

The Prevalence of Breakfast Skipping and its Association with Lifestyle Factors and Weight in 11-15 years Adolescents from Selected Lebanese Regions

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Abstract

Studies have shown that frequent breakfast skipping is associated to overweight and obesity problems. The habit of skipping breakfast is increasing among adolescents. The objective of this study is to determine the prevalence of breakfast skipping among adolescents living in Lebanon. Data was collected from 404 adolescents, located in three Lebanese districts. Anthropometric measurements through calibrated equipments and dietary intake were collected by a validated food frequency questionnaire (FFQ), sociodemographic and lifestyle information were obtained by a pre-tested questionnaire, in addition BMI for age was used to determine obesity. Linear and ANOVA regressions were used to assess the association between breakfast and BMI-for-age. Six definitions of breakfast skipping were used and the prevalence varied between 8.4% and 42.8%. Linear regression was used to test the association between breakfast skipping and BMI for age. Skipping breakfast was correlated with school type, parental preparation of food, sleeping duration, milk consumption and eating meals. The association between breakfast and BMI-for-age could not be settled due to the absence of a standard definition of breakfast skipping. Our findings could not confirm a relation between breakfast and BMI-for-age. Nevertheless, skipping breakfast was related to many factors. Encouraging breakfast could be efficient for the enhancement of health. New research could be settled to find reasons for obesity and to limit its impact on adolescents living in Lebanon.

Keywords: Breakfast; Weight change; Obesity; Overweight; BMI-for-age

Introduction

Today, overweight and obesity rates are on the rise worldwide reaching an epidemic level in the twenty-first century [1]. The IOTF (International Obesity Task Force) indicated that 1 in 10 school-aged children are overweight or obese [2]. According to the World Health Organization (WHO), high body mass index (BMI) during adolescence predicts elevated adult mortality and cardiovascular disease rates, even if the excess body weight is lost [3].

Obesity usually results from a combination of factors including physical inactivity, unhealthy diet, and certain eating habits including breakfast skipping [4]. The prevalence of breakfast skipping among children and adolescents ranges from 10 to 30% in the United States and Europe [5]. Several studies have demonstrated that breakfast consumption may influence appetite [6], dietary intake and composition [7] which may lead to weight gain [8,9] and increase the risk of chronic diseases [10]. Nonetheless, most of the existing studies remain unclear about whether there is a strong relationship between omitting breakfast and weight gain [11,12].

In Lebanon, several studies have shown a high prevalence of obesity in different age groups [13,14] and it was higher among adolescent boys than girls [15]. Moreover, in a large sample of Lebanese adolescents, Salameh et al. found a positive association between obesity and the frequency of dieting and taking diet pills [16].

An interesting hypothesis is that skipping breakfast in adolescents living in Lebanon may be associated with higher BMI-for-age, dieting practices, lower physical activity level, higher screen time and lower socio-economic status (SES).

The aim of the present study is to determine the prevalence of skipping breakfast and associated risk factors among a random sample

of adolescents in public and private Lebanese schools from selected Lebanese regions.

Results of this study would be necessary to provide adequate preventive measures in order to decrease the impact of breakfast skipping on weight and healthy eating practices of adolescents living in Lebanon.

The major strength to this study is that, it would be the first comprehensive study to simultaneously assess the prevalence of breakfast skipping in a sample of Lebanese adolescents in combination with dietary assessment, age, gender, SES and BMI. However, the study is not without limitations; the study findings are not generalizable beyond adolescents attending Lebanese private and public schools in all Lebanese regions, and because the study is cross-sectional in nature, causality cannot be inferred.

Material and Methods

Study design and sample size

This study is a cross-sectional investigation of the prevalence of skipping breakfast among adolescents aged between 11 and 15 years in three Lebanese districts (Jbeil, Kesrouan and Metn) and its effect on

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BMI-for-age. Data were collected between November 2012 and May 2013.

According to the Ministry of higher education, 203 private and public middle schools are spread in these regions, including 25348 students registered for the academic year 2011-2012 [17]. Sample selection took into consideration the different proportions of private and public schools, the different sizes of schools in terms of students' enrollment and the differences between districts. In Jbeil and Kesrouan regions, 2% of the schools' adolescents and 1.3% in Metn District were contacted for participation.

In total 404 adolescents agreed to participate and were selected from 34 Lebanese middle schools out of which 12 schools were public and 22 were private. Adolescents aged less than 11 years or more than 15 years were excluded from the sampling.

Screening tests

Questionnaire: Students were asked to fill a pre-tested questionnaire offered in two languages (French or English) (Appendix 2) and adapted for the purpose of the study. Data collection and anthropometric measurements were held by a licensed dietitian trained to assess in the field.

The questionnaire included questions about age, gender, SES (parental income and private or public school) and parental presence. Several questions were formulated to assess skipping meals, particularly breakfast. Physical activity, screen time and some lifestyle habits (cigarette smoking, sleep duration, alcohol consumption), eating disorders, and some dietary habits were also assessed. Table 1 displays a brief description of the variables used in the current analysis.

Anthropometric measurements: Anthropometric measurements were taken using standardized techniques and calibrated equipment. Subjects were weighed to the nearest 0.1 kg in the morning wearing basic school uniform. Using a stadiometer, height was measured without shoes and recorded to the nearest 0.5 cm. WHO 2007 growth charts were used to monitor growth for children and adolescent aged between 5 and 19 years old that defined the development using z-scores cutoff points [18]. Normal children have a z-score between -1 and 1. A z-score above or equal 1 SD classifies the child as overweight; a z-score above or equal 2 SD mark that the child is obese. As for a z-score below -1 or equal is classified as marginally underweight, below or equal -2 the children is moderately underweight and below or equal -3 he is severely underweight. Z-scores were calculated using the Anthro Plus software [18].

Assessing skipping breakfast: Due to the absence of a standard definition, skipping breakfast was assessed by several questions. First, an open-ended question "In the last 7 days, on how many days did you eat breakfast?" was asked with responses ranging from 0 to 7 days. Thus, three definitions of breakfast skipping were created: Missing breakfast at least once, at least three times, or at least six times in the past seven days. Furthermore, skipping breakfast was also assessed by "where do you usually eat breakfast?" Skippers were those who answered "I never eat breakfast". Energy intake during breakfast, derived from the 24-hour recall, was another tool to assess skipping breakfast. Two definitions of skipping breakfast were used. An adolescent is considered a skipper, if on the day before collecting the data; ate nothing (0 Kcal) before 10 a.m. or ate nothing (0 Kcal) before 12 p.m.

Dietary intake: A 24-hour recall was used to assess dietary intake and was collected for the day before the adolescents' interview, then

assessed by a free automated self-administered 24-hour recall (ASA24) software [19].

Assessing other variables: Physical activity and screen time were assessed using the 2011 Middle School Youth Risk Behavior Survey questionnaire developed by the CDC [20]. For assessment of eating disorders, the SCOFF questionnaire validated among adolescents has been used [21,22]. An adolescent having a score equal or above 2 was considered to be at risk for eating disorders.

Statistical analysis

Statistical analysis was executed using the Statistical Analysis for Social Sciences (SPSS, version 16.0) and the level of significance was set at $p < 0.05$.

Frequencies and descriptive variables were conducted stratified either by gender or by skipping breakfast. Means of age and anthropometric measurements were calculated through an independent sample t-test and ANOVA regression.

The z-scores drawn from the WHO 2007 reference were coded according to different cutoffs and deducing the prevalence of overweight and obesity.

Linear regression was performed for variables with more than 2 categories with the calculation for the significance.

The association between dietary intake of energy and macronutrients was then assessed through Pearson correlation with the calculation of the significance.

Results and Discussion

The main characteristic of the sample for this study is illustrated in Tables 2 and 3. The mean age of the study, indicated in Table 2, is 13.7 ± 1.010 . Half of the participants have a normal BMI-for-age, while 25% were overweight and 20% were obese. Boys were more obese than girls; whereas, girls were overweight more than boys (Table 2).

Various definitions were used to assess skipping breakfast and the prevalence varied between 8.4% according to the location till 42.8% for skipping one or more days per week (Figure 1).

This percentage is comparable to the findings in previous studies. Tin et al. found that 5.2% of Hong Kong children were skippers when they used the location to define breakfast. Whereas in the same country, when Cheng et al. defined breakfast skippers as missing to drink and to eat before morning classes at least one school day during the past week, they found a prevalence of 30.5% skippers [23]. Dialektakou et al. used 24 different definitions for breakfast and the prevalence ranged between 3.6% never eats in the morning and 74.7% eats on average 0-6 mornings/week [24,25]. Thus, care is needed while comparing breakfast skipping with other studies and while assessing the association with different health outcomes [25].

In this study, almost all various definitions agreed that girls skip more breakfast than boys with $p < 0.05$ but without any significance when defining breakfast by calories similar to other studies (Table 4). Timlin et al. found that 16.4% girls against 13% boys never eat breakfast. Furthermore, Merten et al. found that females also tend to skip breakfast more than males during adolescence with $OR = 0.84$ (95% CI: 0.80 to 0.87) [26].

Name of the variable	Type	Description	Source
Age	Continuous	Age of the participant between 11 and 15 years	Adolescent questionnaire
Gender	Binary	Male or female	Adolescent questionnaire
District	Nominal	Jbeli, Kesrouan or Metn	Sample description
School location	Nominal	Altitude less than 500 m, between 500 m and 1000 m, or more than 1000 m	Sample description
School Type	Binary	Private or public	Adolescent questionnaire
Grade	Nominal	7 th , 8 th or 9 th grade	Adolescent questionnaire
Lebanese nationality	Binary	Yes or no	Adolescent questionnaire
Number of persons per households	Nominal	Less or equal than 3, between 4 and 6, or more than 6	Adolescent questionnaire
Father education level	Nominal	Lower, middle, or higher	Adolescent questionnaire
Mother education level	Nominal	Lower, middle, or higher	Adolescent questionnaire
Father occupational status	Nominal	1 Not working at the moment 2 Part time work 3 Full time work 4 Retirement	Adolescent questionnaire
Mother occupational status	Nominal	1 Not working at the moment 2 Part time work 3 Full time work 4 Retirement	Adolescent questionnaire
Parental income	Nominal	Lower, middle, or higher	Adolescent questionnaire
Parental morning presence	Nominal	Never, rarely, sometimes, most of the time, always	Adolescent questionnaire
parents/guardians food preparation	Nominal	Never, rarely, sometimes, most of the time, always	Adolescent questionnaire
parents/guardians breakfast preparation	Nominal	Never, rarely, sometimes, most of the time, always	Adolescent questionnaire
Feeling hungry because there was not enough food at home	Nominal	Never, rarely, sometimes, most of the time, always	Adolescent questionnaire
Location of eating breakfast	Nominal	Never eat breakfast, home, on the way to school, or on the morning break	Adolescent questionnaire
Eating breakfast in the last 7 days	Nominal	Score between 0 and 7 days	Adolescent questionnaire
Reasons for skipping breakfast	Nominal	Never skip breakfast, do not eat in the morning, does not have time, on diet, or there is no food at home	Adolescent questionnaire
Kind of usual breakfast	Nominal	Milk with ready-to-eat cereals, Sandwich, pastries/sweets, fruits or fruit juices, or coffee	Adolescent questionnaire
Meals per day	Nominal	Score between 1 to more than 6 meal/day	Adolescent questionnaire
Skip lunch	Nominal	Never, rarely, sometimes, most of the time, always	Adolescent questionnaire
Eating pastries/sweets per day	Nominal	Score between 0 to more 5 than times/day	Adolescent questionnaire
Eating fruits/ vegetables per day	Nominal	Score between 0 to more 5 than times/day	Adolescent questionnaire
Drinking milk per day	Nominal	Score between 0 to more 3 than times/day	Adolescent questionnaire
Physical activity for more than 1 h/day	Binary	0 not physically active and 1 physically active for more than 3 days	Adolescent questionnaire
Watching TV in a school day	Nominal	Score between 0 to more than 5 hours/day	Adolescent questionnaire
Playing video games or use computer in a school day	Nominal	Score between 0 to more than 5 hours/day	Adolescent questionnaire
Sports team	Nominal	0 or 1 team	Adolescent questionnaire
Sleeping duration	Nominal	Less than 6 hours, between 6 and 8 hours, or more than 8 hours	Adolescent questionnaire
Cigarette or Narguile	Binary	Yes or no	Adolescent questionnaire
Alcohol	Binary	Yes or no	Adolescent questionnaire
SCOFF questionnaire	Binary	No eating disorder or at risk of eating disorders	SCOFF Adolescent questionnaire
Chronic disease	Binary	Yes or no	Adolescent questionnaire
Type of chronic disease	Continuous	Type	Adolescent questionnaire
Medication	Nominal	Yes or no	Adolescent questionnaire
If the participant on diet	Binary	Yes or no	Adolescent questionnaire
BMI for age Z-score	Continuous	z-score	Anthroplus software
BMI for age Z-score	Nominal	From severe malnutrition to obese	Anthroplus software
Energy intake	Continuous	Total calories derived from ASA 24 software	24 hour recall
Energy intake before 10 am	Continuous	Total calorie intake before 10 am derived from ASA 24 software	24 hour recall
Energy intake before 12 pm	Continuous	Total calorie intake before 12 am derived from ASA 24 software	24 hour recall
Fat ratio	Continuous	Calculated from total fat intake derived from ASA 24 software	24 hour recall
Carbohydrate ratio	Continuous	Calculated from total carbohydrate intake derived from ASA 24 software	24 hour recall
Protein ratio	Continuous	Calculated from total protein intake derived from ASA 24 software	24 hour recall

Table 1: List of variables and their description.

	Total sample N= 404	Male N= 203	Female N= 201	significance
Mean age (mean ± SD)	13.7 ± 1.010	13.81 ± 1.027	13.59 ± 0.982	0.024
Playing with a team within a year				
0 team	212 (52.6%)	63 (31%)	149 (74.5%)	$\chi^2=76.340$ p=0.000
1 team	191 (47.4%)	140 (69%)	51(25.5%)	
Physical activity at school for one hour or more				
0 days	41 (10.1%)	21 (10.3%)	20 (10%)	$\chi^2=8.142$ p=0.017
1 day	298 (73.8%)	139 (68.5%)	159 (79.1%)	
2 days	65 (16.1%)	43 (21.2%)	22 (10.9%)	
More than 2 days	0 (0%)	0 (0%)	0 (0%)	
Physical activity per week for more than one hour				
Less than 3 days/week	103 (25.5%)	28 (13.8%)	75 (37.5%)	$\chi^2=29.759$ p=0.000
Exercise at least 3 days/week	300 (74.5%)	175 (86.2%)	125 (62.5%)	
TV viewing				
One hour or less/day	67 (16.6%)	29 (14.3%)	38 (19%)	$\chi^2=1.627$ p=0.443
Between 1 hour and 3 hours	256 (63.5%)	133 (65.5%)	123 (61.5%)	
More or equal than 3 hours	80 (19.9%)	41 (20.2%)	39 (19.5%)	
Internet and video games				
One hour or less/day	84 (20.8%)	40 (19.7%)	44 (21.9%)	$\chi^2=7.213$ p=0.065
Between 1 hour and 3 hours	173 (43%)	77 (37.9%)	96 (47.8%)	
More or equal than 3 hours	146 (36.2%)	85 (41.9%)	61 (30.3%)	
Sleep duration				
less or equal to 6 hours/day	55 (13.6%)	38 (18.8%)	17 (8.5%)	$\chi^2=15.200$ p=0.001
between 6 and 8 hours/day	252 (62.5%)	129 (63.9%)	123 (61.2%)	
more than 8 hours/day	96 (23.9%)	35 (17.3%)	61 (30.3%)	
Smoke cigarette or Naguile				
Yes	89 (22%)	60 (29.6%)	29 (14.4%)	$\chi^2=13.458$ p=0.000
No	315 (77%)	143 (70.4%)	172 (85.6%)	
Alcohol consumption				
Yes	204 (50.6%)	130 (64%)	74 (37.0%)	$\chi^2=29.467$ p=0.000
No	199 (49.4%)	73 (36%)	126 (63.0%)	
Eating disorder				
No eating disorder	336 (83.2%)	180 (88.7%)	156 (77.6%)	$\chi^2=8.822$ p=0.003
At risk of eating disorder	68 (16.8%)	23 (11.3%)	45 (22.4%)	
BMI for age				
Underweight	19 (4.7%)	10 (4.9%)	9 (4.5%)	$\chi^2=14.035$ p=0.007
Normal	207 (51.2%)	92 (45.3%)	115 (57.2%)	
Overweight	101 (25%)	48 (23.6%)	53 (26.4%)	
Obese	75 (18%)	52 (22.1%)	24 (11.9%)	

Table 2: Main characteristics of the study population.

Skipping breakfast in our sample is associated with many factors

Dietary behaviors and lifestyle factors: The majority of our sample tends to eat three to five meals per day. As for eating lunch, breakfast skippers tend to skip lunch more than eaters (17.6% and 8.7% consecutively) (Table 3). For milk consumption, the majority of breakfast skippers never drink milk (82.4%) (Table 3). Furthermore, there is an association between skipping breakfast and sleeping duration where skippers tend to sleep less than six hours per day (29.4%) more than eaters (12.2%) with $p<0.05$ (Table 5). Thus, similar to our findings, healthy behaviors were reported with the daily intake of breakfast [27].

Contradictory results were however found in our study when comparing with previous research. First, physical activity and television viewing were not associated to skipping breakfast. This result might be due to the absence of a universally acceptable method for assessing physical activity and sedentary behaviors in adolescents [28]. Second, eating disorders were not correlated in our sample to skipping breakfast

with $p>0.05$. Thus, breakfast skipping could not be a useful marker in eating disorders for our study. Furthermore, the intake of fruits, vegetables, pastries and sweets were similar for adolescent that were skippers and non-skippers. This was not consistent in the literature [29]. This inconsistency might be explained by the changes in dietary behaviors among adolescents apart from breakfast eating.

SES: Socio-economic variables did not affect skippers as mentioned in the literature [29-31]. This could be due to the similarity in SES for the adolescent that tend to skip or not breakfast with majority of them had middle income. Shaw describes skipping breakfast as a matter of personal choice rather than influenced by SES [32]. However, the type of school has affected the consumption of breakfast where adolescents that attend public schools tend to skip breakfast more than adolescents studying in private schools with $p<0.05$ (Table 3). These results might be explained by less quality of education regarding healthy lifestyle in public schools. Furthermore, the frequency of parents preparing food for adolescents and specifically breakfast were strongly associated to breakfast skipping with $p<0.001$ (Table 3). The result from the present

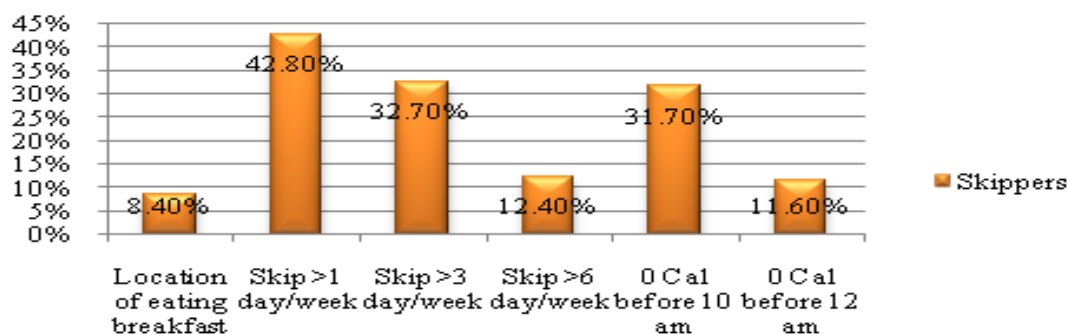


Figure 1: Prevalence of skipping breakfast according to different definitions.

	Total sample N=404 (100%)	On average never eats in the morning N=34	Eat breakfast at home, on way to school or on morning school breaks N=370	Significance
Region				
Jbeil	60 (14.9%)	6 (10.0%)	54 (90.0%)	$\chi^2=1.925$ $p=0.382$
Kesrouan	164 (40.6%)	10 (6.1%)	154 (93.9%)	
Metn	180 (44.6%)	18 (10.0%)	162 (90.0%)	
School type				
Public	324 (80.2%)	12 (15.0%)	68 (85.0%)	$\chi^2=5.611$ $p=0.020$
Private	80 (19.8%)	22 (6.8%)	302 (93.2%)	
Nationality				
Lebanese	384 (95%)	32 (8.3%)	352 (91.7%)	$\chi^2=0.069$ $p=0.516$
Else	20 (5%)	2 (10.0%)	18 (90.0%)	
Meals per day				
Less than 3 meals	29 (7.2%)	9 (27.3%)	20 (5.4%)	$\chi^2=8.663$ $p=0.000$
Between 3 and 5 meals	309 (76.5%)	22 (66.7%)	287 (77.8%)	
More or equal than 6 meals	64 (16.3%)	2 (6%)	62 (16.8%)	
Skipping lunch				
Never	179 (44.3%)	9 (26.5%)	170 (46.2%)	$\chi^2=29.665$ $p=0.000$
Rarely	107 (26.5%)	5 (14.7%)	102 (27.7%)	
Sometimes	60 (14.9%)	7 (20.6%)	53 (14.4%)	
Most of the time	18 (4.6%)	7 (20.6%)	11 (3%)	
Always	38 (9.4%)	6 (17.6%)	32 (8.7%)	
Eat sweet and pastries				
0 times/day	16 (4%)	3 (8.8%)	13 (3.5%)	$\chi^2=5.546$ $p=0.476$
1 time/day	117 (29%)	10 (29.4%)	107 (28.9%)	
2 times/day	117 (29%)	10 (29.4%)	107 (28.9%)	
3 times/day	68 (16.9%)	7 (20.6%)	61 (16.5%)	
4 times/day	33 (8.2%)	1 (2.9%)	32 (8.6%)	
5 times/day	16 (4%)	0 (0%)	16 (4.3%)	
More than 5 times/day	27 (6.7%)	3 (8.8%)	24 (6.5%)	
Eat fruits and vegetables				
0 times/day	34 (8.4%)	5 (14.7%)	29 (7.8%)	$\chi^2=6.375$ $p=0.243$
1 time/day	120 (29.7%)	13 (38.2%)	107 (28.9%)	
2 times/day	95 (23.4%)	5 (14.7%)	90 (24.3%)	
3 times/day	82 (20.3%)	6 (17.6%)	76 (20.5%)	
4 times/day	36 (8.9%)	4 (11.8%)	32 (8.6%)	
5 times/day	21 (5.2%)	0 (0%)	21 (5.7%)	
More than 5 times/day	16 (4.0%)	1 (2.9%)	15 (4.1%)	
Drinking milk				
0 times/day	206 (51%)	28 (82.4%)	178 (48.1%)	$\chi^2=15.034$ $p=0.001$
1 time/day	168 (41.6%)	6 (17.6%)	162 (43.8%)	
2 times/day	30 (7.4%)	0 (0%)	30 (8.1%)	
Number of persons per households				
Less or equal than 3	20 (5.0%)	3 (8.8%)	17 (4.6%)	$\chi^2=2.176$ $p=0.337$
Between 4 and 6	331 (81.9%)	25 (73.5%)	306 (83.2%)	
More than 6	51 (12.6%)	6 (17.6%)	45 (12.2%)	

Father education				
Lower	87 (21.5%)	12 (38.7%)	75 (20.9%)	$\chi^2=5.207$ $p=0.074$
Middle	212 (52.5%)	13 (41.9%)	199 (55.6%)	
Higher	90 (22.3%)	6 (19.4%)	84 (23.5%)	
Mother education				
Lower	71 (17.6%)	10 (31.2%)	61 (16.7%)	$\chi^2=4.244$ $p=0.120$
Middle	204 (50.5%)	144 (3.8%)	190 (52.1%)	
Higher	122 (30.2%)	8 (25.0%)	114 (31.2%)	
Father occupation				
Not working at the moment	3 (0.7%)	0 (0%)	3 (0.8%)	$\chi^2=1.713$ $p=0.788$
Part time work	69 (17.1%)	4 (12.5%)	65 (18.0%)	
Full time work	264 (65.3%)	24 (75.0%)	240 (66.5%)	
Retirement	7 (1.7%)	0 (0%)	7 (1.9%)	
Other	50 (12.4%)	4 (12.5%)	46 (12.7%)	
Mother occupation				
Not working at the moment	257 (63.6%)	18 (52.9%)	239 (64.6%)	$\chi^2=8.388$ $p=0.078$
Part time work	72 (17.8%)	5 (14.7%)	67 (18.1%)	
Full time work	64 (15.8%)	8 (23.5%)	56 (15.1%)	
Retirement	1 (0.2%)	0 (0.0%)	1 (0.3%)	
Other	10 (2.5%)	3 (8.8%)	7 (1.9%)	
Parental income				
Lower	2 (0.5%)	0 (0.0%)	2 (0.6%)	$\chi^2=0.538$ $p=0.764$
Middle	375 (92.8%)	33 (97.1%)	342 (94.2%)	
Higher	20 (5.0%)	1 (2.9%)	19 (5.2%)	
Parental morning presence				
Never	2 (0.5%)	0 (0.0%)	2 (0.5%)	$\chi^2=3.202$ $p=0.525$
Rarely	11 (2.7%)	0 (0.0%)	11 (3.0%)	
Sometimes	41 (10.1%)	5 (14.7%)	36 (9.8%)	
Most of the time	58 (14.4%)	7 (20.6%)	51 (13.9%)	
Always	290 (71.8%)	22 (64.7%)	268 (72.8%)	
Frequency of parents preparation of food				
Never	3 (0.7%)	0 (0.0%)	3 (0.8%)	$\chi^2=10.567$ $p=0.032$
Rarely	6 (1.5%)	0 (0.0%)	6 (1.6%)	
Sometimes	23 (5.7%)	6 (17.6%)	17 (4.6%)	
Most of the time	74 (18.3%)	6 (17.6%)	68 (18.4%)	
Always	298 (73.8%)	22 (64.7%)	276 (74.6%)	
Frequency of parents preparation of breakfast				
Never	41 (10.1%)	10 (29.4%)	31 (8.4%)	$\chi^2=30.423$ $p=0.000$
Rarely	24 (5.9%)	4 (11.8%)	20 (5.4%)	
Sometimes	70 (17.3%)	8 (23.5%)	62 (16.8%)	
Most of the time	57 (14.1%)	8 (23.5%)	49 (13.3%)	
Always	211 (52.2%)	4 (11.8%)	207 (56.1%)	
Food security				
Never	349 (86.4%)	30 (88.2%)	319 (86.2%)	$\chi^2=3.070$ $p=0.546$
Rarely	39 (9.7%)	2 (5.9%)	37 (10.0%)	
Sometimes	12 (3.0%)	1 (2.9%)	11 (3.0%)	
Most of the time	3 (0.7%)	1 (2.9%)	2 (0.5%)	
Always	1 (0.2%)	0 (0.0%)	1 (0.3%)	

Table 3: Demographics, SES and behavioral change among study participants.

	Total sample N=404	Male N=203	Female N=201	Significance
Location of eating breakfast				
On average never eats in the morning	34 (8.4%)	9 (4.4%)	25 (12.4%)	$\chi^2=8.395$ $p=0.003$
Eat breakfast at home, on way to school or on morning school breaks	370 (91.6%)	194 (95.6%)	176 (87.6%)	
On average skipping breakfast more than 1 day per week				
Skippers	173 (42.8%)	99 (48.8%)	74 (36.8%)	$\chi^2=5.893$ $p=0.010$
Eaters	231 (57.2%)	104 (51.2%)	127 (63.2%)	
On average skipping breakfast more than 3 days per week				
Skippers	132 (32.7%)	55 (27.1%)	77 (38.3%)	$\chi^2=5.775$ $p=0.011$
Eaters	272 (67.3%)	148 (72.9%)	124 (61.7%)	

On average skipping breakfast more than 6 days per week				
Skippers	50 (12.4%)	18 (8.9%)	32 (15.9%)	$\chi^2=4.633$ $p=0.022$
Eaters	354 (87.6%)	185 (91.1%)	169 (84.1%)	
On average breakfast calories before 10 am				
Skippers (0 calories)	128 (31.7%)	62 (30.5%)	66 (32.8%)	$\chi^2=0.246$ $p=0.620$
Eaters (≥ 1 calories)	276 (68.3%)	141 (69.5%)	135 (67.2%)	
On average breakfast calories before 12 am				
Skippers (0 calories)	47 (11.6%)	22 (10.8%)	25 (12.4%)	$\chi^2=0.252$ $p=0.616$
Eaters (≥ 1 calories)	357 (88.4%)	181 (89.2%)	176 (87.6%)	
Main reasons for skipping breakfast				
Always eat breakfast	192 (47.9%)	108 (53.7%)	84 (42.0%)	$\chi^2=12.640$ $p=0.027$
Cannot eat in the morning	76 (19.0%)	32 (15.9%)	44 (22.0%)	
No time for breakfast	52 (13%)	27 (13.4%)	25 (12.5%)	
On diet	20 (5%)	4 (2%)	16 (8%)	
Other reason	25 (6.2%)	11 (5.5%)	14 (7%)	
Don't know	36 (9%)	19 (9.5%)	17 (8.5%)	
Don't know	36 (9%)	19 (9.5%)	17 (8.5%)	
Kind of usual breakfast				
Milk with cereals	103 (26.5%)	54 (27.6%)	49 (26.2%)	$\chi^2=8.663$ $p=0.193$
Sandwich	166 (43.3%)	81 (41.3%)	85 (45.5%)	
Pastries /sweets	32 (8.4%)	19 (9.7%)	13 (7.0%)	
Fruit and fruit juices	15 (3.9%)	7 (3.6%)	8 (4.3%)	
Coffee	38 (9.9%)	22 (11.2%)	16 (8.6%)	
Other	23 (6.0%)	13 (6.6%)	10 (5.3%)	
Don't know	6 (1.6%)	0 (0%)	6 (3.2%)	

Table 4: Prevalence of skipping breakfast according to different definitions in the literature.

study supports the literature for this positive association [33]. Thus, parents could play an important role in adolescents' dietary behavior.

Linear regression model non-adjusted or adjusted did not found any association between BMI-for-age and skipping breakfast, even though various definitions were taken into consideration and different confounders were examined as well with $p>0.05$ (Tables 6 and 7).

Many studies in the literature have found a correlation between breakfast intake and weight [5,8]. Several studies have found also no association between breakfast skipping and weight changes [7,11,25,34]. This inconsistency in results might be explained by the absence of a standardized definition for skipping breakfast. Finally, fat intake and carbohydrate intake were positively correlated to BMI-for-age with $p<0.05$, but no association was found while adjusting to total energy $p=0.091$ (Table 8). However, comparing the definition of breakfast by calorie intake to location only 9 adolescents were found to be common (Table 9) with a mean BMI-for-age 1.55 ± 0.78 (Table 10).

Strength and limitations

Other than the absence of standard definition, the major limitation of this study is that it is cross-sectional so the causality could not be drawn. Underreporting energy intake and breakfast for adolescents might be another barrier for studying the relationship between breakfast and BMI. Overweight and obese children tend to underreport food intakes than normal weight [35], so they may also underreport breakfast consumption too [36].

On the other hand, the usage of one single 24-hour recall might not reflect the real intake of the adolescents' population. Multiple 24-hour recalls for the individual are required. Moreover, 24-hour recall reliance on memory might be another limitation besides errors in data collection and the absence of a Lebanese food database.

Finally, this study is the first national study examining breakfast

skipping in relation with weight in Lebanon; a few Lebanese studies have studied skipping breakfast apart and overweight and obesity without searching for a relation between them. The strength of the current study relies in the questionnaire's assessment of a multitude of covariates. Not to mention that, this study assessed skipping breakfast using different definitions that allows for more accurate comparison. However, those results could only be generated to the region where this study was conducted; due to small sampling size that does not represent the entire Lebanese adolescent population.

Conclusion

Prevalence of breakfast skipping and on the other hand overweight and obesity among adolescents has been on the rise in the last few decades. The relation between these two phenomena however remains complex. Due to the importance of regularity in breakfast consumption on nutritional quality of the diet and the improvement in academic performance and psychosocial functioning, the purpose of the current study was to estimate the prevalence of skipping breakfast among 11–15 years old adolescents living in Lebanon and identifying whether there is an association between breakfast patterns and BMI-for-age taking into consideration confounders [37].

According to this study, the prevalence of overweight and obesity were high attaining 25% overweight and 19% obesity among adolescents. In contrast to the absence of a specific definition of breakfast skipping, several definitions were used to describe breakfast skipping and its prevalence varied widely between these definitions from 8.4% till 42.8%.

In an attempt to identify the correlation between breakfast and weight, this analysis found no association between the components despite taking into consideration the various definitions and confounders.

As for dietary intake, fat and carbohydrate were positively associated with BMI-for-age ($p<0.05$) contrary to energy intake where there was

	On average never eats in the morning N=34	Eat breakfast at home, on way to school or on morning school breaks N=370	Significance
Mean age (mean ± SD)	13.88 ± 0.946	13.68 ± 1.015	0.595
Physical activity per week for more than one hour			
Less than 3 days / week	8 (23.5%)	95 (25.7%)	χ ² =0.080 p=0.480
Exercise at least 3 days/ week	26 (76.5%)	274 (74.3%)	
TV viewing			
One hour or less/ day	7 (20.6%)	60 (16.3%)	χ ² =3.130 p=0.209
Between 1 hour and 3 hours	17 (50.0%)	239 (64.8%)	
More or equal than 3 hours	10 (29.4%)	70 (19.0%)	
Sleep duration			
less or equal to 6 hours/day	10 (29.4%)	45 (12.2%)	χ ² =8.319 p=0.016
between 6 and 8 hours/day	19 (55.9%)	233 (63.1%)	
more than 8 hours/day	5 (14.7%)	91 (24.7%)	
Smoke cigarette or nagueile			
Yes	7 (20.6%)	82 (22.2%)	χ ² =0.045 p=0.832
No	27 (79.4%)	288 (77.8%)	
Alcohol consumption			
Yes	17 (50.0%)	187 (50.7%)	χ ² =0.006 p=0.940
No	17 (50.0%)	182 (49.3%)	
Eating disorder			
No eating disorder	31 (91.2%)	305 (82.4%)	χ ² =1.701 p=0.192
At risk of eating disorder	3 (8.8%)	65 (17.6%)	
BMI for age			
Underweight	2 (5.9%)	17 (4.6%)	χ ² =1.385 p=0.847
Normal	15 (44.1%)	192 (51.9%)	
Overweight	10 (29.4%)	91 (24.6%)	
Obese	7 (20.6%)	65 (17.6%)	
Severe obesity	0 (0.0%)	5 (1.4%)	

Table 5: Association between Prevalence of skipping breakfast and lifestyle factors.

R ² =0.002						
Definition	N Eaters	Mean ± SD eaters	N Skippers	Mean ± SD Skippers	β ± SE	p value
On average skip 1 morning/week	173	0.74 ± 1.25	231	0.84 ± 1.14	0.094 ± 0.119	0.431
On average skip 3 mornings/week	272	0.78 ± 1.22	132	0.83 ± 1.12	0.049 ± 0.126	0.700
On average skip 6 mornings/week	354	0.78 ± 1.19	50	0.92 ± 1.19	0.144 ± 0.179	0.423
On average never eats in the morning	370	0.78 ± 1.20	34	0.93 ± 0.99	0.099 ± 0.064	0.121

Table 6: ANOVA regression not corrected for covariates showing the association with BMI and skipping breakfast.

Model: linear, R²=0.03, SE of the estimate 1.17, p=0.032

	β ± SE	p value
Location of breakfast	0.091 ± 0.064	0.157
Age	-0.113 ± 0.059	0.055
Eating disorders	0.142 ± 0.160	0.375
Exercise	0.028 ± 0.141	0.842
Gender	-0.301 ± 0.125	0.017

Table 7: Linear non adjusted showing association with BMI and skipping breakfast.

	Pearson correlation	p-value
Fat intake	0.687	0.02
Carbohydrates intake	0.856	0.009
Total energy	0.067	0.091

Table 8: Correlation between macronutrient intake and BMI-for-age.

no association.

Skipping breakfast was correlated with the school type, parental preparation of food specifically breakfast, sleeping duration, a lower consumption of milk, skipping lunch more often and eating fewer meals per day.

		Location of eating breakfast		
		On average never eats in the morning	Eat breakfast at home, on way to school or on morning school breaks	Total
On average breakfast calories before 12 am	Skippers (0 calories)	9	38	47
	Eaters (≥ 1 calories)	25	332	357
	Total	34	370	404

Table 9: Comparison between the location of eating breakfast and calorie intake on breakfast before 12 pm.

This study could not conclude a relation between BMI-for-age and breakfast in the Lebanese adolescents' population. Nevertheless, admitting that skipping breakfast has no effect on the outcome of health and specifically BMI is inappropriate because causality cannot be settled with cross-sectional studies. However, this research represents a guide for further research that will focus on skipping breakfast regarding weight changes while taking into consideration other variables.

Finally, this research emphasizes the importance and need of more in-to-depth cross-sectional or preferably longitudinal studies to be conducted by public health agencies. These new researches must be

	$\beta \pm SE$	N
Region		
Jbeil	1.13 \pm 1.2	60
Kesrouan	0.73 \pm 1.09	164
Metn	0.73 \pm 1.2	180
Total	0.80 \pm 1.19	404
Gender		
Male	0.93 \pm 1.3	203
Female	0.65 \pm 1.03	201
On average breakfast calories before 12 am		
Skippers (0 calories)	0.97 \pm 0.92	47
Eaters (\geq 1 calories)	0.77 \pm 1.22	357
Location of eating breakfast		
On average never eats in the morning	0.93 \pm 0.99	34
Eat breakfast at home, on way to school or on morning school breaks	0.78 \pm 1.2	370
Total skippers		
0 calories in the morning and never eat breakfast	1.55 \pm 0.78	9

Table 10: Mean BMI-for-age Z-score.

based on large representative samples of the entire Lebanese population in all districts addressing the high prevalence and causes of overweight and obesity [38] and their possible relation to breakfast consumption in Lebanon [39].

Conflict of Interest

The following is a research article in which all participating authors meet the uniform requirements of the Occupational Medicine and Health Affairs criteria for authorship.

This work was approved by the ethics committee at the Holy Spirit University, it was not sponsored by any organization, and there were no conflict of interest regarding this work.

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