Prevalence and Association of Malnutrition with Lifestyle practices of Primary School Children in Assiut City

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Abstract

Coexistence of obesity and underweight in children is a public health challenge, and in order for a child to develop into a healthy adult, he must follow healthy lifestyle practices in all aspects: nutrition, physical activity and recreation. **This study aimed** to determine prevalence of overweight/obesity, underweight and stunting among primary school children in Assiut city as well as to assess their association with lifestyle practices **Subjects and Methods:** A descriptive correlational study design conducted in Assiut city. Four schools were randomly selected (two public and two private) and 850 children from the last three grades were included in the study. A self-administered questionnaire was designed to assess personal data, lifestyle practice and anthropometric characteristics. **Results:** The prevalence of underweight, overweight and stunting of primary school children were 41.2%, 14.4% and 13.8%, respectively. These proportions were high among males versus females without significant difference and were affected significantly by age ($p < 0.05$). Frequency of meals >3 times, always eating during screening time, irregular physical activity, not eating vegetables or breakfast and consumed snacks regularly were highly significant risk factors for being overweight/obese ($P < 0.001$). Whereas, no association between most life style practices and stunting. **Conclusion:** The prevalence of stunting and underweight was high among boys, while girls tend to be overweight / obese. These abnormal weight categories (overweight/obesity and underweight) were significantly associated with lifestyle practices of school children. Therefore, there is need to develop behavioral approach policies to motivate children to change their unhealthy behaviors.

Keywords: Malnutrition, Lifestyle practices and School children

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Introduction

During childhood, good nutrition and dietary behaviors are vital to achieve full growth potential and appropriate body composition and to promote well-being. Children require sufficient energy, protein, and other nutrients for growth as well as maintenance of body functions. Furthermore, Poor dietary quality and physical inactivity during early childhood can stunt the basic cognitive and physical abilities from developing properly ***(Institute of Medicine, 2007).***

Malnutrition defined as "an imbalance between the need and intake of essential nutrients," which may result in either under- or over-nutrition. Both conditions can deteriorate physical and mental development. Previous research has recognized a double burden of malnutrition (DBM), with under- and over-nutrition occurring simultaneously, in the same household of developing countries ***(Food and Agriculture Organization of the United Nations, 2006).*** Common anthropometric indicators of childhood malnutrition include combination of body measurement (e.g. height combined with weight) according to age and sex. Body Mass Index (BMI is defined as the weight in kilograms divided by the square of the height in meters) is a simple index of weight-to-height commonly used to classify underweight, overweight and obesity. While stunting is defined as children with a low height for age ***(Boslaugh, 2008)***.

More than 200 million school age children are stunted and underweight; about one billion school children will be growing up by 2020 with impaired physical and mental development ***(Unicef, 2011).*** In Egypt, malnutrition disorders affect more than 30% of school children ***(Emam et al., 2005)***. Recent research by Egyptian National Nutrition Institute and other research centers showed that malnutrition was still a major health problem in Egyptian community among different age groups and socio-economic classes ***(World Health Organization, 2014).*** In Egypt, 24.5 percent of school-age children were classified as overweight, and 9.8 percent were obese by Egyptian Demographic and Health Survey (EDHS) 2014. ***(EMRO) WHO, 2018)*** Different studies had been conducted in Upper Egyptian cities, in Assiut city; a study was reported that overweight and obesity prevalence was 11.24% and 16.5%, respectively ***(Taha & Marawan, 2015)***. Also, in Sohag city overweight and obesity among children from 6-12 years was 12.28 and 14.6% respectively ***(Hadhood et al., 2017)***.

Of the underlying causes of malnutrition is food insecurity, which in Egypt, is associated with poor access to a balanced diet, as well as poor dietary/lifestyle habits and lack of nutritional awareness among the population ***(Ministry of Health and Population, 2015).*** According to the International Obesity Task Force, in the Eastern Mediterranean Region, data shows that 80% of children aged between 13 and 15 years are overweight or obese and are returning to unhealthy eating habits such as skipping breakfast, low fruits and vegetables intake, high intake of soft drinks and sweets. About 60% of obese children are more likely to

become overweight adults ***(Syahrul et al., 2016)*.** Poor nutritional quality among children quickly became a major concern as Egypt is characterized by a young age structure, with approximately 43% of the population under the age of 18. In addition, socio-environmental factors are the cause of vast majority of obesity cases (95%), which indicates the importance of lifestyle in the emergence of obesity ***(Ribeiro et al., 2017)*.**

The double burden of malnutrition (is coexistence of both under-nutrition and overweight) is a major challenge in Egypt. This double burden of malnutrition is exacerbated by poor dietary diversity among some segments of the population. In urban governorates, 19 percent of the population had poor dietary diversity compared to 56 percent in Upper Egypt. Controlling double burden of malnutrition in Egypt requires comprehensive and appropriate measures ***(Ministry of Health and Population, 2015)***. Addressing this double burden of undernutrition and over-nutrition is a major challenge so, information on appropriate estimates and causative factors is essential. In addition, little is known about data on lifestyle practices as dietary habits, physical activity and sedentary behaviors among primary school children and their associated underweight, overweight /obesity and stunting prevalence in Assiut City. Therefore, ascertaining these associations is an important step to understand the behavioral factors of school children that drive the double burden of under and over-nutrition and to design appropriately targeted interventions that will effectively address these childhood problems.

Aim of the study

This study aimed to determine the prevalence of underweight, overweight/obesity and stunting among the primary school children as well as to assess their association with lifestyle practices.

Research Questions:

Q1. what is the prevalence of stunting, underweight and overweight/obesity among primary school students?

Q2. What are common life style practices of primary school students?

Q3. Is there an association between primary school students' malnutrition and their lifestyle practices?

Subjects and Methods

Research design:

Descriptive correlational study design was utilized.

Setting:

This study was conducted at four primary schools that represented all geographic areas of Assiut city including both private (El-Tahreir and El-Future school) and public (El-Emam Ali and Al- Gamea) schools.

Sample Desisgn:

Multi-stage stratified cluster sampling technique was used to select randomly targeted students. In the first, the schools inside Assiut city were divided into 2 separate districts (East and West), which represent different regions in Assiut city, far to cover all social and demographic categories. In the second stage, schools in each region were

stratified into 2 strata (public and private education), then in the third stage a cluster sample was chosen from each academic year within each school and groups was chosen through simple random sample.

Sample size:

It was calculated according to equation for the sample size of descriptive study design, and prevalence of obesity in Egyptian children aged 6-12 years ***(National Nutrition Institute, 2008).***

$$N = (Z1-\alpha/2)2\ P\ (1 - P)/\ D2$$

All convenient students (both sexes) from the last three grades of the selected schools (can read and understand the questionnaire) enrolled in this study (total number 850). Students with chronic illnesses, physical impairment or long-term managements were excluded.

Tools

Data was collected using a self-administered questionnaire that included four parts:

Part 1: Personal data

It included name of school, age, sex and father and mother jobs.

Part 2:Assessment of lifestyle practices

The questionnaire was designed in compliance with several validated questionnaires on the quality of life, eating habits, and physical, educational and recreational activity. The questions were grouped in three categories; dietary pattern, physical activity and sedentary behaviors. Children's dietary habits are based on frequent consumption of certain selected nutrients; consume these nutrients at least one day a week was considered as a habitual intake**.** Questions related to dietary pattern during the past 30 days as number of meals per day, food in between meals (snacks), eating breakfast, vegetables intake, fruits intake, soft drinks taking and fast food consumption. Two questions on physical activity performed by child per week. For evaluation of sedentary behaviors as, time spent in front of a screen (TV, computer, mobile phone) and behaviors during screen time. A maximal cut-off value for total screen time equivalent to 2 hours per day that was recommended by the American Academy of Pediatric Guidelines was used ***(Committee on Public Education, 2001).***

Part 3: Anthropometric measurements:

Anthropometric assessment of the children was based on body height and weight. Anthropometric measurements for all students was taken by the same researcher and using the same instruments to avoid any error bias. Measurements were taken with students dressed in light clothing and without footwear in their classroom according to the standard procedures ***(WHO, 1998).*** The body weight was measured in kilogram (kg) by a standardized balanced digital scale to the nearest 0.5 kg. Height in centimetres (cm) was measured with a wall stadiometer to the nearest 0.1cm. Weight, height, and age data were used to calculate z-scores of the three different nutritional indicators in comparison to the newly published World Health Organization/National Center for Health Statistics (WHO/

NCHS) reference population ***(WHO and UNICEF, 2009)***. BMI is the recommended method for screening overweight and underweight status in all children from 2–20 years of age ***(Kreps & Jacobson 2003).*** Then students were classified according to these percentile curves into: underweight, normal weight, overweight /obese. Assessment of stunting among primary school students with the height percentile for age were classified as short stature< 5^{th} percentile, normal stature >=fifth and < 95^{th} Percentile ***(Center of Disease Control, 2000).*** **Validity:** Five experts in nursing and nutrition secured a jury acceptance of the final forms content before actual study work (content validity was 97.6%).

Methods:

- Administrative approval was obtained from the Dean of Faculty of Nursing, before implementation of the study. Meetings with school managers to explain the objectives of the study as it helped to gain their cooperation and to allow the release of students during minimal workload activities.
- After developing the tool, a pilot study implemented on five children in each school to test tool clarity, completeness and to determine the required time and they were excluded. The internal consistency of reliability was estimated by alpha Cronbach's test for the tool and its result was R = 0.87.

Field of the work

Data collection was done from September 2019 to December 2019 in the selected schools from 9 am to 2pm, three days a week (according to students' schedule). Initially, the researchers met the class teacher, gave background about the study. After that actual work started by meeting the students, the researchers first introduced themselves to students and gave them a complete background about the study.

Pre- designed questionnaire in Arabic Language was distributed and students were asked to keep it until anthropometric measurements were made. To make students feel free and avoid admiring told them not to write their names (Anonymity).

The duration for completing the questionnaire ranged between 10 and 15 minutes. One researcher was available for more clarification whenever needed. The other researcher formed anthropometric measurements and re-encoded on student s' questionnaire (about 5-10 minutes for each student).

Statistical analysis of data:

Compatible computer using software SPSS version 16 for windows used to statistical analysis. Frequencies, descriptive statistics, correlation, X2 test, t-test and multivariate logistic regression analysis were done. The probability of less than 0.05 was used for cut off point for all significant tests.

Ethical consideration:

The institutional ethical review board reviewed and approved the study. Written informed consent was obtained from parents for each child through interactive meetings and discussions. Maintaining privacy when taking measurements for students.

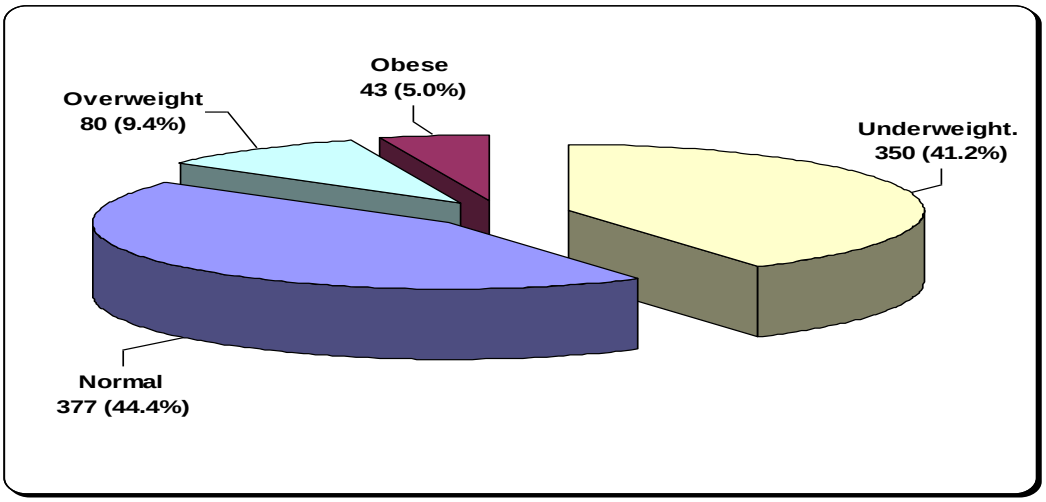
Results

Table (1): Frequency and percentage's distribution of personal characteristics among the studied primary school students.

Item	No. (850)	%
School type:		
Private	482	56.7
Public	368	43.3
Gender:		
Boy	442	52.0
Girl	408	48.0
Age: (years)		
< 10	142	16.7
10-12	497	58.5
> 12	211	24.8
Mean ± SD (Range)	10.98 ± 1.38 (9.0-13.0)	
Father occupation:		
Professional	196	23.1
Skilled	128	15.1
Unskilled	60	7.1
Governmental employee	439	51.6
Not working	27	3.2
Mother occupation:		
Professional	67	7.9
Governmental employee	347	40.8
Housewife	436	51.3

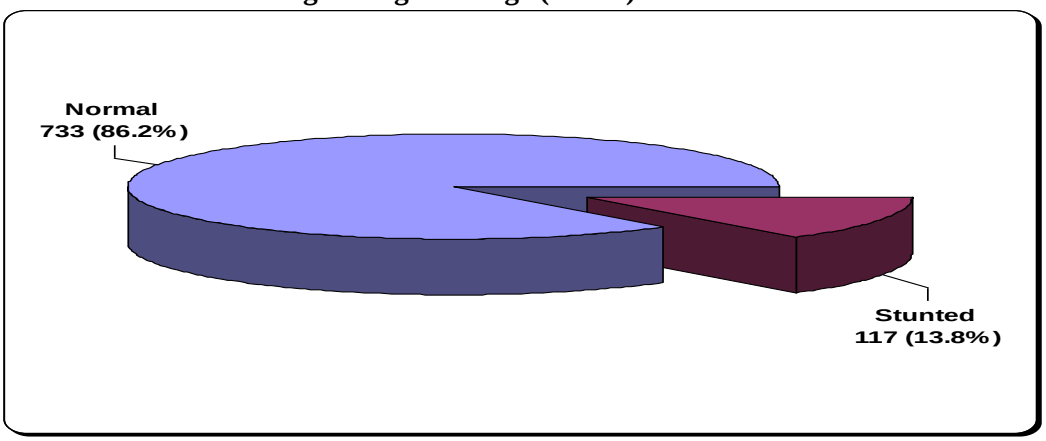
Personal characteristics of (850) participating students enrolled in four mixed schools presented in **table (1)**, it was found that 56.7% of them recruited from private schools and 43.4% were from public ones. Their mean age was 10.98 ± 1.38 years ranged between (9.0-13.0) years and more than half of the students (52.0%) were boys.

Fig (1): Frequency and percentage's distribution of the studied primary school students according to BMI (n= 850).



On studying distribution of BMI values among the studied primary school children, it was observed that 41.2% of the participating students were underweight, 14.4% of students were overweight/obese (overweight ٩.4% and obese ٥.0%) and 44.4% of them had normal BMI **(Figure 1).**

Fig (2): Frequency and percentage's distribution of the studied primary school students according to height-for age (n=850)



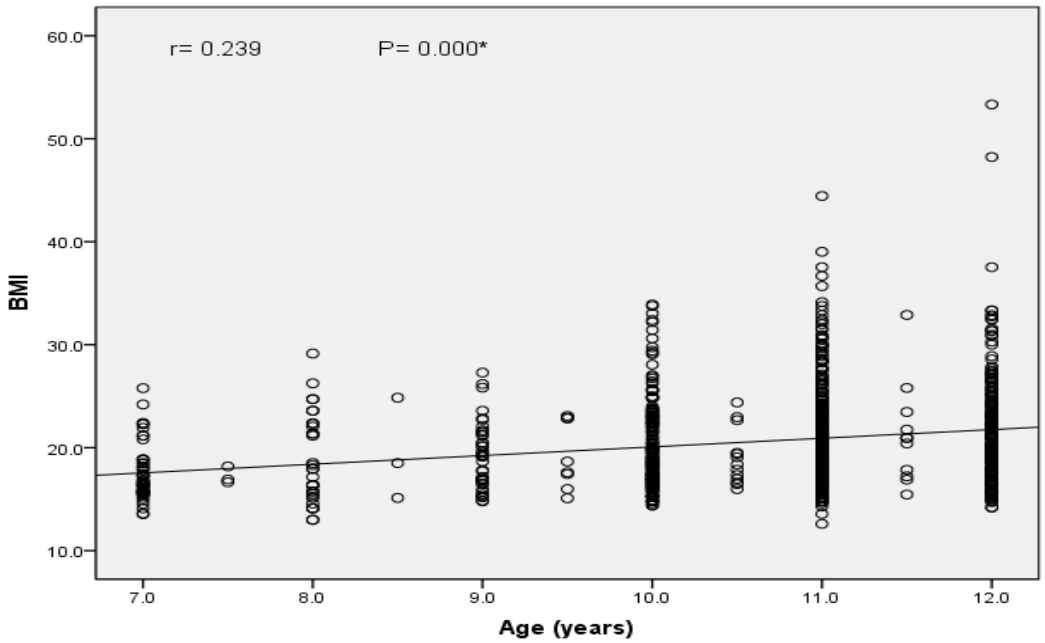
Regarding height for age, **Figure (2)** revealed that the prevalence of stunting among the participating students was 13.8% and the rest of them (86.2%) had normal height for their age. These results confirmed the coexistence of undernutrition and over-nutrition among Egyptian children.

Table (2): Frequency and percentage's distribution underweight, overweight/obesity or stunting among participating students (n=850) according their personal characteristics.

Item	Total No.	Wt. for-Age (BMI)						X^2	P-value	Ht. for-Age				X^2	P-value
		Underweight (n=350)		Normal (n=377)		Overweigh/Obese (n=123)				Normal (n=733)		Stunting (n=117)			
		No.	%	No.	%	No.	%			No.	%	No.	%		
Age (years)															
< 10	142	87	61.3	49	34.5	6	4.2	37.10	0.000*	112	78.9	30	21.1	9.25	0.010*
10 - < 12	497	196	39.4	225	45.3	76	15.3			441	88.7	56	11.3		
> 12	211	67	31.8	103	48.8	41	19.4			180	85.3	31	14.7		
Gender															
Boy	442	194	43.9	193	43.7	55	12.4	4.36	0.113	381	86.2	61	13.8	0.001	0.975
Girl	408	156	38.2	184	45.1	68	16.7			352	86.3	56	13.7		
Type of school:															
Public	368	181	49.2	149	40.5	38	10.3	20.00	0.000*	310	84.2	58	15.8	2.18	0.140
Private	482	169	35.1	228	47.3	85	17.6			423	87.8	59	12.2		

Table (2) showed frequency and percentage's distribution of underweight, overweight/obesity or stunting regarding personal characteristics of the participating students. According to age, the greatest prevalence of stunting (21.1% versus 11.3% and 14.7%) is at age of less than 10 years with a significant difference. Based on the BMI for age status, 61.3% of students under the age of 10 years were underweight compared to the other two older age groups (10 - < 12years and ≥ 12 years). In contrast, the older age group (≥ 12 years) had a higher prevalence of overweight / obesity (19.4%), compared to the younger age group (4.2%). With regard to the difference between boys and girls for the results of anthropometric evaluation, higher percentages of underweight and stunting were observed among boys (43.9% and 13.8% respectively) compared to girls (38.2% and 13.7% respectively) without significant difference (P= >0.05). On the other hand, girls were more overweight/obese (16.7%) than boys (12.4%). The same table showed that the percentage of overweight /obesity is significantly higher (17.6%) among students from private schools, while it was high percentage of underweight (49.2%) among students from public ones (P= <0.000).

Fig (3): Correlation between age of the primary school students and their BMI



The correlation between age of the participating students and BMI values was portrayed in **Figure (3).** It was obvious that BMI values significantly increased with increasing age (P< 0.000, R= 0.239)

Table (3): Association between the participating students' BMI and their height for-age

Height for age	BMI						X^2	P-value
	Underweight		Normal		Overweight/Obese			
	No.	%	No.	%	No.	%		
Normal	288	82.3	332	88.1	113	91.9	8.95	0.011*
Stunted	62	17.7	45	11.9	10	8.1		

According to the results showed in **Table (3)**, a clear association was established between BMI of the participating students and their height values. Stunting was significantly associated with low BMI (P< 0.011) (i.e. underweight is a risk factor of stunting).

Table (4): Frequency and percentage's distribution of life style practices (dietary pattern, physical activity and sedentary behaviors) among participating students according to gender.

	Total		Gender				X^2	P-value
			Boys (n=442)		Girls (n=408)			
	No.	%	No.	%	No.	%		
Dietary pattern:								
Three or less meals eaten regularly	739	86.9	397	89.8	342	83.8	6.71	0.010*
More than 3 meals eaten regularly	111	13.1	45	10.2	66	16.2		
Snacks consumed regularly	622	73.2	312	70.6	310	76.0	3.14	0.076
No snacks	228	26.8	130	29.4	98	24.0		
Types of snacks consumed*:								
Fruits	211	33.9	102	32.7	109	35.2	0.42	0.516
Chips	146	23.5	70	22.4	76	24.5	0.38	0.541
Sandwiches	101	16.2	58	18.6	43	13.9	2.55	0.111
Juice	3	0.5	1	0.3	2	0.6	Fisher	0.623
Sweets	69	11.1	36	11.5	33	10.6	0.13	0.723
Milk	92	14.8	45	14.4	47	15.2	0.07	0.795
Regular eating breakfast	551	64.8	397	89.8	342	83.8	1.49	0.010*
Not eating breakfast	299	35.2	45	10.2	66	16.2		
Eating vegetables	623	73.3	312	70.6	310	76.0	0.00	0.076
Not eating vegetables	227	26.7	130	29.4	98	24.0		
Eating fruits	766	90.1	397	89.8	342	83.8	0.29	0.010*
Not eating fruits	84	9.9	45	10.2	66	16.2		
Taking soft drink	444	52.2	225	50.9	219	53.7	0.65	0.419
Not taking soft drink	406	47.8	217	49.1	189	46.3		
Fast-food consumption	145	17.1	73	16.5	72	17.6	0.19	0.661
No Fast-food consumption	705	82.9	369	83.5	336	82.4		
Physical activity:								
Done	789	92.8	414	93.7	375	91.9	0.98	0.322
Not done	61	7.2	28	6.3	33	8.1		
Physical practice /week:								
Regular	369	46.8	221	53.4	148	39.5	15.30	0.000*
Not regular	420	53.2	193	46.6	227	60.5		
Number of physical practices:								
Daily	358	45.4	211	51.0	147	39.2	12.01	0.002*
Twice weekly	315	39.9	153	37.0	162	43.2		
Once weekly	116	14.7	50	12.1	66	17.6		
No. of hours watching TV/ screen/day:								
≤ 2 hours	559	65.8	303	68.6	256	62.7	3.18	0.075
> 2 hours	291	34.2	139	31.4	152	37.3		
Eating while watching TV:								
No	397	46.7	217	49.1	180	44.1	4.82	0.090
Sometime	356	41.9	184	41.6	172	42.2		
Always	97	11.4	41	9.3	56	13.7		

Life style practices of participating student presented in **table (4).** It was found that the majority of students (86.9%) consumed three or less meals a day and girls reported a significant greater frequency of eating more than three meals compared to boys (P= 0.010). About 73.2% of students reported that, they consume snacks regularly but the highest percentage of them reported an unhealthy snacks; chips (33.9%) and sweet snacks (16.2%). Even though about two-thirds of the students (64.8%) ate breakfast regularly, the frequency of skipping breakfast was significantly higher among girls than boys did (P= 0.010). The table denotes that most of students ate vegetables and fruits at least once a day (73.3% and 90.1%, respectively). Another interesting observation was that more than half of the students (52.2%) reported daily consumption of soft drink while only 17.1% of them ate fast food. Regarding physical activity, nearly half of students did it daily and regularly (46.8% and 45.4%, respectively). Moreover, regular daily physical practices were significantly higher among boys (P=0.000). When sedentary behaviors was questioned, about 65.8% of them spent 2 hours or less in front of television or computers and more than half of them ate either sometimes or always (41.9%, 11.4%, respectively) during this time. Furthermore, the percentage of children who daily spent more than two hours and always ate while on screen was high among girls (37.3% and 13.7%) compared to boys (31.4% and 9.3%), respectively.

Table (5): Association between lifestyle practices and stunting, underweight or overweight/ obesity among participating students

	Height for age				X^2	P-value	BMI						X^2	P-value
	Normal		Stunted				Underweight		Normal		Overweight			
	No	%	No	%			No.	%	No	%	No	%		
Dietary pattern:														
≤ 3 meals eaten regularly	634	85.8	105	14.2	0.94	0.333	341	46.1	350	47.4	48	6.5	294.2	0.000*
> 3 meals eaten regularly	99	89.2	12	10.8			9	8.1	27	24.3	75	67.6		
Snacks consumed regularly	547	87.9	75	12.1	5.69	0.017*	183	29.4	323	51.9	116	18.6	135.8	0.000*
No snacks	186	81.6	42	18.4			167	73.2	54	23.7	7	3.1		
Regular eating breakfast	478	86.8	73	13.2	0.35	0.553	226	41.0	286	51.9	39	7.1	79.31	0.000*
Not eating breakfast	255	85.3	44	14.7			124	41.5	91	30.4	84	28.1		
Eating vegetables	539	86.5	84	13.5	0.16	0.693	256	41.1	328	52.6	39	6.3	144.9	0.000*
Not eating vegetables	194	85.5	33	14.5			94	41.4	49	21.6	84	37.0		
Eating fruits	656	85.6	110	14.4	2.32	0.128	316	41.3	343	44.8	107	14.0	1.68	0.432
Not eating fruits	77	91.7	7	8.3			34	40.5	34	40.5	16	19.0		
Taking soft drink	385	86.7	59	13.3	0.18	0.673	135	30.4	188	42.3	121	27.3	132.0	0.000*
Not taking soft drink	348	85.7	58	14.3			215	53.0	189	46.6	2	0.5		
Fast-food consumption	134	92.4	11	7.6	5.62	0.018*	3	2.1	23	15.9	119	82.1	649.0	0.000*
No fast-food consumption	599	85.0	106	15.0			347	49.2	354	50.2	4	0.6		
Physical activity:														
Done	677	85.8	112	14.2	1.72	0.190	343	43.5	366	46.4	80	10.1	166.9	0.000*
Not done	56	91.8	5	8.2			7	11.5	11	18.0	43	70.5		
Physical practice p/week:														
Regular	315	85.4	54	14.6	0.11	0.741	202	54.7	166	45.0	1	0.3	87.12	0.000*
Irregular	362	86.2	58	13.8			141	33.6	200	47.6	79	18.8		
Number of physical practices:														
Daily	304	84.9	54	15.1	1.69	0.430	194	54.2	162	45.3	2	0.6	457.0	0.000*
Twice weekly	269	85.4	46	14.6			142	45.1	170	54.0	3	1.0		
Once weekly	104	89.7	12	10.3			7	6.0	34	29.3	75	64.7		
No. of hours watching TV														
≤ 2 hours	485	86.8	74	13.2	0.38	0.537	234	41.9	263	47.0	62	11.1	15.75	0.000*
> 2 hours	248	85.2	43	14.8			116	39.9	114	39.2	61	21.0		
Eating while watching TV														
No	342	86.1	55	13.9	1.19	0.551	219	55.2	143	36.0	35	8.8	113.3	0.000*
Sometime	304	85.4	52	14.6			107	30.1	201	56.5	48	13.5		
Always	87	89.7	10	10.3			24	24.7	33	34.0	40	41.2		

According to the results showed in **Table (5),** no significant associations were found between the stunting and lifestyle practices (dietary intake, physical activity and sedentary behaviors) of studied primary school children ($p>0.05$), except that stunting was significantly more prevalent in students didn't consume snakes regularly or fast food (P=0.017 or P=0.018, respectively). The same table showed a significant association between the participating students' overweight/ obesity and dietary intake ($p <0.05$), it was found that highly significant prevalence of overweight/ obesity among students who ate more than three meals (67.6%, p =0.000), consumed snacks regularly (18.6%, p =0.000), skipped breakfast (28.1%, p =0.000) and ate fast food (82.1%, p =0.000). Additionally, the prevalence of irregular physical activity, spending more than two hours on screen and always

eating during this were significantly high among overweight/ obese students (18.8%, 21.0% and 41.2%, respectively. p <0.05). Whereas, underweight was significantly more prevalent among students who used to eat three or less meals a day (46.1%, p <0.000), never snacked, did not take soft drink or fast food (73.2%, 53.0 or 49.2% respectively, p=0.000) and never ate while watching TV (55.2%, p=0.000).

Table (6): Multiple logistic regression analysis for risk factors of overweight/ obesity

	P-value	OR	95% C.I. for EXP(B)	
			Lower	Upper
Age (years)	**0.001***	1.52	1.18	1.97
Private school	**0.002***	2.75	1.46	5.18
Frequency of meals (> 3)	**0.000***	17.33	9.53	31.50
Snacks consumed regularly	**0.016***	2.90	1.22	6.91
Not eating breakfast	**0.047***	1.80	1.01	3.22
Not eating vegetables	**0.000***	6.91	3.75	12.73
Eating while watching TV	**0.000***			
Sometime	**0.034***	1.93	1.05	3.56
Always	**0.000***	7.53	3.02	18.77

A multivariate logistic regression analysis about factors associated with overweight/ obesity presented in **(Table 6).** It was noted that the odds of being overweight / obese were higher among the students with older age (OR = 1.52, 95 % CI 1.18–1.97; P = 0.001) and who in private school (OR = 2.75, 95% CI: 1.46–5.18; P = 0.002). Moreover, frequency of meals more than three times, always eating during screening time, not eating vegetables or breakfast and consumed snacks regularly were independent factors for being overweight/obese (P <0.05).

Discussion

According to the overall nutritional status of primary school children in this study, more than half of them had an undesirable BMI (underweight and overweight/obese) and high prevalence rate of stunting. These findings indicated coexistence of under- and over-nutrition among school children that culminate into double burden of malnutrition. The same finding reached by ***El-Shafie et al. (2020)*** who reported high prevalence of stunting in addition to underweight, overweight and obesity which characterize double burden of malnutrition of the low income and developing countries. Likewise, Egyptian Demographic and Health Survey (EDHS) report showed that malnutrition had been continuously increasing since 2000, with a double burden of undernutrition and over-nutrition ***(El-Zanaty et al., 2014)***.

Current study's results showed that prevalence of underweight among school children (41%) exceeded the numbers mentioned in previous studies. In 2014, a study conducted in seven African

countries showed that rate of underweight was 12.6% in Egypt ***(Manyanga et al., 2014)***. Additionally, a cross-sectional survey designed to evaluate nutritional status of students aged (5-19 years) in Beni-Suef Governorate and showed that ten percent of them were underweight ***(Abdelaziz, et al., 2015)***. When the finding of the present study are compared with studies reported previously, a growing trend of underweight in children was apparent. Perhaps this can be explained because there was a time gap of more than 5 years, and income poverty in Egypt increased from 25% to 28%. Upper Egypt hosts fifty-one percent of Egypt's poor and about seventy-four percent of them very poor ***(Central Agency for Public Mobilization and Statistics, 2017).*** Moreover, this interpretation is supported by another result of this study, which found that the prevalence of underweight was higher among students in public schools (as an indication of a low economic degree) than in private schools (p= <0.000).

The prevalence of overweight /obesity in the present study was 14.4%. This is relatively close to a report from an Egyptian study by ***Abdel Wahed et al. (2017)*** which found that the prevalence of overweight/obesity was 14.9% among school children. While, finding of the current study was less than the results of a study conducted in Behera Governorate and showed that about nineteen percent of children were overweight and obese ***(Abd El-Fatah and Abu-Elenin, 2019)***. It could be attributed to cultural and dietary habits differences between Assiut (as Upper Egypt Governorate) and Behera (Lower Egypt Governorate). In addition, ***(EDHS 2018)*** confirmed that children living in Upper Egypt were less likely to be overweight or obese.

In 2017, results of cross-sectional study conducted in Sohag Governorate showed that the prevalence of stunting reached 18.4 percent ***(Hamed et al., 2020)***. In Egypt, a recent study ***(El-Shafie et al., 2020)*** was conducted in 59 primary schools, which found that the rate of stunting prevalence was 17 percent. In the present study, there was a decline in the prevalence of stunting. This was consistent with United Nations Decade of Action on Nutrition (from 2016 to 2025) with the goal of reducing the prevalence of stunting ***(United Nations Decade of Action on Nutrition, 2015).*** In addition, reducing the prevalence of stunting in recent years shows that significant improvements can be achieved as a result of socioeconomic changes as well as dietary interventions. However, this requires greater and sustained efforts to reach low prevalence rate like as developed countries.

Current results had shown a significant age impact with a higher prevalence of overweight in older children, compared to a high prevalence of underweight and stunting in younger age groups. This finding was reinforced by previous studies that showed an increasing proportion of overweight with increasing age. Inversely, underweight was a trend at a young age ***(Abdelkarim et al., 2020)***. Moreover, **Hamed et al. (2020)** reported that mean age of the children with stunting was 8.01 (SD 2.9) years. Current findings, along with those studies, support that childhood can be viewed as a key stage of life in which malnutrition intervention programs are

essential to enhance the health benefits. In relation to gender, this study found that boys had a higher prevalence of underweight/stunting than girls did, whereas overweight was more prevalent in girls. This may be interpreted that girls in Upper Egypt are culturally involved in the cooking of family-food, and increased access to food, besides boys spend more time playing outdoors than girls. This was similar to results of previous studies ***(Chaulagain, 2020)***, which showed male children had a higher underweight prevalence than females while the reverse was true for overweight and obesity. In addition, the Egyptian study conducted by ***Abdelaziz, et al. (2015)*** showed that stunting was higher in males than in female children. This was explained by sexual differences in the genetic and biological makeup, as boys were biologically weaker than girls ***(Mikki, et al., 2009)***. Regarding economic status, it was found that children from private schools (who belonged to families with higher incomes) were more prevalent of overweight/obesity compared to underweight children from public schools. ***El-Shafie, et al. (2020)*** supported this finding and stated that childhood obesity was associated with higher-income families and higher socio-economic status (SES) and poor children undernourished**.**

The present study found that low BMI was associated with stunting. Since BMI is a measure of nutritional status of children, this finding indicates that malnutrition may be an important risk factor for stunting. However, there is no strong evidence that correcting malnutrition increases children's height, which suggests that the relationship between malnutrition and stunting is not causal. A similar observation noted by ***Hamed et al. (2020)*** who demonstrated that stunted children had a lower BMI.

The patterns of food consumption and dietary habits in the countries of Eastern Mediterranean Region have changed significantly over the past four decades. There was an increase in energy per capita and fat intake in all countries ***(FAO, "Food Balance Sheet 2009)***. Regarding this, Assiut community is still a traditional society in terms of eating habits as in most families food is cooked at home as ordering food is present in less than a fifth of the children questioned. An explanation may lie in the less favorable economic situation of families and the presence of traditional alimentation. In this study there were some points of interest, as girls seemed to consume soft drinks, fast foods more frequently and ate more than three meals a day. Additionally, skipping breakfast was a common habit among girls. These findings concurred with previous studies ***(Tayyem et al., 2014).*** Fruits are naturally sweeter than vegetables. Children find them 'sweet', 'juicy' or 'fun to eat' as opposed to vegetables which are 'bitter', 'ugly', 'boring' or 'horrible' to eat ***(Kurlner et al., 2011)***. In this regard, both boys and girls in this study who ate fruits also consumed vegetables, but fruits consumption was higher than vegetables consumption. The results of the present study in agreement with **Bundhun et al., (2018)** who asserted that a higher intake of fruits and vegetables among children who prefer fruits more.

On studying other lifestyle practices such as physical activity and sedentary behaviors among school children, the present results showed a high performance of regular physical activity among boys, compared to girls. High rate of physical inactivity among female children have also been reported in a study conducted in Egypt ***(Abdelkarim et al., 2020)***. This may be attributed to the presence of many cultural restrictions in Upper Egypt that limit girls' participation in physical activity such as negative attitudes by family members towards girls practicing exercise/sport and because boys in general, have more freedom and places to practice. While, the current study showed that a higher percentage of girls exposed to technology-based entertainment such as playing computer games and watching television for more than two hours and ate during this compared to boys. ***Manyanga et al. (2014)*** also reported similar findings regarding television-viewing and eating behaviors during it. These adverse dietary patterns and lifestyle practices of girls may be the reasons for their increased obesity.

It is most likely, that dietary pattern, physical activity and the sedentary lifestyle among communities in the Eastern Mediterranean Region (EMR) have played an important role in the rise of obesity ***(Musaiger, 2011)***. The current study showed that consumption of fast food and soft drink were high among the obese and overweight children. This may be because fast food and soft drink contain high amount of salt, sugar and fat, which can contribute to high-energy intake. The same findings were reached by ***Tayyem et al.(2014)*** Additionally, in a multivariate logistic regression analysis, taking more than three meals a day, snacks consumption, and omission breakfast were risk factors of obesity while daily vegetables intake was a protective factor. Regarding similar frequency of meals, ***Abd El-Fatah and Abu-Elenin (2019)*** mentioned that eating ≥ 4 meals/day was significantly associated with overweight/ obese children. Current study found that the odds of being overweight / obese were higher among school children who did not eat breakfast or regularly snaked. Since skipping breakfast results in less energy-dense and less nutritious snacks later in the day. This observation was consistent with a recent study ***(Hamam et al., 2017)***, which found that children who skipped breakfast and snacked regularly show a three times greater risk of obesity. Moreover, present study showed a negative relationship between eating vegetables daily and overweight/obesity. This confirmed by ***(Musaiger, 2011),*** who reported that a dietary pattern characterized by high consumption of fruits and vegetables is associated with lower risk of childhood obesity. However, eating breakfast regularly and vegetables intake maybe protective form among school children.

In this study, the screen time, which was reported by children in watching TV as well as playing games on a mobile phone or computer, was not significantly associated with any anthropometric measurements. This was in line with **Puia and Leucuta, (2017)** study which showed that no association between the time spent by students in front of a screen and anthropometric index. While the strongest factor in students'

overweight/obesity was eating during screen time. This may lead to overeating because the type and amounts of food consumed may be less self-monitoring. This finding concur with previous study which showed that eating while watching TV and other screens was a determinant of obesity ***(Alam et al., 2019)***. Further observation in this study revealed an inverse relationship between physical activity and BMI values. This could imply that physically inactive children were more likely to be overweight/obese. This was consistent with **Custodio et al. *(2010)*** who found that children with higher BMI values had lower levels of physical fitness. More precisely, it was found that being overweight could lead to decrease physical activity levels and vice versa ***(Abdelkarim et al., 2020)***.

The current study showed that inadequate dietary intake contribute to underweight among school children, as eating fewer daily meals, not eating snacks, not eating while watching TV, and never consuming fast food or soft drinks were important factors for underweight. These observations were consistent with a study conducted by ***Wolde et al. (2015)*** who confirmed an association between dietary intake and underweight. Recently, an Egyptian study ***(Abd El-Fatah and Abu-Elenin, 2019)*** showed a significant association between infrequent snack intake and underweight.

However, in the present study a direct association between most life style practices and child stunting could not be demonstrated. Of all the potential risk factors, only no snacking or fast food consumption were associated with stunting. This ran with ***Wolde et al. (2015)*** who reported no association between dietary intake and stunting in their study and interpreted that might be because stunting is a chronic nutritional problem. Similarly, ***Scheffler et al. (2020)*** reported that growth in height does not just depend on the extent and nature of the diet and stunting is not synonymous with poor nutrition.

Conclusion:

High prevalence of underweight, overweight/obesity and stunting in this study revealed that double burden of malnutrition re-mains a significant problem among school children. The prevalence of stunting and underweight was high among boys, while girls tended to be overweight / obese. These abnormal weight categories (overweight/obesity and underweight) were associated with lifestyle practices of school children.

Implications and Recommendations:

More precision in association between lifestyle practices and children's health is an important topic on the public agenda. However, even with the widespread recognition that the food children consume has a strong impact on their health, children's food preferences do not always lead to better nutritional choices. The coexistence of under - and over nutrition in the same households has implications for food and nutrition programming. This study provides a detailed comparative description of the prevalence of underweight, overweight and obesity among primary school children. Additionally, results of this study

highlight common lifestyle practices and its association with malnutrition among school children.

Moreover, this study provided important data on nutritional status and dietary/lifestyle patterns of primary school children in Upper Egypt that will help shape the direction of the child nutrition programs in the future. Understanding this link between lifestyle practices and children's health is important for developing programs and behavior change strategies to improve their lifestyle in general and reduce diet-related diseases in particular ***(Blondin et al., 2016)***. As ***Stok et al. (2018)*** suggested, food and nutrition researchers should not only focus on dietary factors but also incorporate other aspects of lifestyle into the analysis. Food canteens and other school facilities should ensure the availability of more healthy options (such as fruits and vegetables), as well as encourage regular physical activity practices. Giving school children the skills necessary to be more aware of what a healthy diet / lifestyle means would enable them to make better food choices throughout their lives. Many authors have suggested that interventions should be specific for the targeted population (i.e., children and young adults). This aspect can be helpful in promoting healthy diets without creating eating disorders ***(Ashton et al., 2017)***.

Therefore, the researchers recommended that the need to develop behavioral approach policies to motivate children to change their unhealthy behaviors. Public health and nutrition strategies should pay attention to addressing the food emergencies observed among school children. Under and over-nutrition intervention should focus on periodic monitoring, education about healthy dietary and lifestyle behaviors. Replication and further studies should be performed with taking into consideration certain limitations as with any research. Firstly, this study was cross-sectional so the causal relationship to life style practices with underweight, overweight / obesity and stunting should not be inferred. Likewise, it makes it difficult to gauge any conclusion of a growth pattern over time. Secondly, the nature of data was self-reporting, and it may have resulted in over-reporting or under-reporting, there is no gold standard method to overcome recall bias. Since participants were recruited from the semi-urban community, school children in rural areas were not covered. Therefore, it is not possible to generalize.

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