11.6, respectively). The REC % for carbohydrates and fats were higher and for protein was lower than the recommended. It was about 104% for carbohydrates, 113% for fats and 37% for protein for both sexes when combined. Table (4) also shows that all childrens received more SFA (140%) and MUFA (131%) and less PUFA (70%) than the recommended for REC% of these fatty acids (10% each).

Table (5) shows the children intakes of micronutrients. In general, boys received more micronutrients than girls, and both sexes consumed less than the recommended rates. The average intake deficiency of PUFA was -33% and -39% for n-6 and -58% and -66% for n-3 for boys and girls, respectively. For vitamins, the deficiencies in diets of boys and girls were -33.5% and -39.3% for vitamin A, -39.2% and -42.4% for vitamin C and -26.5% and -34.5% for five-B-complex vitamins (thiamin, riboflavin, niacin, folate and B12). However, boys and girls received adequate dietary vitamin E. They consumed about 99% of the recommended rate. Mineral deficiency in the diets of boys and girls was -32.1% and -36% for calcium, -27% and -34% for iron, -40% and -44% for zinc and -36% and -39.6 for iodine. The average deficit of these seven vitamins was about -29.3% for boys and -36% for girls (about -33% as average for both sexes),while deficits of the four minerals was about -34% for boys and -38% for girls (about -36% as average for both sexes).

4. DISCUSSION

Anthropometrics can be considered sensitive indicators of health, growth and development in infants and children. They are used to assess the size, proportion and composition of human body (WHO, 1995). The ultimate intention of nutritional assessment is to improve human health (Beghin *et al.*, 1998). Malnutrition which refers to an impairment of health either from a deficiency or excess or imbalance of nutrients is a public health significance among children all over the world (Amuta and Houmsou, 2009). There were various indices based on anthropometry used to evaluate the nutritional status of the children (WHO, 1995). It has now been well established that the body mass index (BMI) is the most appropriate variable for nutritional status (Must *et al.*, 1991; Rolland-Cachera, 1993, and Amuta and Houmsou, 2009). To study the nutritional status of preschool children, two methods were used in this study; they were anthropometrics and dietary measurements. The means of height and weight of the studied children were found to be much inferior when compared to NCHS standards which are the reference data recommended by WHO. Children had about 94%, 85% and 99% of NCHS standards for height, weight and BMI for matched age. Noteworthy, the present BMI mean, which nearly matched the standard, cannot be strongly used as an index for assessing the nutritional status of the studied children. Means of height, weight and BMI of boys were better than those of girls and came in accordance with NCHS standards for matched age. However, boys consumed more energy and macro and micro nutrients than girls, and this may have resulted in their higher body measurements (Agrabar-Murugkar, 2005; Leahy *et al.*, 2008 and Briefel *et al.*, 2009).

It was observed that the mean prevalence of severe and moderate stunting (ht/age), which was used as index of chronic malnutrition was about 17%; of wasting (wt/ht), used as index of current malnutrition was about 15%, and of underweight (wt/age) was about 22% for boys and girls taken together. These data indicate the occurrence of malnutrition among the study boys and girls and may be attributed to various factors such as body size at birth and the nutritional status of mothers

Table (2): Percentage of preschool children according to status of stunting, wasting, underweight and undernutrition.

Status	Gender	Severe -3 SD Z score		Moderate >-3 to -2 SD Z score		Normal >-2 to> +2 SD Z score		Over +2 SD Z score	
		NO.	% **	NO.	% **	NO.	%	NO.	%
Stunting	Boys	2	1.9	14	13.2	87	82.1	3	2.8
Height/Age	Girls	2	2.3	14	15.9	70	79.5	2	2.3
Wasting	Boys	3	2.8	10	9.5	91	85.8	2	1.9
Weight/Height	Girls	4	4.5	11	12.5	70	79.6	3	3.4
Underweight	Boys	4	3.8	17	16.0	84	79.3	1	0.9
Weight/Age	Girls	5	5.7	16	18.2	65	73.9	2	2.2
Undernutrition	Boys	2	1.9	9	8.5	93	87.7	2	1.9
BMI*/Age	Girls	3	3.4	8	9.1	74	84.1	3	3.4

*BMI: the Outlet's index – actual weight (kg)/ height in meter squared – (Lee and Nieman, 2003) Note: References of height/ age, weight/height, weight/age and BMI were the medians of NCHS standards. ** Percentages of boys were significantly lower than those of girls: *P*-value < 0.05.

Table(3): Energy (Kcal/day) and protein (g/day) requirements based on dietary reference intake (DRI) and body height and weight.

Characters	Actual Intake (AI) a	Reference Intake (RI)		% of + or – of AI over RI	
		DRI *	Calculated **	DRI	Calculated
Energy (Kcal)					
Boys	1233 ± 11	1742	1565	-24.1	-15.1
Girls	1244 ± 14	1642	1541	-24.2	-19.3
Protein (g)					
Boys	12.4 ± 0.6	19.0	15.7	-34.7	-21.0
Girls	11.6 ± 0.8	19.0	15.0	-39.0	-22.7

a : AIs of boys were significantly higher than those of girls: *P*-value < 0.05.*: Recommendations of FNB, 2002; **: calculated on the base of actual height (cm) multiplied by 15 Kcal/cm for energy requirements (Beal, 1970) and actual weight (Kg) multiplied by 0.95 g/Kg for protein requirements (FNB, 2002).

Table (4): Macronutrients intake and their relative energy contribution (REC %) in total energy intake of preschool children. *

Nutrients	Actual Intake (g)a		REC% (A)		Ref. REC% (R)**		% of + or – of A over R	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Carbohydrates	205 ± 2.4	194 ± 3.6	62.0	62.5	60	60	+3.3	+4.1
Total Fats	48.5 ± 1.3	46.7 ± 2.5	34.3	33.8	30	30	+14.3	+12.6
SFA [1]	20.9 ± 1.0	18.91 ± 1.6	14.2	13.7	10	10	+42	+37
MUFA [2]	19.6 ± 1.4	17.8 ± 2.1	13.3	12.9	10	10	+33	+29
PUFA [3]	10.0 ±1.2	9.9 ± 1.4	6.8	7.2	10	10	-32	-28
Protein	12.4 ±0.6	11.6 ± 0.8	3.7	3.7	10	10	-63.0	-63.0
Total Energy Intake (Kcal)	1323 ± 11	1244 ± 14	100	100	100	100	-	-

*Total energy content (Kcal) of average daily food intake was calculated by multiplying the daily eaten carbohydrates, fats and protein (grams) by 4, 9 and 4, respectively (Williams, 1985).**: REC% for carbohydrates, total fat and protein the (Health and Welfare Canada Nutrition, HWCN, recommendation, 1990) and for SFA[1] (Saturated fatty acids), MUFA [2] (monounsaturated fatty acids) and PUFA [3] (polyunsaturated fatty acids) the REC% on the base of 10% of total energy intake (Lee and Nieman, 2003). a : Actual intakes of carbohydrates, total fats, SFA, MUFA and protein of boys were significantly higher than those of girls: *P*-value < 0.05

(Mozumder *et al.*, 2000 and Sanghvi *et al.*, 2001), mothers education (Islam *et al.*, 1994 and Smith and Haddad, 2000). Father's education was an important factor that is significantly associated with underweight status among preschool children. Usually the father is the main earner and decision maker of a family and so his high education level plays an important role to ensure better nutritional status of children (Rayhan and Khan, 2006). Inadequate intake of dietary energy and protein are well-known causes of growth retardation (Mora *et al.*, 1981 and Habicht *et al.*, 1995). Protein and fat are the two most important macronutrients with high impact on children growth and energy provision (Pourhashemi *et al.*, 2007). The role of specific micronutrient deficiencies in the etiology of growth retardation has gained attention more recently (Allen, 1994; and Brown *et al.*, 2002). Deficiencies of some micronutrients, such as iron, magnesium and zinc, result in anorexia (Lawless *et al.*, 1994 and Clausen and Dorup, 1998). Therefore, these nutrient deficiencies also may contribute to growth retardation indirectly by reducing the intake of other growth-limiting factors, such as energy and protein. Inadequate zinc intake may be contributing to the high prevalence of stunting. This mineral deficiency was identified as a cause of stunting and delayed development in the Middle East in the 1980s (Sandstead, 1991; Rivera *et al.*, 2003 and Sarraf *et al.*, 2005). Zinc deficiency occurs in diets low in rich sources of zinc such as red meats and high in whole–grain cereals rich in fibre and phytate which decreases zinc absorption (Sandstead, 1998 and PDR Health, 2004). Inadequate dietary zinc was reflected as biochemical signs (Mahmoodi and Kimiagar, 2001). The addition of animal foods to the food list of children was associated with a markedly higher average concentration of serum zinc and may promote linear growth (Government of Kenya, 1999; Bwibo and Neumann, 2003 and Murphy and Allen, 2003). n-6 and n-3 PUFA, especialty linoleic acid, play a role in physical growth (Heird, 2001).

However, the present data show that the children received inadequate amounts of energy, protein, vitamins, minerals and PUFA and may have resulted in growth retardation, especially in girls. The observed low growth indices compared with NCHS standards may be attributed to nutritional and socio-economic factors rather than genetic factors since many researchers (Tanner, 1961; Banik *et al.*, 1973; Janes, 1974; Esiet, 1984; Nwokoro *et al.*, 2006) reported that African origin subjects residing in developed countries have growth standards comparable to or even higher than those of NCHS standards.

The recommended dietary allowances (RDA) represent an establishment of planning and assessing dietary intake and are the levels of intake of essential nutrients considered to be adequate to meet the known needs of practically all healthy people (Pourhashemi *et al.*, 2007). However, requirements differ with age and body size owing to differences in genetic makeup; with the physiological state of individuals growth rate, and with sex. In the present study, the children received about 76% (for both sexes) and 83% (85% for boys, 81% for girls) of their energy requirements and about 63% (65% for boys, 61% for girls) and 78% (79% for boys, 77% for girls) of their protein requirements on the basis of RDA and calculated requirements, respectively. These deficiencies, which accounted for about 24% energy and 37% for protein on the base of RDA, were however, noted in Senegale (Idohou-Dossou, 2003), in Bangladish (Rayhan and Khan, 2006), in Iran (Pourhashemi *et al.*, 2007) and in India (Khandare *et al.*, 2008). Although there is a great deal of evidence that the RDAs are too low for optimal health, the argument over whether to raise these levels is intense (Cryan and Johnson, 1997) However this dialogue, many people do not receive even today's lower allowances. Workers in the nutrition field generally agree, however, that people who consume less than 70% of an RDA are at risk for developing nutritional deficiency, and these disturbing figures suggest that nutrient deficiencies may be common (Pourhashemi *et al.*, 2007).

To study the dietary balance of the studied children, the macronutrient intakes and their REC% in total energy intake were calculated and accordingly compared with the recommendations of HWCN (1990), which suggest 60%, 30% and 10% for carbohydrates, fat and protein, respectively. Based on the healthy recommendations, and to study the balance of dietary fat intake, the total fat intake was divided into three groups: SFA, MUFA and PUFA, and the REC% of each group was compared with the recommended REC% (10% each, Lee and Nieman, 2003). On the basis of their actual total energy intake, the children received more energy from carbohydrates (+4%) and total fats (+13%) and low energy from protein (-63%) than the recommended balanced diet. Furthermore, the children consumed more energy from SFA (+40%) and MUFA (+31%) and less energy from PUFA (-30%) than the recommended dietary fat balance.

Table (5): Micronutrients intake of preschool children

Nutrients	Actual Intake (AI)a		Reference Intake* (RI)		% of + or – of AI over RI	
	Boys	Girls	Boys	Girls	Boys	Girls
[1] n-6 PUFA (g)	6.7 ± 0.5	6.1 ± 0.7	10	10	-33	-39
[1] n-3 PUFA (g)	0.42 ± 0.01	0.34 ± 0.02	1	1	-58	-66
Vitamins						
[2]A (mcg)	266 ± 8	243 ± 9	400	400	-33.5	-39.3
[3]E (mg)	6.9 ± 0.8	6.9 ± 0.9	7.0	7.0	-1.4	-1.4
[4]C (mg)	15.2 ± 1.1	14.4 ± 1.2	25	25	-39.2	-42.4
[4]Thiamin (mg)	0.45 ± 0.03	0.37 ± 0.04	0.60	0.60	-25.0	-38.3
[4]Riboflavin (mg)	0.42 ± 0.04	0.38 ± 0.03	0.60	0.60	-30.0	-36.7
[4]Niacin (mg)	6.1 ± 0.4	5.7 ± 0.6	8.0	8.0	-23.8	-28.8
[4]Folate(mg)	156 ± 6	141 ± 8	200	200	-27.0	-29.5
[4]B12(mg)	0.82 ± 0.02	0.73 ± 0.03	1.2	1.2	-31.7	-39.2
Minerals						
[4] Calcium (mg)	543 ± 14	512 ± 16	800	800	-32.1	-36.0
[4] Iron (mg)	7.3 ± 0.4	6.6 ± 0.5	10	10	-27.0	-34.0
[4] Zinc (mg)	3.0 ± 0.2	2.8 ± 0.3	5	5	-40.0	-44.0
[4] Iodine (mcg)	57.5 ± 2.6	54.4 ± 3.1	90	90	-36.0	-39.6

Reference intake of 1, 2, 3, 4 and 5: dietary reference intake, FNB (2002, 2001, 2000, 1998 and 1997, respectively).
a : Actual intakes all nutrients(but vitamin E) of boys were significantly higher than those of girls: P-value < 0.05

In comparison with their requirements (FNB, 1997; 1998; 2000; 2001), the boys and girls consumed low vitamins, namely A, C, thiamin, riboflavin, niacin, folate and B12. The average deficit of these seven vitamins was about -33% (ranging from -26% for niacin to- 41% for vitamin C) for boys and girls combined, and may be due to low children intakes of foods from animal sources and vitamin C sources. In contrast, the children received adequate vitamin E and that may be due to high oil and fat intake. The children consumed low dietary minerals, namely calcium, iron, zinc and iodine. The average deficit of these four minerals was about -36% (ranging from -31% for iron to -42% for zinc) for boys and girls combined. The above mentioned data were doubtlessly indicative of inadequacy in childrens dietary vitamins and minerals, which reached about -35% for the mentioned seven vitamins and four minerals. However, the deficiency in these nutrients was higher in girl`s diet than in boys` diet. In instance, this status of children's vitamins and minerals was a mirror of their foods. They frequently eat fast food products rich in sugar or fat or both and low in micronutrients (energy-dense foods), for example, confectionary, soft drinks, lollipop, and chips even for the main meals. Among bad dietary habits of the present studied children was abstaining from regular meals. They drank more soft sugary drinks, and this accounted for about 15% of total energy intake for most of them. The same observation was reported by Leahy *et al.* (2008) and Briefel *et al.* (2009). As in most populations, breakfast is the least important main meal in terms of energy and is frequently inadequate from the nutritional point of view. Out of 106 boys, 41 (39%) and of 88 girls, 30 (34%) received no breakfast, only tea or juice or milk. The most common habits for most of the tested children were eating sandwiches, especially falafel (made from fried chick-pea), seneora and thyme with olive oil, eating potato and corn chips, drinking more soft drinks, eating less food from animal sources (meats, endogenous organs, fish, dairy products). These habits resulted in high intake of fat and carbohydrates, low intake of protein, especially from animal sources, and low intake of micronutrients.

In the 1980s, the Nutrition Collaborative Research Support Program identified six micronutrients that were particularly low in the primarily vegetarian diets of school children in rural Egypt, Kenya and Mexico: vitamin A, B12, riboflavin, calcium, iron and zinc (Juan *et al.*, 2003). Negative health outcomes associated with inadequate intake of these nutrients include anemia, poor growth, rickets, impaired cognitive performance, blindness, neuromuscular deficits and eventually death (Black, 2003). Animal source foods are particularly rich sources of these nutrients, and relatively small amounts of these foods added to the plant foods can substantially increase nutrient adequacy, as happened with snacks designed for Kenyan school children when milk and ground beef were added to their diets (Murphy and Allen, 2003 and Bwibo and Neumann, 2003). However, here is a question: can we provide our children in Jordan like these snacks in the light of our knowledge that their parents cannot present to them all nutrition requirement especially from animal sources which gained high prices in later years?

Nutrition status is a major determinant of the health and well being of children, and inadequate diets are associated with poor nutrition. Children are the first consideration in development process because they are the most vulnerable and crucial of human development. Early childhood constitutes the most crucial period in life when the foundations are laid for cognitive, social and emotional language, physical development and cumulative life long learning. Therefore, the lower values obtained from this study are suggestive of the need for the improvement in the nutritional status of preschool children in Jordan. As mentioned in the beginning, this study was executed in cities and gave a general idea; it showed that the nutrition status of city children is 'not good'. This idea implies that the nutrition status of village children may be at 'bad' form.

In conclusion, energy, protein and macronutrient deficiencies seem to be a more serious problem among the studied children. Increase in animal foods and fruits and vegetables is one suggestion for improving the nutritional status of the children which requires enhancing nutrition knowledge of parents, and implies the important role of government in aiding the families especially in times of the raised prices, and in encouraging animal farming.

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تقويم الحالة التغذوية للأطفال في عمر ما قبل المدرسة في الاردن

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ملخص

درست الحالة التغذوية ل ١٩٤ طفلا (١٠٦ ذكر و ٨٨ أنثى) من مدينتي الكرك والسلط في الأردن .

تم تقييم الحالة التغذوية لهؤلاء الأطفال بطريقتين ، الأولى هي : القياسات البدنية والثانية هي : المتناول من الطاقة والمغذيات . حسبت اربعة أدلة للقياسات البدنية وقورنت بالمقاييس المرجعية لمركز الإحصاء الصحي الوطني الأمريكي حيث تم حساب ما يعرف بالمدى الصفري للأدلة الاربعة التالية : الطول \ العمر و الوزن \ الطول و الوزن \ العمر. و دليل كتلة الجسم \ العمر . كانت الأدلة المذكورة والمتناول من المغذيات للذكور أفضل منها للإناث وهي على النحو التالي :كانت نسبة الأطفال القصيرين – طول \ عمر – كانت ١٧% (١٥% للذكور و ١٨% للإناث) وكانت نسبة الأطفال ناقصي الوزن بالنسبة للطول – وزن \ طول – كانت ١٥% (١% للذكور و ١٧ % للإناث) ونسبة الأطفال ناقصي الوزن بالنسبة للعمر – وزن \ عمر – كانت ٢٢% (٢٠ % للذكور و ٢٤ % للإناث) ونسبة الأطفال قليلي التغذية – كتلة الجسم \ العمر كانت ١٢% (١٠% للذكور و ١٣% للإناث) . لوحظ مقارنة بمرجع التناول الغذائي عوزا في تغذية الأطفال يقدر بحوالي ٢٤% في الطاقة (٢٤,١% للذكور ٢٤,٢%للإناث) وحوالي ٣٧ % في البروتين (٣٤,٧% للذكور و ٣٩ % للإناث) وحوالي ٣٣% في سبعة فيتامينات هي أ ، جـ ، ثيامين ، رايبوفلافين ، نياسين ، فوليت ، ب ١٢ (٢٩,٣% للذكور و ٣٦,٣% للإناث) وحوالي ٣٦ % في اربعة معادن غذائية هي الكالسيوم والحديد والزنك و اليود (٣٣،٨% للذكور و ٣٨,٤% للإناث). لقد تراوحت نسبة العوز في الفيتامينات بين ٢٥,٨ % للفوليت الى ٤٠،٨% لفيتامين جـ وفي المعادن تراوحت نسبة العوز بين ٣٠,٥ % للحديد الى ٤٠% للزنك . أظهرت الدراسة بان الأطفال قد تناولوا كفاية من فيتامين هـ (حوالي ٩٩% من مرجع التناول الغذائي) .

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