HEALTH STATUS, BLOOD PRESSURE AND DIETARY PATTERN A PILOT STUDY AMONG EGYPTIAN ADOLESCENTS

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Abstract: This pilot study was carried out to assess the nutritional status, blood pressure (B.P) and dietary intake of some school adolescents in Giza governorate, aiming to investigate the relationship between adolescent nutritional status and the development of diet related diseases. 308 students were randomly chosen from 5 public secondary schools. Clinical examination, B.P, and anthropometric measurements were recorded. BMI was calculated. 24 hour dietary recall and socioeconomic questionnaires were filled by interviewing the students. The study revealed that 2.6% of the students were stunting, and by using weight/age and BMI parametres, 26.6%, 6.8% were obese The mean energy intake was below the RDA, with a wide range between low and high values among the three social groups. The mean daily intake of some vitamins &minerals were low. Over weight / obese and chronic undernourished students had mean B.P higher than normal weight. There was high positive correlation ($p \leq 0.01$) between both systolic and diastolic BP and most of the anthropometric measurements except for height when sexes were taken in consideration. In conclusion these data clarified the presence of both under and over nutrition among Egyptian adolescents and reinforce the association between both conditions and the elevated BP. Further more high salt consumption may be a common and important factor associated with the elevated blood pressure.

Keywords: Adolescents, Anthropometry, dietary intakes, Blood pressure.

INTRODUCTION

Nutrition is one of the most important environmental factors affecting health and growth. An adequate food supply alone, does not ensure sufficient food intake by everybody as other factors, including food habits and beliefs; are involved, The choice of food is largely determined by many inter-related factors as geographic location and climatic changes that influence the cultivation of food crops, Cultural traditions

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transmitted from generation to generation and the socioeconomic conditions that may facilitate or interfere with the access of individuals to the foods available in the community (Serra et al., 2003).

Adolescent commonly is defined as the time between the onset of puberty and adulthood. Adolescent is one of the most dynamic periods of human development. This period is characterized by dramatic physical, cognitive, social, and emotional changes (American Dental Association, 2000). Teens need lots of energy for rapid growth and plenty of protein for muscle development. They also have high mineral needs: calcium for building bones, zinc for normal maturation, and iron for making blood cells, especially for teen girls (Dayle, 2006).

Egypt's demographic momentum has created the largest ever cohort of young people between ages of 10 and 19 more than 13 million. Enabling the successful transition to adulthood for this generation will have profound effects on Egypt's ability to sustain its development trajectory (National Survey of adolescents, Egypt, 2003). Egypt is a developing country that is facing the double burden of malnutrition, the changed consumption patterns of Egyptian population have been associated with increasing intakes of fats and oil, high – fat products, sugar, meat and refined carbohydrates and decreasing cereal consumption. The data from national surveys show that the percentage of receiving more than 100% recommended dietary allowances (RDAs) of energy is increased with a decrease in physical activity, explain the high prevalence of obesity in adolescents. (Hassan and Mousa, 2005). Based on Body Mass Index categories, the prevalence of overweight and obesity among adolescents aged 10-18 years was 20.5 %. (National Survey for Diet, nutrition and non-communicable diseases "DNPCNCD" National Nutrition Institute, 2008). However among the Egyptian adolescents, there was an apparent problem in bone mass accumulation and this may be a reflection of the very low calcium intakes. Calcium intake level among Egyptian adolescents is far below the recommended international figures to prevent osteoporosis. The results of a national survey (DNPCNCD) carried out by the National Nutrition Institute, Egypt (2008), reported that, the 25 percentile of the daily calcium intake among adolescents aged 10-18 years was 323.5g, while the 50 and 75 percentiles were 494.8g and 704.2 respectively. In A National Survey for the determination of Bone Mass Density among Adolescents and Adults in Egypt 2004 (National Survey for determination of Bone MASS, Egypt, 2004) nearly two-thirds or more of all targets were receiving (≥100%) of their requirements for protein, Almost all the studied males had copper intake less than 75% of RDA versus half the studied females. Mean Iron intake among males was significantly higher than mean intake among females, nearly 70% of females were receiving less than 50% of RDA, and mean zinc intake was significantly lower than RDA for all studied targets. The prevalence of zinc deficiency (<70μg /dI) was 22%, 29.9% among male and female adolescents. Mean Vitamin A intake was significantly lower among the studied targets. Nearly two –thirds had less than 75% of RDA. The results showed that Vitamin A deficiency (<20μg /dI) was 22.9% and 22.5% among male and female adolescents. Deficiency of Vitamin D (<14 ng/I) was 5.1% and 3.02% among male and female adolescents. Selenium deficiency (<7.5μg / dI) was 22% and 29.9% among male and female adolescents.

A study by (Amer, 2000) reported that according to BMI, the percentage of underweight students was 9.3% and those having standard weight was 45.2%; the pre-obese (overweight) was 20%; grade I & grade II obesity represents 11.7% & 11.6% respectively; grade III obesity was 2.2%. Obesity was found to be more prevalent in low & middle socioeconomic classes

The prevalence and rate of diagnosis of hypertension in children and adolescent appear to be increasing (Sorof et al., 2004). This is may be due to the increasing prevalence of childhood obesity as well as growing awareness of this disease. There is evidence that childhood hypertension can lead to adult hypertension (Lauer and Clarke, 2002). In developing countries nutritional deficit during prenatal and continuing in post-natal life is very common. This condition leads to stunting and important metabolic changes (Amer, 2000). In addition to the relation between B.P and body weight and height there is evidence that substantial variation in salt intake can produce measurable changes in blood pressure.

The aim of this study was to assess the current nutritional status, dietary intake and blood pressure among urban Egyptian school adolescents, randomly chosen from five public schools. Adolescence is the second most critical period of physical growth; however they received few health cares as they are considered a low risk group. The rationale and the potential for preventive practice are based on well established relationships between nutritional risk factors and the onset of diet-related diseases.

SUBJECTS AND METHODS

The subjects and places of the study

Cross section pilot study including 308 adolesents, 152 males and 156 females were recruited randomly to represnt differnt socioeconomic status in five public secondary schools from different places located in Giza Governorate Egypt. The adolesents classifed according to their ages into two categories; age group (I) 13.5-<15 years; age group (II) up to 18 years. Adolescents who had any renal or/and endocrine disorders were excluded, no drop out of cases as it is a cross sectional study not a follow up one.

Egyptian national census was the bases for the demographic criterion for the selection of the targeted school included in this study, (Central Agency for Public Mobilization and Statistics, Arab Republic of Egypt, 2008). Informed consent decument for the members of the investigative team were developed, as well as for the examination and data collection from the general director of the Giza education office. Written parent' consent was obtained for each student.

Assessment of the socio-economic characteristics

Data related to Socio-economic characteristics for each subject was assessed using a questionnaire sheet, specially designed for the present study. Personal interview was conducted by trained social workers. The questionnaire sheet included the following data:

Adolesent data**:** age, sex, number of brothers & sisters and his ranks in the family (birth order). Family data: family income, type and size, parent's age, education and occupation. House condition: water source, heigenic sewage disposal and electric instruments and number of rooms. The socioeconomic status of the household was calculated from the following equation (El-Shakhs, 1995).

Predicted Socioeconomic Status=2.259+ 1.016 (C1)+0.886 (C2)+0.622 (C3).

Where are: C1; Average income of the household per month in Egyptian pounds. C2; Score of the father's profession, C3; Score of the father's education

The socioeconomic levels were categorized as fallow; low level ranged between (48-96), medium level between (97-144) and high level greater than (145-192).

Assessment of the nutritional status of the adolescent included the following

Repeated Twenty-four hour recall method, record food intake for three scattered days (3 recalls), includes one day as a holiday. Data were collected by qualified dietary staffs, by personal interview. Detail description of all food and beverages consumed, including cooking methods and the amount of each ingredient in recipe was recorded. The conversion of household measures to grams was achieved through use of prepared list of weighs of commonly used household measures in Egypt. Nutrient intake were calculated using computer programmes (World Food Dietary Assessment System, 1995)**.** The daily intakes of calories and protein were compared with National Research Council (National Research Council, USA, 1989)**,** while vitamins and minerals were compared with FAO/WHO 2002**.**

Assessment of anthropometric measurements

The anthropometric measurements were recorded by trained physician according to Lee and Nieman, (2003). The measurements included the following: Body weight, body height, Body Mass Index (BMI), skin fold thickness (triceps, biceps, sub scapular, suprailiac), circumferences; biceps extended and chest.

Clinical examination

The clinical examination was carried out by physician, according to a specially designed sheet included data about the following:

Hair, Face& scalp, Skin, Nails, Eyes, Lips, Tongue, Gum, Teeth, Thyroid.

Blood pressure measurement:

Three blood pressure measurements were taken by physician using conventional sphygmomanometer according to standard protocol (Perloff and Flack, 1993). Normal blood pressure was defined as systolic < 120 mmHg and diastolic < 80 mmHg and Pre-high blood pressure or prehypertension is 120/80 to 139/89 mmHg, high blood pressure begins at 140/90 mmHg and goes up from there, according to (Nina et al., 2006).

Statistical Analysis of Data

Statistical analysis was performed using the SPSS (Chicago, IL, USA) software for Windows (SPSS Inc., Chicago, IL, Version 13.0, 2004).

RESULTS

Table (1): showed the mean ±SEM of the anthropometric parameters of the studied adolescents according to sex, age and socio-economic status. Results showed that the mean was gradually increase with age while the effect of the socio-economic status on the mean values of the anthropometric parameters was not well apparent.

Table (2): shows the Precent distribution of height / age, weight / age and BMI of the males and females adolescents 2.6% of the pupils were complained from severe stunted ($<5^{th}$) while 25.3% were blow 25^{th} no sex

Table 1 Mean ±SEM of the anthropometric parameters of the studied adolescents according to Sex, age and socioeconomic status.

Parameters	*Age 13-14.9 Years (no=47)*			*Age15-17.9 Years (no=105)*		
Male	*Low (11) Mean ± SE*	*Middle (27) Mean ± SE*	*High (9) Mean ± SE*	*Low (31) Mean ± SE*	*Middle (52) Mean ± SE*	*High (22) Mean ± SE*
Age (year)	13.9 ±0.21	14.1 ±.13	13.9 ±0.15	15.4 ±0.10	15.5 ±0.11	15.3 ±0.14
Height (Cm)	167.1 ±3.06	167.6 ±1.53	167.0 ±5.98	173.5[a]** ±1.35	168.0 ±1.21	168.1 b** ±1.84
Weight (Kg)	62.8 ±6.30	60.5 ±2.53	68.1 ±5.98	66.8 ±2.66	62.0 ±1.92	62.9 ±2.79
BMI (kg/m)	22.3 ±1.64	21.4 ±0.69	24.3 ±2.03	22.2[a]** ±0.86	21.9 ±0.63	22.1 ±0.73
Arm Circumference (cm)	26.2 ±1.46	24.2 ±0.61	26.4 ±1.57	25.8 ±0.69	24.6 ±0.52	24.9 ±0.65
Chest (Cm)	85.2 ±4.59	83.6 ±1.57	89.1 ±4.02	87.0 ±1.91	85.6 ±1.23	85.4 ±1.79
Sum of Skin Fold (mm)	31.9 ±5.78	29.4 ±2.63	33.8 ±2.89	38.9 ±3.81	35.5 ±2.15	35.4 ±3.37
Female	*Low (18) Mean ± SE*	*Middle (25) Mean ± SE*	*High (7) Mean ± SE*	*Low (36) Mean ± SE*	*Middle (57) Mean ± SE*	*High (13) Mean ± SE*
Age (year)	13.1 ±.14	14.1 ±.13	14.0 ±0.01	15.3 ±.12	15.5 ±.14	15.4 ±0.14
Height (Cm)	159.3 ±1.41	159.1 ±0.99	161.5 ±2.43	160.7 ±1.29	160.8 ±0.74	161.5 ±2.47
Weight (Kg)	59.1 ±3.97	56.3 ±2.25	59.0 ±4.97	62.6 ±2.04	60.9 ±1.47	59.1 ±4.95
BMI (kg/m)	23.2 1.39	22.2 ±0.79	22.5 ±1.35	24.2 ±0.71	23.5 ±0.56	22.4 ±1.44
Arm Circumference (cm)	25.1 ±0.92	25.4 ±2.96	24.9 ±1.55	25.3 ±0.59	24.6 ±42	24.3 ±1.05
Chest (Cm)	85.3 ±4.01	82.8 ±2.96	87.1 ±3.29	87.1 ±2.18	86.9 ±1.33	84.4 ±3.83
Sum of Skin Fold (mm)	50.7 ±3.86	45.2 ±3.26	52.4 ±6.99	52.7 ±2.65	48.4 ±1.98	45.5 ±4.31

Low vs Middle a, Low vs High b, Middle vs High c,

*Significant at p< 0.05,** Highly significant at p< 0.01.

Table 2 Precent distribution of height / age, weight / age and BMI prcentiles of the males and females adolescents.

Height / age												
Percentiles	*<5*		*5 - < 25*		*25 - > 75*		*≥ 75*		*≥ 95*		*Total*	
Sex	No	%	No	%	No	%	No	%	No	%	No	%
Males	4	2.6	36	23.7	70	46.1	15	9.9	27	17.8	152	49.4
Females	4	2.7	38	24.4	65	42.8	14	8.9	35	22.4	156	50.6
All Sex	8	2.6	74	24.03	135	43.8	29	9.4	62	20.1	308	100
Weight / age												
Percentiles	*<5*		*5 - < 25*		*25 - > 75*		*≥ 75*		*≥ 95*		*Total*	
Sex	No	%	No	%	No	%	No	%	No	%	No	%
Males	11	7.3	19	12.5	44	28.9	34	22.4	44	28.9	152	49.4
Females	24	15.4	31	19.9	31	19.9	32	20.5	38	24.4	156	50.6
All Sex	35	11.4	50	16.2	75	24.4	66	21.4	82	26.62	308	100
BMI												
Percentiles	*<5*		*5 - < 25*		*25 - > 75*		*≥ 75*		*≥ 95*		*Total*	
Sex	No	%	No	%	No	%	No	%	No	%	No	%
Males	18	11.8	47	30.9	55	36.2	23	15.1	9	5.9	152	49.4
Females	13	8.3	26	16.7	65	41.7	40	25.6	12	7.7	156	50.6
All Sex	31	10.1	73	23.7	120	38.9	63	20.5	21	6.8	308	100

difference was observed. 11.4% of the pupils were severely under weight ($<5^{th}$), using weight /age parameter, the percent of female was higher than male, 15.4% and 7.3% respectively. using BMI parameter 10.1% were thin, 11.8% female and 8.3% male. The percent of over weight pupils $\geq 75^{th}$ -< $95^{th.}$ Were 6.8% while the obese $\geq 95^{th}$ were 6.8%.

Table (3) showed the mean ± SEM of the daily intake of macro and micronutrients of the adolescents and its relation to the RDAs according to age and socioeconomic status. All the reported means were blow the RDAs except that of the protein, but a wide range of the intake was observed. Significant differences were detected among the social groups in the intake of the protein, folate, iron, phosphorus and sodium.

Table (4) showed Signs of clinical deficiencies among adolescents according to their sex and socioeconomic status. Signs that related to vitamins and minerals deficiencies had been detected especially thoes related to vitamin A, riboflavin and iron deficiencies, with higher prevalence among low socioeconomic compared to middle and high socioeconomic groups.

Table 3 Mean ± SEM of the daily intake of the macro and micro nutrients of the adolescents and its relaton to the RDAs according to age and socioeconomic status.

socioeconomic status	*Low (n=93)*		*Middle (n=164)*		*High (n=51)*		*Sig*
Items	*Mean ± SE* *Range*	*% of RDAs* *Range*	*Mean ± SE* *Range*	*% of RDAs* *Range*	*Mean ± SE* *Range*	*% of RDAs* *Range*	
Energy (Kcal)	1644 ± 52 713-2750	67 25-119	1751 ± 33 851-2824	70 38 -128	1923 ±68 820-3092	73 37-125	**.153**
Protein (g)	55.1±2.2 12.4-104.0	112.63 23.4-224.1	61.2±1.5 25.3-121.5	125.12 48.9-264.1	66.6±3.4 25.9-178.2	130.04 58.9-302	**.033***
VitaminA (µgRE)	1024.84±70.55 69.0-3649.0	102.48 6.9-364.9	539.59±77.38 25.0-4032.4	53.96 2.5-403.2	477.45±36.81 83.0-1290	47.75 8.3-129.1	**.114**
Vitamin C (mg)	36.75±2.86 1.0-99.0	64.10 1.67-182	37.71±2.13 3.0-98.0	67.37 5-196	42.08±4.29 7.0-99.0	73.41 11.7-196	**564**
Vitamin D (mcg)	0.76±0.20 0.10-9.0	15.16 0.1-180	1.19±0.19 0.3-10.0	23.78 0.11-200	0.71±0.25 0.10-10.0	14.12 0.1-200	**.206**
Vitamin E (TE)	3.45±0.19 0.2-10.0	39.84 0.1-125	3.45±0.13 0.2-9.0	38.45 0.1-112.5	3.71±0.23 1.0-7.0	40.15 10-87.5	**.800**
VitaminB6 (mg)	0.92-±0.02 0.20-1.67	55.77 14.29-105.3	0.949±0.02 0.20-2.0	57.13 14.3-142.9	0.98±0.02 0.40-2.24	56.55 20-112	**.867**
VitaminB12 (mcg)	1.48±0.14 0.07-5.19	73.77 0.01-609.5	1.68±0.02 0.01-3.0	84.09 0.1-150	1.76±0.11 0.07-2.87	88.19 3.5-143.5	**.168**
Thiamin (mg)	0.82±0.02 0.16-137	66.35 14.55-124.5	0.85±0.03 0.28 -1.51	67.39 21.5-137.3	0.88±0.02 0.30-1.43	66.72 27.3-120	**.934**
Riboflavin (mg)	0.92±0.02 0.28-2.30	63.23 15.56-133.9	1.04±0.04 0.31 -3.12	69.78 23.9-173.3	1.01±0.01 0.29-2.50	64.88 22.3-138.9	**.174**
Niacin (mg)	9.84±0.45 1.0-21.70	59.48 6.67-144.67	10.44±0.31 1.7-22.0	62.11 11.33-146	10.79±0.55 3.8-21.0	61.36 22-124	**.726**
Folate (mcg)	169.96±5.62 23.0-331.0	94.83 15.33-165.5	181.48±3.49 51.0-281.0	103.69 28.3-187.3	184.02±7.25 44.0-272.0	101.61 24.4-167.3	**.052**
Calcium (mg)	376.51±32.46 56.0-1748.0	28.96 4.31-134.46	407.13±23.92 66.0-1577.0	31.32 5.08-121.3	475.84±39.81 56.0-1400	36.60 4.3-107.7	**.174**
Iron (mg)	7.33±0.35 1.67-18.21	53.85 11.13-121.4	7.84±0.23 1.64-16.84	59.09 10.9-134.8	184.02±7.25 44.0-2720	64.37 16.7-143.5	**.045***
Phosphorus (mg)	862.99±33.84 193-1709	69.04 15.44-136.7	939.48±24.15 365.0-2032.0	75.16 29.2-162.6	998.73±39.28 348-1521	79.89 27.8-121.7	**.032***
Sodium (mg)	3888.54±313 65-7396	216.03 7.22-410.88	4073.88±161 166-4587	226.33 9.22-254.8	4981±371.1 166-5578	276.73 9.22-309.9	**.034***
Magnesium (mg)	225.34±9.15 640.0-440.0	66.81 17.78-144.6	229.56±5.7 71.0-452.0	71.01 19.7-129.6	244.69±11.9 348-1521	71.44 22.2-119.2	**.441**
Zinc (mg)	7.13±0.29 1.37-13.73	54.43 9.13-114.42	7.80±0.22 2.43-18.49	58.25 20.3-154.1	8.49±0.44 3.21-17.07	61.09 26.8-113.8	**.203**

* Significant at $p < 0.05$

** Highly significant at $p < 0.01$

Table 4 Signs of clinical deficiencies among adolescents according to socio-economic status.

Socioeconomic status	*Low*				*Medium*				*High*			
Sex	*Males*		*Females*		*Males*		*Females*		*Males*		*Females*	
Clinical signs	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Face												
Normal	28	75.7	50	89.3	63	76.8	57	69.5	25	75.8	12	66.7
Seborrhea	9	24.3	6	10.7	19	23.2	25	30.5	8	24.2	6	33.3
Hair												
Normal	17	45.9	39	69.6	52	63.4	40	48.7	15	45.4	14	77.8
Dry	20	54.1	17	30.4	30	36.6	42	51.2	18	54.5	4	22.2
Eyes												
Normal	33	89.2	55	98.2	70	85.4	74	90.2	29	87.9	18	100
Pale conjuctiva	4	10.0	1	1.8	8	9.8	2	2.4	2	6.1	0.0	0.0
Conjuctival xerosis	0.0	0.0	2	2.4	6	2.4	2	6.1	2	6.1	0.0	0.0
Lips												
Normal	21	56.8	34	60.7	55	67.1	52	63.4	24	72.7	13	72.2
Pallor	16	43.0	22	39.0	27	32.9	30	36.6	9	27.3	5	27.8
Tongue												
Normal	36	973	56	100	78	95.1	82	100	33	100	18	100
Glossitis	1	2.7	0.0	0.0	2	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Smooth with glossitis	0.0	0.0	0.0	0.0	2	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Gum												
Normal	37	100	55	98.2	80	97.6	81	98.8	31	93.9	18	100
Cyanotic	0.0	0.0	1	1.8	0.0	0.0	1	1.2	2	6.1	0.0	0.0
Swollen&red	0.0	0.0	0.0	0.0	2	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Skin												
Normal	31	83.8	45	80.4	73	89.0	75	91.4	30	90.9	17	94.4
Xerodermia	1	2.7	11	19.6	0.0	0.0	1	1.2	0.0	0.0	0.0	0.0
Follicular hyperkeratosis	5	13.5	0.0	0.0	9	10.9	6	7.3	3	9.0	1	5.6
Nail												
Normal	22	59.5	41	73.2	32	39.0	60	73.1	25	75.7	14	77.8
Pallor	15	40.0	15	26.0	50	60.9	22	26.8	8	24.2	4	22.2
Teeth												
Normal	23	62.2	26	46.4	51	62.2	49	59.7	24	72.7	11	61.1
Caries up to 2	11	29.7	24	42.9	22	26.8	21	25.6	7	21.2	1	5.6
Caries up to 3	3	8.1	5	8.9	8	9.8	10	12.2	2	6.1	5	27.8
More	0.0	0.0	1	1.8	1	1.2	2	2.4	0.0	0.0	1	5.6
Thyroid												
Normal	37	100	50	89.3	78	95.1	82	100	33	100	18	100
Enlargement	0.0	0.0	6	10.7	4	4.9	5	6.1	0.0	0.0	0.0	0.0

Table (5) showed the distribution of the studied group according to blood pressure levels. 75.7% of the pupils, 71.1% male and 80.1% female had normal blood pressure. 21.8% of the pupils were having prehypertension codition with higher percentage of the male pupils (26.3%) while 2.6% were hypertensive with no sex difference is detected in these group.

Table (6) showed the mean ±SEM of systolic and diastolic blood pressure and percent of per and hypertensive according to BMI and height. 39.3% of overweight/obese pupile were per & hypertensive, lower percents were found among the stunted and under weight, 30.5% and 14.2% respectively. 19.2% of the normal pupils were pre and hypertensive.

Table (7) showed the Mean ±SEM intake of fat, sodium and calcium of studied adolescents in relation to to blood pressure levels. Only significant differences at P < 0.04 was detected between the sodium intake of the normal / prehyperteasive and hyperteasive adolescents.

Table (8) showed the correlation cefficient between blood pressure and anthropometric measurements among the male and female adolescents. Significant positive correlatins were observed at p≤0.01 & 0.05, between the systolic and the diastolic BP and most of the parameters. Weak correlations were found between diatolic BP and height in male and female adolescents, except the relation between systolic BP and male's height, it was significant at (p≤0.05).

Table 5 Distribution of the studied group according to Blood pressure levels.

Sex	*Male (n=152)*		*Female (n =156)*		*Total*	
Parameter	NO	%	NO	%	NO	%
Normal	108	71.1	125	80.1	233	75.7
Pre hypertension	40	26.3	27	17.3	67	21.8
Hypertension	4	2.6	4	2.6	8	2.6
Total	152	100	156	100	308	100

Table 6 Mean ±SEM of systolic and diastolic blood pressure and percent of pre and hypertensive according to BMI and height/age.

Groups	*No.*	*%*	*Blood pressure*		
			systolic	*diastolic*	*Per & hypertensive No. %*
Normal	120	38.9	115.±0.93	78.1±0.63	22 18.3
Underweight	104	33.8	114±1.04	75.6±0.83	20 19.2
Overweight & obese	84	27.3	121.4±1.08	80.1±0.87	33 39.3
Stunted	82	26.6	116.4±1.32	77.8±0.88	25 30.5

Stunted: height/age

Table 7 Mean ±SEM intake of Fat, Sodium and Calcium of studied adolescents according blood pressure level.

Parameter	*Normal (n:233)*	*Prehypertensive (n:6) (n:7)*	*Hypertensive (n:8)*	*Sg.*
Nutrient	*Mean ±SE Range*	*Mean ±SE Rang*	*Mean ±SE Rang*	
Fat (g)	58.01±1.38 13.8-128.3	59.4±2.69 21.6-115.4	64.8±8.49 35.3-98.6	0.626
Sodium (mg)	4126.84±147.22 65-5578	4214.25±408.55 166-7330	4985±488.73 236-7396	0.04*
Calcium (mg)	401.58±19.36 56-1515	429.61±41.96 92-1748	462.87±100.29 188-1084	0.709

*p<0.05

Table 8 Correlation coefficient between Blood pressure and anthropometric measurements among the male and female adolescents.

Parameter	*All sample (n=308)*		*Males (n=152)*		*Females (n=156)*	
	Systole	*Diastole*	*Systole*	*Diastole*	*Systole*	*Diastole*
Height (Cm)	0.136*	0.168**	0.178 *	0.114	0.025	0.080
Weight (Kg)	0.278**	0.278**	0.290**	0.253**	0.332**	0.279**
BMI	0.228**	0.228**	0.248**	0.237**	0.382**	0.282**
Arm Circumference	0.212**	0.212**	0.303**	0.241**	0.212**	0.216**
Chest (Cm)	0.162**	0.162**	0.289**	0.233**	0.167*	0.120
Waist (Cm)	0.047	0.047	0.028	0.025	0.199*	0.134
Hip (Cm)	0.198**	0.198**	0.316**	0.231**	0.246**	0.200*
Triceps (Cm)	0.146*	0.127*	0.117	0.124	0.281**	0.248**
Biceps (Cm)	0.062	0.037	0.084	0.110	0.135	0.093
Sub scapular	0.194**	0.172**	0.215**	0.248**	0.303**	0.272**
Suprailiac	0.180**	0.139*	0.220**	0.194*	0.282**	0.267**
Sum of Skin fold	0.181**	0.149**	0.188*	0.199*	0.312**	0.276**

* Significant at 0.05 ** Highly significant at 0.01

DISCUSSION

This study describes the nutritional status of the Egyptian adolescents both males and females with different socio-economic status. The data obtained clarified the presence of the double burden of chronic undernutrition and overnutrition as reported in other developing countries. Indeed economic transition, urbanization, industrialization, globalization, bring about lifestyle changes, westernization in diet and social inequities (Sawaya et al., 1995).

The anthropometric measurements and the clinical signs reported in this study revealed a different percent of malnutrition either undernutrition or overnutrition. The percent recorded for severe chronic undernutrition (stunting) was 2.6%, while the percent of moderate and mild stunting (<25th percentile) was 25.3%. The overall percent for low weight /age and low BMI was 27.6% and 33.8%. On the other hand over weight among the studied adolescent were 21.4% and 20.5% using weight / age and BMI measurements while the percent of obesity among them reached 26.6% and 6.8% using the same parameters. Woodruff and Deffield (2002), stated that anthropometric indices in adolescents change with age and sexual development, this may explain the difference found in the percent of obesity among the adolescents when using weight/age and BMI parameters. The effect of the socio-economic status on the mean values of the anthropometric parameters was not well apparrent. However the mean body weight of the male belonging to the high social class (group1) showed higher value compared to the other social classes, 68.1, 60.5, 62.8kg for the high, middle and low socioeconomic classes respectively. Chest circumference denotes muscle development, and the mean of the sum of the skin fold denotes fat depot, were also higher among the same group, 89.1 cm and 33.8mm respectively compared to 83.6& 85.2 cm and 29.4 & 31.9 mm for the other socioeconomic classes. Under nutrition (being too thin or short) frequently caused by chronic energy deficiency (Looker et al., 2002). On the other hand a positive balance between energy expenditure and energy intake is a possible underlying cause of obesity. The increase in obesegenic living environments including excessive consumption of high density food has likely supported this positive energy balance (Crespo et al., 2001). Protein is an essential nutrient for growth and maintenance of tissue. During adolescent growth spurt, protein needs are high and utilization of protein is dependent on adequate energy supply (Whitney and Hamilton, 2000). In this study the mean energy intake among the three socioeconomic groups was 67, 70, 73 percent of the RDA with a wide range variations within each group (25-119, 38-128, 37-125% respectively), which explains the presence of different types of malnutrition ranging from stunting and underweight to obesity. The mean protein intake for the same groups was 112.63, 125.12, and130.04 percent of the RDA, however wide range of intake within each group was recorded. In this context these variation in the intake of both nutrients, could explain the presence of both under and over nutrition among the sample studied and the social difference.

Important micronutrients that may be deficient in adolescent include vitamin A, zinc, iron and calcium (WHO/UNICEF/ IVACG, 2003). Similar results were obtained in this study, low mean values of these micronutrients were observed compared to the RDA but also with wide range variation (table 3). Clinical examination revealed signs of deficiency of these micronutrients affecting skin, conjunctiva, tongue, and nails.

The mean values of the systolic and diastolic blood pressure showed normal values. However the percent distribution of the studied group revealed that 26.32% of the male and 17.31% of the female were pre hypertensive, while 2.63% and 2.56% of them respectively were hypertensive. In international studies prevalence of essential hypertension during childhood range from 1.2% to 13% (Rosner et al., 2000, Rosner et al., 1993). Although the pre-hypertensive adolescent cannot be considered hypertensive as yet, these subjects are likely to suffer the consequences of these alterations during adult hood (Fernandes et al., 2003). Factors related to BP in children may be particularly important in this regard, because BP level have been seen to track from childhood to adulthood (Simon et al., 1997). As expected, the higher body weight explains the higher level of BP in adolescents with normal nutritional status in comparison with those of their counterparts suffering from different level of malnutrition (Soudarssanane et al., 2006). The results of this study revealed that the overweight /obese pupils had mean BP higher than the malnourished and normal weight pupils, 39.3% of them were suffering from pre and hypertension. Similar findings were also reported elsewhere in India (Thakor et al., 1998), Hungary (Torok et al., 1985), and France (Aullen, 1978). On the other hand, in spite of adolescents complaining of chronic under nutrition (stunted) they had normal mean BP, however 30.5% of them were pre and hypertensive. Malnutrition seem to be a risk factor for the development of arterial hypertension in early life, and during adolescence (Gillum et al., 1982). It had been reported that stature is the index that best evaluates skeletal age and is also related to arterial BP irrespective of age (Allen and Gillespie, 2001). Worldwide the most frequent type of under nutrition is stunting caused by chronic under nutrition most frequently starting pre natal (Simon et al., 1997). There are number of pathogenic mechanisms reported in both experimental and human studies, by which under nutrition intra-uterine or early in life could initiate or further increase higher BP: (1) activation of rennin-angiotensin system (Godard et al., 1983, Kindom et al., 1993); (2) alteration in vascular structure, function and compliance (Yoshida et al., 1995, Zureik et al., 1995); (3) increase sympathetic nervous activity (Phillipsand and Barker, 1997); (4) increased insulin-sensitivity (Leon et al., 1998, Somova and Moodley, 2000); (5) plasma insulin –like growth factor-1levels (Fall et al., 1995); (6) high plasma glucocorticoid concentrations (Jacobson et al., 1997, Langley, 1997); and (7) reduction in nephron number (renal mass) associated with retarded fetal growth (Bremmer, 1994).

Constant high significant correlation ($p \leq 0.01$) was reported between both systolic and diastolic BP in both sexes and weight, BMI, mid arm, chest, hip circumferences and skin folds thicknesses especially that denote central obesity (subscapular and suprailiac). This constant relation did not seen clearly with adolescent' height when sexes were taken in consideration, except that of systolic BP among male adolescents, that could be explained by the effect of stunting BP relationship.

Consumption of sodium chloride among pupils in this study was high; it was 216.03, 226.33, and 276.73% of the RDAs among the low, middle and high socioeconomic classes respectively. Although only a significant difference ($p \leq 0.04$) was observed between the calculated amount of the salt that daily consumed by the normal, pre hypertensive and hypertensive adolescents, but the overall consumption may be a common and important factor associated with high BP observed among them. In this context high consumption may explained the high prevalence of pre and hypertension among the normal and also an additional factor for the undernourished adolescents. One important aspect of hypertension prevention and management that was raised questions is the effect of sodium consumption on blood pressure. Sodium chloride or table salt increases average levels of blood pressure. Some individuals have greater blood pressure responses to salt than other (Soudarssanane et al., 2006).

In conclusion the data of our study proved the presence of both type of malnutrition either under nutrition or over nutrition among Egyptian adolescents. The results describe the association between both under nutrition (chronic under nutrition) and over nutrition (overweight and obesity), and the high sodium chloride intake with the elevated blood pressure.

BIOGRAPHY

Safaa Taha Zaki is an Assistant Professor in the Child Health Department, Medical Division, National Research Center, Cairo, Egypt. Safaa is specialized in clinical nutrition field with following up of clinical cases in the nutrition, obesity and under weight, clinic at the Medical Services Unit, NRC, Egypt. for about 15 years. She was a co-Principal Investigator and participated in many projects in the field of Obesity, nutritional assessment of Egyptian children and adolescents. Safaa had written and published many manuscripts in the field of obesity and nutritional status of Egyptian children in different chronic diseases.

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