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Original Research Article

The Influence of Socioeconomic Factors and Physical Activity Level on Adolescent Weight Status in Benghazi, Libya

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Abstract: Rapid social and economic changes as a result of industrialization, urbanization, economic development and market globalization, have led to adverse changes in diet, weight, health and nutritional status of the adolescent population, particularly in developing countries. It is therefore, necessary to monitor prevalence rates and trends in under-nutrition and over-nutrition among adolescents. The main objectives were to assess the association of socioeconomic status (SES) and physical activity level in terms of frequency and duration on underweight, overweight and obesity prevalence among Benghazi's adolescents. Anthropometric measurements were taken by professionally trained researchers and subject's weight status was defined according to BMI. The sample, representing adolescents aged between 14 and 19 years, consisted of 552 subjects, 324 of whom were females (58.7 %), while 228 were males (41.3 %). The current study reports a 18.3% and 12.1% prevalence of overweight and obesity in Benghazi adolescents, with a lesser underweight prevalence (4.9%); reflecting a presence of two faces of malnutrition in the country. Gender, age, school address, mother's occupation, frequency of walking for long distance and football playing, duration of football training, and total energy expenditure are the variables which associated with adolescent weight status at (P<0.05).
Keywords: Underweight, Overweight, Obesity, Adolescents, Socioeconomic, Physical activity.

INTRODUCTION

Weight status and nutrition are important factors in the promotion and maintenance of good health throughout life. The effects of over and/or under nutrition may be limited to nutrient deficiency disease or may have long lasting effects by increasing the risk for many chronic diseases. The importance of optimal nutrition during adolescent stage of the human life cycle is crucial and the establishment of healthy weight becomes all the more essential in view of the numerous research which show young people following unhealthy diet habits and consuming unhealthy foods [1, 2]. Whereas there has been considerable research on socioeconomic status(SES)and overweight prevalence among adults, little is known about the impact of SES on lifestyle behaviours among youth. Social inequalities in obesity increase during early adolescence. Preventive measures, targeting adolescent of low socioeconomic status, should be put in place at this stage of life[3,4]. The higher prevalence of overweight and obesity among female adolescents is similar in some countries. However, this has not been a consistent finding. In many other countries, weight loss and under weight is common among female adolescent[5]. Although recent studies report increasing weight concerns among adolescent males; studies to date have reported greater concern with body weight and shape among female adolescents[6]. Furthermore, there is evidence of a change in the pattern of the relationship between socioeconomic status and adolescent weight status in developing countries depending on social position such as parental occupation[7].

Studies also demonstrate that overweight and obese adolescents show lower sport participation in term of duration and frequency and have a less positive attitude toward physical activity[8].

The purpose of this paper is to assess the association of subject characteristics factors, physical activity level in term of frequency and duration and

under-weight, over-weight and obesity among Benghazi's adolescents.

SUBJECTS AND METHODS

This study was conducted in Benghazi, Libya. The study subjects were recruited from secondary public schools in Benghazi. A list of names of government schools was obtained from the office of the director of general education in the ministry of education of Benghazi. A multi-stage stratified sampling process was used to select the schools and subsequently the students within each school. The sample included 46 urban secondary schools, 27 female schools, and 19 male schools listed by. Overall 552 students, (324 females, and 228 males) were randomly recruited.

Questionnaire:

Students were interviewed, they were given a brief explanation about the study, and questionnaire filling procedure, it's objectives, and its ultimate goal. Each of the students was given a form with enough privacy. The questionnaires were reviewed for missing portion or ambiguity. Incomplete or unclear questionnaires were excluded from the study. The questionnaire was divided into two subsections. The first section covered various characteristics like preliminary information like gender and age. There were additional questions within this section regarding student address, school address, father and mother's education, father and mother's profession, type of housing, living condition (with both parents, father, mother or relatives) and number of family members in the household.

The next part of the questionnaire had a detailed section for obtaining information about height, weight, physical activity, smoking, average night sleep hours, employment status, type of employment and number of working hours. Activity levels were defined based on the contribution of the type, duration and frequency of the self-reported activities.

Measurements:

Anthropometric measurements were taken by professionally trained researchers. Weight was measured according to the National health and nutrition examination survey (NHANES)[9] using a mounted stadiometer from Seca (Model 769; Seca, Hamburg, Germany) was used to record weights, along with a measuring tape for height measurements for reconfirmation.

Students were asked to stand erect on the scale; that was calibrated periodically; barefoot, with heavy clothing removed. For taking height, students were asked to stand erect against a wall, with their back head, shoulder blades, buttocks, and legs touching the wall and their head in a Frankfurt position, afterwards a headboard was lowered slowly and with a minimal compression enough to press the hair subjects weight status was defined according to BMI (BMI = weight (kg) / height $(m)^2$) standards. For adolescents up to 19 years old[10] estimates of the prevalence of underweight, healthy weight, overweight and obesity were based on the cut-off points of CDC values. CDC defines underweight as BMI below 5^{th} percentile for sex and age, healthy weight as BMI equal to or greater than 5^{th} percentile and less than 85^{th} percentile for sex and age, overweight as BMI equal to or greater than 85^{th} percentile and less than 95^{th} percentile for sex and age and obesity as BMI equal to or greater than 95^{th} percentile for sex and age[11]. For students 20 years or older, Under-weight was defined as BMI less than 18.5Kg/m^2, healthy weight as BMI 18.5- 24.9Kg/m^2, overweight as BMI 25- 29.9Kg/m^2, obesity as BMI 30Kg/m2 and above. According to the Clinical guidelines established in 1998 by the National Heart, Lung, and Blood Institute, were followed[12]. For comparison of results subjects weight status was also defined according to weight for age CDC growth charts for Boys and girls aged 2- 20 years were used[13-15].

Ethics

The University Ethics Committee and the Libyan Ministry of Education approved the protocol. Informed consent was obtained from the subjects who were also assured of the confidentiality of the information collected. The research was approved by the administration of the schools involved. Prior to the start of the project the respective schools administrations were informed in writing about the aim of the study to obtain the maximum possible cooperation to conduct the study.

Statistical analysis:

The data were entered and processed on computer by SPSS (statistical package for social sciences, Chicago IL, USA). Chi-square test was performed to test the difference in proportions of categorical variables with $p < 0.05$ as the cut-off value for significance. Bivariate Correlation was performed to test correlation between age and BMI values.

RESULTS

The sample of adolescents aged between 14 and 19 years, consisted of 552, subjects, 324 of whom were females (58.7 %), while 228 were males (41.3 %) as shown in table 1.

Table-1: Subject characteristics

Age (Years)		Sex		Total
		Male	Female	
14	No.	7	7	14
	%	1.3	1.3	2.6
15	No.	10	15	25
	%	1.8	2.7	4.5
16	No.	88	73	161
	%	15.9	13.2	29.2
17	No.	101	86	187
	%	18.3	15.6	36.2
18	No.	18	117	135
	%	3.3	21.2	24.5
19	No.	4	26	30
	%	0.7	4.7	5.4
Total	No.	228	324	552
	%	41.3 %	58.7	100
Mean ± SD		17 ± 1.2	18 ± 1.7	

There was a significant correlation between gender and BMI, with P-value equal to 0.002(<0.05). Underweight appeared more prevalent in males, while overweight was more prevalent in females ; 25.5% of females had excess body weight (both overweight and obese) as detailed in Table 2

Table-2: Distribution of BMI among gender

% BMI Distribution among gender	Males	Females	Total
Under weight	7.9	2.8	4.9
Normal	68.9	61.7	64.7
Over weight	13.2	21.9	18.3
Obese	10.1	13.6	12.1
Total	100 %	100%	100

Table-3: Distribution of BMI according to age

Age (years)	% BMI Distribution				
	Under weight	Normal	Over weight	Obese	Total %
14	0	100	0	0	100
15	8	68	8	16	100
16	3.7	64	20.5	11.8	100
17	4.5	66.5	17.5	11.5	100
18	3.7	65.9	19.3	11.1	100
19	20.8	45.5	12.9	20.8	100

Age correlated significantly at 0.05 (two tailed) with BMI status. It was equal to 0.016 (<0.05).Table 3

Adolescents aged 19 years old had the highest underweight and obesity prevalence with the lowest healthy weight, while the highest overweight prevalence was observed among those aged 17 years.

There was a significant correlation between BMI and school location , with P-value = 0.015.

Students in our sample who were attending schools located in Berka area (n=264), had 5.3% underweight and had more overweight and obese adolescents (36.3%) than other areas, while Benghazi centre schools (n=96) had 4.2% underweight and 22.9 % overweight and obese adolescents. As detailed in Table (4).

When considering fathers' educational level, adolescents with illiterate fathers held the highset underweight prevalence (12%) and the highest obesity prevalence (24%), while those with fathers holding a university or postgraduate degree appeared more at risk of obesity (22% overweight as defined by BMI). However, variables did not significantly correlate P-value equal to 0.267

Comparing mother's education; there were no significant correlation with P-value equal to 0.281. However, adolescents with illiterate mothers had more underweight prevalence than the remaining adolescents in the sample (7.7%), overweight prevalence seemed similar across groups with basic, secondary or university education level, while obesity appeared less in those whose mother had basic education. All of which are detailed in Table 4

Adolescents had similar underweight prevalence across all fathers' occupation groups, with no significant correlation (P-value equal to 0.46) figures ranging from 4.3% to 5.6%, and same for obesity which ranges from 7 to 8% overweight was highest among adolecents with employed fathers (2.8 %).

Table-4: Distribution of BMI among Subjects social characteristics

Social characteristics	**BMI Distribution %**							
	Under weight		Normal		Over weight		Obese	
School Address					18.9			
Berka	5.3		58.3		17.7		17.4	
Benghazi Central	4.2		72.9		17.7		5.2	
El-salawi	4.7		69.3				8.3	
Family Size								
1-3	0		64.7		11.8		23.5	
4-6	3.7		66		16.8		13.6	
7-9	4.3		63.8		22		9.8	
+10	10		64.4		12.2		13.3	
House								
Villa	7		54.8		24.3		13.9	
Classic New House	4.1		69.6		18.1		8.2	
Classic Old House	0		65.5		10.3		24.1	
Flat	5.1		65.8		16.5		12.7	
Parents Education and Occupation	M	F	M	F	M	F	M	F
Illiterate	7.7	12	69.2	48	9	16	14.1	24
Basic	5	1	66.4	70.9	20	14.6	8.6	13.6
Secondary	5.4	5.9	61.1	66.4	20.4	16.8	13.2	10.9
Graduate	3.3	4.9	62.3	62	19.9	22.1	14.6	11
Post graduate	0	4.9	87.5	61	12.5	22	0	12.2
Employee	5.6	5.6	67.2	62.5	16.8	20.8	10.4	11.2
Retire	30.8	5.6	46.2	67.6	15.4	14.1	7.7	12.7
Business	0	3.7	80	64.2	0	18.5	20	13.6
Others	0	4.3	0	76.1	0	10.9	0	8.7
Unemployed	3.9	0	64.3	50	19.1	0	12.7	50
F Father M Mother								

On the other hand, there was a significant correlation between a mother's occupation and nutritional status, with P-value equals to 0.008 .30.8% of adolescents with retired mothers were classified as underweight, with least prevalence of obesity in this group. The least underweight prevalence appeared in

housewives group. Overweight had similar distribution across all mother's occupation groups. While students whose mother's job was business, had the highest percentage of healthy-weight (80%), and highest obesity (20%). Obesity was least in the retired group (7.7%). Table 4

Adolescents who lived in large families (>10 members) had the highest percentage of underweight. While obesity was highest among those living in small families (1-3 members) reaching 23.5%. Those at risk of obesity were highest in families with 7-9 members. As shown in Table 4. There wasn't significant correlation between family size and nutritional status, with P-value equal to 0.114

Underweight appeared more prevalent in adolescents living in Villas (7%), and lowest in those living in new houses (4.1%). Overweight also appeared highest in adolescents living in Villa (24.3%) while obesity was highest in those living in old houses (24.2%). as detailed in Table 4. There wasn't significant correlation between home type and BMI, with P-value equal to 0.096 (>0.05).

Physical Activity Frequency and Duration

There was a significant correlation between walking frequency and BMI in adolescents, with P-value equal 0.009(<0.05). Adolescents who reported walking occasionally for long distances had the highest percentage of healthy weight 70.7%. Those who performed no walking had highest underweight and overweight prevalence, while obesity was highest in those who rarely walked. As detailed in Table 5. However, when duration of walking activity was taken into account there wasn't significant correlation between walking duration and BMI, with P-value equal to 0.053(>0.05). Despite similar distribution; highest underweight and overweight was shown in adolescents who reported 0 time dedicated to walking, while obesity was highest in those who walked 61-120 minutes. As detailed in Table 6

Jogging frequency and duration did not correlate with BMI status (p= 0.611, and 0. 593 respectively). Those who went moderate jogging appeared to have the highest prevalence of underweight. Overweight highest in those who reported no jogging at all, while obesity highest in those who did jog on a daily basis. With regard to jogging duration; underweight was highest in those jogging for more than 120 minutes, while obesity highest in 60-120 min jogging group.

Football playing frequency and duration showed significant correlation with BMI status, (P= 0.01, P= 0.000 respectively). Adolescents who reported playing no football at all or playing it only occasionally had highest prevalence of overweight and/or obesity, while those who played football on daily basis had highest prevalence of underweight. Similar distribution appeared when considering duration; highest underweight prevalence was in those playing football for more than 120 min while obesity and overweigh highest in those reporting 0 minutes of playing football.

Riding bicycles showed similar distribution of underweight BMI across all riding groups, while overweight and obesity highest in those who did not ride bicycles or only did so occasionally. Underweight was highest in those who reported 60-12 minutes of riding bicycles, overweight highest in 0 minutes' group while obesity highest in more than 120 minutes of bicycle riding. There wasn't significant correlation between riding bicycle frequency/duration and BMI, with P-value equal to 0.610 and 0.608 respectively.

Volley- ball playing showed similar distribution of all BMI status across all playing groups. Underweight was highest in 0 min group, overweight highest in 61-120 min group while obesity highest in 31-60 minutes of playing volleyball. There wasn't significant correlation between volley ball frequency/ duration and BMI, with P-value equal to 0.05 and 0.097 respectively.

On the other hand, underweight was highest in those who did not report playing tennis. With overweight and Obesity highest in those playing tennis on a daily basis. Similar distribution was shown across duration groups; those who dedicated 0 minutes for tennis playing had the highest underweight prevalence, with overweight and obesity highest among those who played tennis for 61-120 minutes.

There wasn't significant correlation between table tennis both frequency and duration, and BMI, with P-value equal to 0.646, 0.668 respectively. All physical activity and duration details are listed in Table 5 and 6.

Table 5: Distribution of BMI among Physical Activity Frequency

Physical Activity Frequency	**% BMI Distribution**				
	Under weight	Normal	Over weight	Obese	Total %
Walking					
No	8.2	61.8	20.6	9.4	100
Rarely	2.9	57.8	16.7	22.5	100
occasionally	3.2	70.7	18.1	8	100
daily	4.3	65.2	16.3	14.1	100
Jogging					
No	4.6	63.2	20.3	11.9	100
Rarely	4.4	63.7	16.5	15.4	100
occasionally	7.5	71.3	13.8	7.5	100
daily	2.8	66.7	13.9	16.7	100
Football					
No	3.7	59.8	22.3	14.3	100
Rarely	4.7	65.6	14.1	15.6	100
occasionally	3.7	72	18.3	6.1	100
daily	9.5	72.4	9.5	8.6	100
Riding bicycle					
No	5.3	62.3	19.8	12.6	100
Rarely	2.9	72.1	13.2	11.8	100
occasionally	3.3	70	16.7	10	100
daily	5.3	84.2	5.3	5.3	100
Volleyball					
No	6.3	64	19.5	10.2	100
Rarely	1	72.8	10.7	15.5	100
occasionally	1.8	61.4	22.8	14	100
daily	7.1	50	21.4	21.4	100
Table tennis					
No	5.5	64.3	18.9	11.2	100
Rarely	2.1	72.3	10.6	14.9	100
occasionally	0	66.7	16.7	16.7	100
daily	3.7	55.6	22.2	18.5	100

Table 6: Distribution of BMI among Physical Activity Duration

Physical Activity Duration	**% BMI Distribution**				
	Under weight	Normal	Over weight	Obese	Total %
Walking					
0	8.2	61.8	20.6	9.4	100
1-30	4.1	59.8	18	18	100
31-60	3.2	69.6	16.7	10.2	100
61-120	2.1	58.3	18.8	20.8	100
>120	3.8	80.8	15.4	0	100
Jogging					
0	4.6	63.2	20.3	11.9	100
1-30	3,5	71.1	12.7	12.7	100
31-60	10	57.5	20	12.5	100
61-120	5.3	57.9	21.1	15.8	100
>120	16.7	66.7	16.7	0	100
Football					
0	3.7	59.8	22.3	14.3	100
1-30	3.9	71,8	11.7	12.6	100
31-60	4.3	67	18.1	10.6	100

61-120	7.7	76.9	12.8	10.6	100
>120	33.3	66.7	0	0	100
Riding bicycle					
0	5.3	62.3	19.8	12.6	100
1-30	2.6	76.3	13.2	7.9	100
31-60	3.6	64.3	17.9	14.3	100
61-120	11.1	77.8	0	11.1	100
>120	0	75	0	25	100
Volleyball					
0	6.1	64.1	19.6	10.2	100
1-30	3.1	65.6	17.6	13.7	100
31-60	2.5	67.5	5	25	100
61-120	0	53.3	33.3	13.3	100
>120	0	100	0	0	100
Table tennis					
0	5.5	64.3	18.9	11.2	100
1-30	1.9	67.9	17	13.2	100
31-60	3.2	71	6.5	19.4	100
61-120	0	44.4	33.3	22.2	100
>120	0	60	20	20	100

Daily Energy Expenditure based on physical activity level

Energy expenditure was calculated for physical activities reported by participants. Underweight appeared more in adolescents who spent more than 500 kcal/day exercising. Overweight on the other hand was highest in those who did not reportedly spend any energy on exercising. While obesity wasmore prevalent in those spending 1-100kcal/day as shown in table 7.

There was a significant correlation between daily energy expenditure and gender with P-value equal to 0.000(<0.05). Girls were more likely to have low total daily energy expenditure based on the reported physical activity.

Table-7: Distribution of BMI among Daily Energy Expenditure

Daily Energy Expenditure	**% BMI Distribution**				
	Under weight	Normal	Over weight	Obese	Total %
0 kcal	4.5	60.6	27.3	7.6	100
1-100 kcal/kg	4.1	60.2	19.4	16.3	100
101-300 kcal/kg	3.3	68.8	15.8	12	100
301-500 kcal/kg	6.1	69.4	20.4	4.1	100
500 kcal/kg>	12.1	67.2	10.3	10.3	100

Table -8: Association of socioeconomic factors, physical activity and energy expenditure with adolescent weight status

SES and Activity Factors	**Correlation**
Sex	0.002*
Age	0.016*
School address,	0.015*
Mother occupation,	0.008*
Frequency of walking	0.009*
Football frequency	0.01*
Football duration,	0.00*
Daily energy expenditure	0.043*

*** *P*<0.05**

DISCUSSION

Adolescence is a critical period that represents a transitional stage between childhood and adulthood. Addressing adolescents can provide an opportunity to prevent the onset of nutrition related chronic diseases in adult life[16,17].

This study has been conducted to assess factors associated with over and under nutrition in adolescents in Benghazi Libya. The findings revealed that over nutrition is a problem in adolescents in Benghazi, with third of adolescents in the study classified as either obese or at risk of developing obesity. Prevalence of obesity, overweight and underweight are discussed in more details elsewhere[18].Gender, age, school address, mother occupation, frequency of walking for long distance, football frequency and duration of playing, and daily energy expenditure on physical activity were the factors found to associate with weight status of adolescents as assessed by BMI.

Boys in our study were found to be thinner than girls, this meant that girls are more at risk of developing obesity. Upon comparison with literature; most studies showed significant gender differences with regard to weight status[19-49].However, the more predisposed gender to the unhealthy weight on both sides of the weight spectrum is not well defined.

Studies carried out in Saudi and Brazil (19, 20) showed that girls tend to be heavier in general. In South Africa (21), Seychelles (22), Tunisia (23), Mexico (24) Bahrain (25), Saudi Arabia (26), and Sweden (27), girls appeared more are at risk of developing obesity than boys. While studies in South Africa (21), Seychelles (22), Tunisia (23), and Bahrain (25) Show that obesity in particular is more in girls.

While those carried in Asia and Europe; Taiwan (28), Finland (29), and Austria (30), as well as studies in Canada (31), China (32), USA (33), Israel (34), Qatar (35)Iran (36)Saudi Arabia (37)Cyprus (38), Taiwan (39), Germany (40), Czech Republic (41), Italy (42), Greece (43), Portugal (44) Sweden (27), Australia (45) Denmark (46) Hungary (47), and New Zealand (48)showed higher obesity rates among adolescent boys than amongst girls. In Canada (31), Qatar (35) Cyprus (38), Taiwan (49), Czech Republic (41), Greece (43), Germany (40), Italy (42), Australia (45), Hungary (47), and Denmark (46)boys were more overweight. Others however did not observe any gender differences in overweight and overweight or obesity prevalence among adolescents[50].

Considering sexual maturation and nutritional status, age in our study is another factor appeared to have affected the weight status in adolescents. End stage adolescents; particularly in boys, showed highest rates of low BMI, while 15 years olds were the most at risk of developing obesity. This corresponds to other studies. (51- 59, 35)Adolescents in final developmental stage are expected to be thinner(60) and those in stages 1 and 2 of pubertal development occasionally show an increase in body BMI[51].

However, on the contrary of what has been expected in terms of obesity versus age (51);the highest rate of obese BMI was also shown at same adolescence stage (19 year olds); particularly girls; who also had the lowest rates of healthy weight. This indicates that girls, especially at end stage adolescence are more prone to obesity.

Our failure to study lifestyle elements that could have earlier roots that presented until this stage makes it difficult to speculate the explicit reasons behind these findings in Libya. Nonetheless its important to point out that Libya is a country with deep social and cultural norms, factors that can affect nutrition to a large extent, particularly inadolescents.(61) Girls in Libya, and in other places in the Arab region in general are more home bound than their male counterparts and thus have more excess food and eating(62-66), while boys on the other hand, being less restricted by culture, have more excess physical activity[55, 59, 67, 68-71].

Correspondingly; boys in our study were engaged in more physical activity than girls, and spend more energy as estimated by such activities. One of the main reasons for girls not participating in sports could be the religious and social norms and other restrictions that could preclude females from engaging in public sporting.(63) This cultural drawback can be contributive toward the higher rate of overweight and obesity prevalent among girls in our study across different age groups. Though this is based on self-reported data due to the nature of data collection procedure, the association between weight status, age and gender is suggestive of age and gender-related, still unidentified, unhealthy lifestyle or environmental factors that, as opposed to genetic elements, are amenable, in principle, to intervention. More comprehensive and large scale studies specific to this area and society, and focusing also on cultural influences are needed to identify why girls in particular seem to regain weight at end of their adolescence.

Despite the absence of strong statistical correlation, observations on family size and nutritional status corresponded to other those revealed in other studies[55,72- 74]. The highest prevalence of underweight was observed among those belonging to a large family. Where as overweight was more in middle-sized families, and obesity in the smallest.

Parental education appears to be one of the household factors that can influence the nutritional status of adolescents[35]. In this study, both parent's education did not employ significant disparity on their children's nutritional status. This may be due to the fact that the majority of fathers and mothers in the sample were educated and only a minority were illiterate. (4.5 % and 14.1 % respectively), which corresponds to nationally estimated figures (3.3%, and 14.4% respectively)[75].

A review of results on socioeconomic status and BMI from 333 countries reported that non significant results would be obtained when occupation is used to classify SES and in self-reported surveys, and was attributed to difficulties youngsters find in describing parental occupation [76], compatibly; father occupation in our study didn't seem to affect adolescents' BMI. However, mother occupation did correlate with nutritional status. Students whose mothers at time of the study were retired, had the highest percentage of underweight as compared to students whose mothers were currently employed or homemakers. On the other hand, the majority of students with healthy-weight belong to mothers whose job was business. The occupation of the mother mainly, and the health of adolescent has been the subject of previous studies. Several studies have shown inverse relationships between the occupation of parents (especially the mother) and BMI in adolescent[77,78]. Employed mother has more stable economic status. Consequently, the children of those mothers have higher accessibility and affordability of healthy food[79].Furthermore, overweight and obesity in children are linked to the image that parents reflect and behaviour they try to inculcate in their children, in particular, food habits and consumption[80]. In the present study there was a significant correlation between weight status and school address. Berka schools had higher percentage of both underweight and obesity, as compared to Benghazi-center and El-Selawi. This nevertheless might have roots related to the fact that Berka is a highly populated area and thus almost half of participants recruited into the study are attending Alberka schools.Walking and football playing correlated with nutritional status in the present study. Those who walked or played football daily had the most chance of having a healthy body weight, while those who walked rarely were the most obese. Underweight was higher in those playing football for more then 120 minutes. Since football is a vigorous activity and costs more than 7 kcal/ minute[81]an inverse relationship between physical activity and BMI have been described in other studies[82].Football players in general were shown to have lower prevalence of overweight than observed in the general population[83].

Level of physical activity as determined specifically by walking and playing football and their metabolic equivalent were reported to have a significant inverse association with BMI, the engagement in physical activities, the time spent on physical activity level, and the energy expenditure were all found to be significantly higher among boys than girls. This was similarly observed in large national study conducted in Iran[82].The limitations of our study include the small sample drawn only from one city (Benghazi)in Libya; yet, we think that some results can be generalized with caution given that Benghazi is the second most populated and the second largest city. The self-reported nature of the data on exercise and socioeconomic factors may have limited our ability to accurately quantify their impact on body weight and nutritional status as assessed by BMI.

Conclusion

This study demonstrates the existence of the double burden of malnutrition, mainly over-nutrition among adolescents in Benghazi Libya. Factors were shown to have affected nutritional status were sex, age, school address, mother occupation, frequency of walking for long distance and football, duration of football, and total energy expenditure on physical activity. Our findings enhance the need to explore other potential risk factors for malnutrition among adolescents in Benghazi, and highlights the need for intervention strategies to improve the health of future adults.

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