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Effects of Food Habits and Lifestyle on Prevalence of Overweight/Obesity among Schoolchildren in Taif Area, KSA

Fayez Hamam[1*], Ahmed Eldalo[1], Mohammad Khaleel[2], Abdullah Alwagdani[3], Ahmed Alqarni[3], Bandr Daghas[3], Msfer Alharthi[3], Huda Alharthy[3], Samah Hassen[3], Abrar Alsofiany[3], Sahar Alotaibie[3]

[1]Department of Pharmacology and Toxicology, College of Pharmacy, Taif University, Taif, Kingdom of Saudi Arabia
[2]Department of Pharmaceutics and Pharmaceutical Technology, College of Pharmacy, Taif University, Taif, Kingdom of Saudi Arabia
[3]Department of Clinical Pharmacy, College of Pharmacy, Taif University, Taif, Kingdom of Saudi Arabia
Email: *fhamam@yahoo.com, f.hamam@tu.edu.sa

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Abstract

Background/Objectives: The Saudi population has experienced significant transformations in their lifestyle which could be attributed to several factors. **Aims:** This work sought to determine effects of food habits and lifestyle on prevalence of overweight (OW)/obesity (OB) among schoolchildren in Taif City, KSA. **Materials and Methods:** A cross-sectional study was carried out using well-designed questionnaire. Pretested questionnaire was randomly distributed among schoolchildren in Taif city. Body mass index and waist circumference were used as tools for assessing nutritional status of schoolchildren. **Results:** A total of 2027 students filled the questionnaire with a mean age of 15.83 ± 2.18 years. The prevalence of OW and OB was 14.6% and 12.9%, respectively, while the combined one was 27.5%. The combined prevalence of OW and OB was significantly higher among boys than girls (31.9 vs. 21.9). Schoolchildren from high income families had high rate of OW and OB. Smoking, stress, TV viewing, daylight and night sleep had no effects on BMI, while only smoking of a family member and stress had considerable relationship with W_C. Unfortunately, 52.2% of students admitted that they were physically inactive but this effect was insignificant for both indicators. Students skipped breakfasts constitute 18.8% of subjects included but link with BMI and W_C was statistically insignificant. Regular soft or diet drinks had significant effects on BMI. Results showed considerable link between consumption of fruits/vegetables, grains and W_C. **Conclusions:** The prevalence of combined OW/OB among schoolchildren was 27.5%. Family income, participant's gender, intake of regular soft or diet drinks had significant effects on

BMI. While, stress, smoking of a family member, and uptake of fruits and vegetables showed considerable relationship with W_C.

Keywords

Overweight, Obesity, Body Mass Index, Waist Circumference, Food Habits, Lifestyle

1. Introduction

KSA is a country that a large percent of population is youth [1]. The population of KSA experienced significant transformations in their lifestyle [2]. The epidemic of OW and OB among children and adolescent is alarming in KSA, since there is a tendency of OW and obese children to remain OW and obese as adults [3]. The impact of OW and OB on children's health is manifested in terms of increase risk of heart disorders, hypertension, lessening of flow of cerebral blood, and asymptomatic coronary heart atherosclerosis. OB and OW also affect the endocrine (*i.e.* high risk of type 2 diabetes mellitus and hypogonadism). The socio-economic consequences of OB and OW include low self-esteem, poor body image, and limitation in mobility and production [4]. Several research works showed that food habits are the most crucial factors affecting the health status of schoolchildren in KSA. For example, Collison *et al.* [5] conducted a cohort study of 9433 schoolchildren aged 10 to 19 in the capital city (Riyadh). The researchers found that boys had higher rates of OB than girls. Abahussain [6] found that 28% of school girls in the Eastern Province of KSA were overweight and obese. Omer *et al.* [2] found that 11% of Al-Baha (South Western part of KSA) schoolchildren were OW or obese. Al-Reethaiaa *et al.* [7] found that the prevalence of OW and OB was 21.8% and 15.7%, respectively among male Health Sciences students at Qassim University, KSA [7]. Amin *et al.* [8] indicated that the prevalence of OW and OB among schoolchildren in Al-Hassa (Eastern Province, KSA) was 14.2% and 9.7%, respectively. El-Quadh [9] showed that the prevalence of OB among male Health Sciences students was higher than females (16.7% VS. 6.7%) in the North Western City of Tabuk (KSA). El-Hazmi and Warsy [10] demonstrated that the combined prevalence of OW and OB in Saudi boys and girls is 16.7% and 19.4%, respectively. Farghaly [11] found that the most consumed diet by schoolchildren in Abha City (KSA) contained higher quantity of carbohydrates and lower amount of fiber. Al-Oboudi [12] showed that 26.0% of school girls in Riyadh were either OW and/or OB. Almuhnna *et al.* [13] found considerable ($P < 0.05$) link between OB and uptake of fast foods. Abahussain [14] did not find a significant change in BMI among Saudi school girls between 1997 and 2007. Al-Shehri [15] confirmed positive relationship between intake of unhealthy foods and body mass. In conclusion, many studies were conducted in KSA to assess nutritional status among residents of the kingdom. However, none of the previously mentioned studies, at least to the best of

our knowledge, tried to assess nutritional status among schoolchildren in Taif area. The objectives were 1) to investigate effects of students' demographic characteristics on BMI and W_C among schoolchildren in Taif City (Western part of KSA); 2) to assess the association between students' eating habits and BMI and W_C, and 3) to evaluate the link between lifestyle of participants and both indicators.

This study determined the prevalence of overweight/obesity and relationship with eating habits and lifestyles among schoolchildren in Taif area. Shedding light on the nature of the link between overweight/obesity and food habits as well as lifestyle will be of great significance in the prevention and treatment of several diseases related malnutrition, such as obesity, heart diseases, diabetes mellitus, and hypertension, among others. Furthermore, this study will be the basis of the second stage which will try to initiate a partnership among different parties, including schools, College of Pharmacy at Taif University, parents, department of school health services, and health-care giver. Furthermore, this study will be the basis for initiating and implementing a health education program that will encourage students to take steps toward preventive actions, including limiting less-healthy diets and endorsing healthy foods in their meals.

2. Materials and Methods

2.1. Study Design and Study Population

A cross-sectional study design was carried out in the period from Feb. to Oct. 2015. This study was conducted among schoolchildren attending preparatory and secondary schools in Taif City, KSA. A suitable sampling technique was adopted. Schools were carefully selected from different areas of Taif. A total of 5000 questionnaire was distributed to representative schools in the four different regions of Taif city. A consent form was explained by members of the research team and students were asked to bring signed consent form their parents before participating in this study. It should be noted that filling out questionnaires was done under direct supervision of the research team members. Thus, the pretested questionnaire was explained and basic information about food guide and tips to get active was presented before a small group of students (e.g. grade 7 class composed of 20 - 25 students).

2.2. Study Instrument

A structured well-prepared questionnaire was designed. The questionnaire composed of two sections. The first section was designed to obtain students' demographic characteristics such as: gender, area of residence, family income etc. This section also collected anthropometric measurements include: height (meters), weight (kg), and waist circumference (cm). Anthropometric measurements were measured by members of the research team to ensure accuracy of measurements. Height of participants was determined to the nearest 0.2 cm using a measuring scale equipped with sliding head part attached to a measuring rod. Body mass was determined to the closest 0.1 kg. After that BMI was calculated using stan-

dard equation. The calculated BMIs were classified to underweight, normal weight, OW and obese depending on the US Centers for Disease Control and Prevention (CDC) growth charts for classification of OW and OB among children. According to this chart, children were classified as OW when their percentile located between ≥85th to <95th, and as obese when their percentile located ≥95th. Those located between ≥5th to <85th percentile were classified normal. When the percentile <5th children were considered normal [16]. Even though BMI is a widely used screening methods, it has major restrictions since it isn't able to differentiate between lean and fat (muscle) mass; it has been proposed that percentage of body fat plays a more significant role in distinguishing healthy from unhealthy subjects [17]. Thus, waist circumference has been used as another tool for assessing nutritional status. The cut-off points for classification of OW and OB based on W_C were determined according to the International Diabetes Federation (IDF) [18]. The second section collected data about participants' lifestyle and food habits.

2.3. Ethical Consideration

This study had obtained ethical approval (No: 83056) from the Ethical Committee at Taif University, KSA. Informed verbal consent was obtained from every student before filling the study tool.

2.4. Sampling Technique and Sample Size

A total of 2027 questionnaires were randomly distributed to students in representative schools. It should be noted that filling out questionnaires was done under direct supervision of the researchers.

2.5. Analysis of Data

Data was analyzed using the statistical package for social sciences (IBM SPSS, version 22, Armonk, NY: IBM Corp.). Means and frequencies as percentages were used to describe different variables. Chi-square analysis was employed to examine the association between the participants' demographic attributes, lifestyle, eating habits and BMI, and W_C. The significance of the differences was determined at P value < 0.05.

3. Results

3.1. Demographic Characters

A total of 2027 students from both genders filled the questionnaire with a mean age of 15.83 ± 2.18 years. The response rate was 100%. Out of them 293 (14.6%) were OW and 260 (12.9%) were obese. The prevalence of OW + OB was 553 (27.5%), while 1808 (89.3%) were at no risk when W_C was used as an assessment tool. More than half 1137 (56.1%) of the subjects included were male and the majority 1565 (77.2%) were Saudi students. There were significant associations (P < 0.001) between participants' gender and their BMI, 31.9% of males

and only 21.9% of females were OW and obese. The OB percentage among students comes from low-income families were significantly lower (13%) from those come from high-income families (15.2%) ($P < 0.001$). Children live in the Sothern part of Taif City had the highest prevalence of OW (17.4%) and OB (18.4%), furthermore, the combined rate of OW and OB (35.8%) was also the highest among schoolchildren live in the Southern part compared to those live in other regions of Taif City (Table 1).

3.2. Life Style

Table 2 shows the effects of lifestyle and environmental exposure on BMI and W_C. Although the majority of participants were non-smokers 1847 (91.8%), their family members smoking rate was high 912 (45%). Smoking neither affected

Table 1. Demographic characteristics and their effects on BMI and W_C among schoolchildren living in Taif City, KSA.

Characters		Freq. (%)	Body mass classification					Waist Circumference		
			Under-weight	Normal weight	Over-weight	OB	*P*-value	No risk	Risk	p-value
Gender	Male	1137 (56.1%)	228 (20.1%)	545 (48.1%)	163 (14.4%)	198 (17.5%)	<0.001	956 (84.2%)	179 (15.8%)	<0.001
	Female	890 (43.9%)	75 (8.5%)	612 (69.6%)	130 (14.8%)	62 (7.1%)		852 (95.7%)	38 (4.3%)	
Nationality	Saudi	1565 (77.2%)	235 (15.1%)	884 (56.9%)	232 (14.9%)	202 (13.0%)	0.927	1405 (89.8%)	159 (10.2%)	0.317
	Non-Saudi	460 (22.7%)	68 (14.8%)	271 (59.2%)	61 (13.3%)	58 (12.7%)		401 (87.4%)	58 (12.6%)	
Grade	7	354 (17.5%)	56 (16%)	192 (54.7%)	53 (15.1%)	50 (14.2%)	0.119	326 (92.4%)	27 (7.6%)	0.092
	8	355 (17.5%)	55 (15.5%)	196 (55.4%)	52 (14.7%)	51 (14.4%)		306 (86.2%)	49 (13.8%)	
	9	247 (12.2%)	48 (19.5%)	129 (52.4%)	37 (15%)	32 (13%)		214 (86.6%)	33 (13.4%)	
	10	321 (15.8%)	39 (12.1%)	180 (56.1%)	50 (15.6%)	52 (16.2%)		287 (89.4%)	34 (10.6%)	
	11	438 (21.6%)	56 (12.9%)	270 (62.4%)	58 (13.4%)	49 (11.3%)		399 (91.1%)	39 (8.9%)	
	12	307 (15.1%)	49 (16.2%)	187 (61.7%)	41 (13.5%)	26 (8.6%)		272 (88.6%)	35 (11.4%)	
Family income	<SAR 5000	450 (22.2%)	65 (%)	266 (59.8%)	56 (12.6%)	58 (13%)	0.006	399 (88%)	50 (11.1%)	0.556
	SAR 5000 - 10,000	622 (30.7%)	110 (17.7%)	344 (55.5%)	98(15.8%)	68 (11%)		547 (88.1%)	74 (11.9%)	
	SAR 10,000 - 15,000	451 (22.2%)	70 (15.6%)	264 (58.9%)	57 (12.7%)	57 (12.7%)		408 (90.5%)	43 (9.5%)	
	>SAR 15,000	479 (23.6%)	50 (10.5%)	275 (57.9%)	78 (16.4%)	72 (15.2%)		433 (90.4%)	46 (9.6%)	
Location of residency	Taif North	400 (19.7%)	66 (16.5%)	241 (60.4%)	48 (12%)	44 (11%)	<0.001	367 (91.8%)	33 (8.3%)	0.248
	Taif South	323 (15.9%)	26 (8.1%)	180 (56.1%)	56 (17.4%)	59 (18.4%)		285 (88.2%)	38 (11.8%)	
	Taif East	549 (27.1%)	71 (%13.1)	343 (63.4%)	77 (14.2%)	50 (9.2%)		494 (90.1%)	54 (9.9%)	
	Taif West	750 (37.0%)	139 (18.6%)	390 (52.2%)	111 (14%)	107 (14.3%)		658 (87.9%)	91 (12.1%)	
	Total		303 (15.1%)	1157 (57.5%)	293 (14.6%)	260 (12.9%)		1808 (89.3%)	217 (10.7%)	

Freq. (%) = Frequency (percentage); SAR = Saudi Arabia Riyals.

Table 2. Effects of lifestyle and environmental exposure on BMI and W_C among schoolchildren living in Taif City, KSA.

		Freq. (%)	Body mass classification					Waist Circumference		
			Under-weight	Normal weight	Over-weight	OB	*P*-value	No risk	Risk	p-value
Smoking	Yes	164 (8.1%)	281 (17.1%)	77 (47%)	33 (20.1%)	26 (15.9%)	0.100	142 (86.6%)	22 (12.4%)	0.436
	No	1847 (91.8%)	274 (14.8%)	1079 (58.4%)	260 (14.1%)	234 (12.7%)		1664 (89.5%)	195 (10.5%	
Smoking of a family member	Yes	912 (45%)	143 (15.8%)	517 (57.1%)	130 (14.4%)	115 (12.7%)	0.587	836 (91.8%)	75 (8.2%)	0.013
	No	1110 (55%)	159 (14.4%)	638 (57.8%)	163 (14.8%)	143 (13%)		967 (87.2%)	142 (12.8%)	
Role of stress	Yes	955 (47.1%)	135 (14.3%)	554 (58.7%)	141 (14.9%)	114 (12.1%)	0.541	868 (90.9%)	87 (9.1%)	0.030
	No	1045 (51.6%)	164 (15.7%)	586 (56.2%)	151 (14.5%)	141 (13.5%)		914 (87.6%)	129 (12.4%)	
Physical activity	Yes	961 (47.4%)	137 (14.4%)	569 (59.6%)	136 (14.3%)	112 (11.7%)	0.470	848 (88.2%)	113 (11.8%)	0.116
	No	1058 (52.2%)	164 (15.6%)	585 (55.7%)	155 (14.7%)	147 (14%)		954 (90.3%)	102 (9.7%)	
Duration of Physical activity	< 1 h	251 (12.4%)	38 (15.3%)	140 (56.2%)	41 (16.5%)	30 (12%)	0.665	226 (90%)	25 (10%)	0.233
	2 h or less	192 (9.5%)	30 (15.7%)	124 (64.9%)	17 (8.9%)	20 (10.5%)		172 (89.6%)	20 (10.4%)	
	3h a wk	137 (6.8%)	20 (14.8%)	76 (56.3%)	23 (17%)	16 (11.9%)		117 (85.4%)	20 (14.6%)	
	4 h a wk	111 (5.5%)	141 (12.6%)	69 (62.2%)	15 (13.5%)	13 (11.7%)		101 (91%)	10 (9%)	
	>5 h a wk	262 (12.9%)	35 (13.5%)	156 (60%)	36 (13.8%)	33 (12.7%)		225 (85.9%)	37 (14.1%)	
Duration of viewing TV…	<2 h a day	541 (26.7%)	84 (15.6%)	316 (58.5%)	79 (14.6%)	61 (11.3%)	0.252	475 (87.8%)	66 (12.2%)	0.057
	2 - 4 h a day	832 (41%)	114 (13.8%)	491 (59.6%)	120 (14.6%)	99 (12%)		757 (91.1%)	74 (8.9%)	
	4 - 6 h a day	349 (17.2%)	60 (17.3%)	176 (50.9%)	53 (15.3%)	57 (16.5%)		300 (86%)	49 (14%)	
	>8 h a day	300 (14.8%)	43 (14.4%)	171 (57.4%)	41 (13.8%)	43 (14.4%)		271 (90.6%)	28 (9.4%)	
Duration of daylight sleep	Never	368 (18.2%)	63 (17.3%)	194 (53.3%)	52 (14.3%)	55 (15.1%)	0.129	318 (86.4%)	50 (13.6%)	0.252
	<1 h	209 (10.3%)	35 (16.8%)	115 (55.3%)	35 (16.8%)	23 (11.1%)		187 (89.5%)	22 (10.5%)	
	1 - 2 h	410 (20.2%)	55 (13.4%)	228 (55.7%)	69 (16.9%)	57 (13.9%)		374 (91.2%)	36 (8.8%)	
	2 - 3 h	608 (30%)	95 (15.7%)	355 (58.8%)	72 (11.9%)	82 (13.6%)		538 (88.5%)	70 (11.5%)	
	≥4 h	422 (20.8%)	54 (12.9%)	262 (62.4%)	62 (14.8%)	42 (10%)		384 (91%)	38 (9%)	
Duration of sleep at night	<4 h	197 (9.7%)	26 (13.3%)	126 (64.3%)	20 (10.2%)	24 (12.2%)	0.380	176 (89.3%)	21 (10.7%)	0.180
	4 - 6 h	527 (26%)	74 (14.2%)	288 (55.2%)	86 (16.5%)	74 (14.2%)		476 (90.3%)	51 (9.7%)	
	6 - 8 h	740 (36.5%)	118(16%)	410 (55.6%)	117 (15.9%)	92 (12.5%)		645 (87.2%)	95 (12.8%)	
	>8 h	545(26.9%)	83 (15.3%)	321 (59.2%)	69 (12.7%)	69 (12.7%)		497 (91.2%)	48 (8.8%)	
	Total		303 (15.1%)	1157 (57.5%)	293 (14.6%)	260 (12.9%)		1808 (89.3%)	217 (10.7%)	

Freq. (%) = Frequency (percentage); h = hours.

BMI ($P = 0.10$) nor W_C ($P = 0.587$). Unfortunately, more than half 1058 (52.2%) of students admitted that they were physically inactive, and only 111 (5.5%) of the participants were physically active for 4 hours per week. Against expectation, there was insignificant association between physical activity and BMI ($P = 0.47$) or W_C ($P = 0.116$).

A total 832 (41%) of respondents watch TV 2 - 4 hours per day, while 300 (14.8%) out of them spent more than 8 hours watching TV. Nonetheless, results of this study showed that the time spent on TV watching had no significant effect on BMI ($P = 0.252$) or on W_C ($P = 0.057$). Regarding sleeping, 422 (20.8%) of students used to sleep 4 hours or more during the daylight, while only 740 (36.5%) of them used to sleep 6 - 8 hours a night. Sleeping time during the daylight or at night had no considerable ($P > 0.05$) effect on both indicators (Table 2).

3.3. Eating Habits

The results of this study revealed that 381 (18.8%) of studied students skipped breakfast, while 875 (43.2%) of them used to have their breakfast nearly every day. Against expectation, breakfast intake had insignificant effect on BMI ($P = 0.121$) and/or W_C. The majority 1591 (78.5%) of students used to have meals with their families, more than half 893 (56.6%) of them have normal BMI and 215 (13.6%) of them were obese ($P = 0.111$). Only 82 (4%) of respondents did not have fast food meals, while 277 (13.7%) of them did this on daily basis. Results presented here indicated that fast foods intake had insignificant effects ($P = 0.714$) on BMI and/or W_C ($P = 0.137$). Seldom of investigated students 159 (7.8%) never had soft drinks during the day, while 649 (32%) of them had drunk them on daily basis. Soft drinks intake significantly ($P = 0.015$) affects BMI. OW and OB were lower in students skipped diet soft drinks (24.1%) compared to those consumed these drinks (ranged from 28% up to 31.6%) ($P = 0.003$) (Table 3). Table 4 illustrates the effects of eating habits on both BMI and W_C. It was found 425 (21%) of students ate meat every day and 757 (37.3%) of them had meat 1 - 2 times weekly, while only 137 (6.8%) of participants never ate meat. Meat intake had insignificant effects on BMI ($P = 0.283$) or on W_C ($P = 0.144$) (Table 4). Liver intake significantly affected BMI ($P < 0.001$) and on W_C ($P = 0.027$). A total 7 (18.9%) of students who ate liver daily were obese, while 93 (11.4%) of those who never ate liver were obese. About one fifth 393 (19.4%) of students never included eggs in their meals and 651 (32.1%) ate 1 - 2 eggs per week, while 110 (5.4%) of them consumed 5 - 11 eggs weekly. Seafood intake among students was rare; either 1 - 2 times per month 780 (38.5%) or 293 (14.5%) out of interviewed students skipped it from their meals. Seafood and eggs intake had insignificant effects on both indicators ($P > 0.05$). Fried foods intake was considered common among students, only 96 (4.7%) of them never had it through their meals, whereas 871 (43%) of them ate them 1 - 2 times weekly. Milk intake by schoolchildren was common either daily 693 (34.1%) or 1 - 2 times weekly 530 (26.1%). Although, 57.0% of lean students consumed milk

Table 3. Effects of eating habits on BMI and W_C among schoolchildren living in Taif City, KSA.

		Freq. (%)	Body mass classification					Waist Circumference		
			Under-weight	Normal weight	Over-weight	Obesity	*P*-value	No risk	Risk	*P*-value
Breakfast intake	Never	381 (18.8%)	45 (12%	227 (60.4%)	58 (12.2%)	46 (12.2%)		347 (91.3%)	33 (8.7%)	
	2 a wk	396 (19.5%)	70 (17.7%)	225 (57%)	52 (13.2%)	48 (12.2%)		350 (88.6%)	45 (11.4%)	
	3 a wk	174 (8.6%)	17 (9.8%)	94 (54%)	33 (19%)	30 (17.2%)	0.121	150 (86.2%)	24 (13.8%)	0.426
	4 a wk	186 (19.2%)	35 (18.8%)	96 (51.9%)	31 (16.8%)	23 (12.4%)		170 (91.4%)	16 (8.6%)	
	≥5 a wk	875 (43.2%)	134 (15.4%)	505 (58.2%)	119 (13.7%)	110 (12.7%)		777 (88.8%)	98 (11.2%)	
Light meal intake	Daily	846 (41.7%)	126 (15%)	498 (95.4%)	121 (14.4%)	94 (11.2%)		765 (89.4%)	90 (10.6%)	
	4 - 6 a wk	301 (14.8%)	43 (14.3%)	170 (56.7%)	46 (15.3%)	41 (13.7%)		268 (89.3%)	32 (10.7%)	
	2 - 3 a wk	468 (23.1%)	78 (16.8%)	249 (53.7%)	72 (15.5%)	65 (14%)	0.269	416 (88.9%)	52 (11.1%)	0.953
	1 - 2 a wk	182 (9%)	33 (18.2%)	107 (59.1%)	20 (11%)	21 (11.6%)		165 (90.7%)	17 (9.3%)	
	never	212 (10.5%)	20 (9.5%)	123 (58.3%)	33 (15.6%)	35 (16.6%)		187 (88.2%)	25 (11.8%)	
Eating with family	Daily	1591 (78.5%)	244 (15.5%)	893 (56.66%)	227 (14.4%)	215 (13.6%)		1420 (89.4%)	169 (10.6%)	
	3 - 4	76 (3.7%)	13 (17.3%)	44 (58.7%)	13 (17.3%)	5 (6.7%)	0.111	70 (92.1%)	6 (7.9%)	0.05
	1 - 2	194 (9.6%)	32 (16.5%)	114 (58.8%)	22 (11.3%)	26 (13.4%)		164 (84.5%)	30 (15.5%)	
	Rarely	163 (8%)	14 (8.6%)	103 (63.6%)	31 (19.1%)	14 (8.6%)		152 (93.3%)	11 (6.7%)	
Fast food intake	Daily	277 (13.7%)	42 (15.6%)	146 (54.1%)	42 (15.6%)	40 (14.8%)		252 (91.3%)	24 (8.7%)	
	4 - 6 a wk	560 (27.6%)	84 (15.1%)	232 (59.7%)	76 (13.7%)	64 (11.5%)		501 (89.5%)	59 (10.5%)	
	2 - 3 a wk	667 (32.9%)	104 (15.6%)	387 (58.2%)	89 (13.4%)	85 (12.8%)	0.714	599 (89.8%)	68 (10.2%)	0.137
	1 - 2 a wk	432 (21.3%)	63 (14.6%)	240 (55.7%)	68 (15.8%)	60 (13.9%)		373 (86.3%)	59 (13.7%)	
	never	82 (4%)	8 (9.8%)	46 (56.1%)	18 (22%)	10 (12.2%)		76 (93.8%)	5 (6.2%)	
Soft drink intake	Daily	649 (32%)	98 (15.3%)	354 (55.2%)	86 (13.4%)	103 (16.12%)		573 (88.4%)	75 (11.6%)	
	4 - 6 a wk	506 (25%)	88 (17.4%)	293 (57.9%)	76 (15%)	49 (9.7%)		454 (89.9%)	51 (10.11%)	
	2 - 3 a wk	433 (21.4%)	61 (14.2%)	250 (58.1%)	59 (13.7%)	60 (14%)	0.015	384 (88.7%)	49 (113%)	0.707
	1 - 2 a wk	276 (13.6%)	30 (11%)	158 (57.9%)	51 (18.7%)	34 (12.5%)		284 (89.9%)	28 (10.1%)	
	never	159 (7.8%)	25 (15.7%)	101 (63.5%)	21 (13.2%)	12 (7.5%)		146 (91.8%)	13 (8.2%)	
Diet soft drink	Daily	171 (8.4%)	29 (17.1%)	92 (54.8%)	21 (12.5%)	26 (15.5%)		184 (87.1%)	22 (12.9%)	
	4 - 6 a wk	190 (9.4%)	25 (13.2%)	105 (55.3%)	34 (17.9%)	26 (13.7%)		167 (88.4%)	22 (11.6%)	
	2 - 3 a wk	226 (11.1%)	31 (13.8%)	125 (55.8%)	32 (14.3%)	36 (16.1%)	0.003	205 (90.7%)	21 (9.3%)	0.773
	1 - 2 a wk	266 (13.1%)	32 (12.2%)	135 (51.3%)	41 (15.6%)	55 (20.9%)		235 (88.3%)	31 (11.7%)	
	never	1169 (57.7%)	184 (15.8%)	699 (60.1%)	164 (14.1%)	116 (10%)		1049 (87.7%)	120 (10.3%)	
High calorie beverage	Daily	150 (7.4%)	23 (15.5%)	88 (59.5%)	17 (11.5%)	20 (13.5%)		140 (94%)	9 (6%)	
	4 - 6 a wk	225 (11.1%)	31 (14%)	125 (56.3%)	38 (17.1%)	28 (12.3%)		205 (91.1%)	20 (8.9%)	
	2 - 3 a wk	296 (14.6%)	37 (12.5%)	165 (55.9%)	4 (15.9%)	46 (15.6%)	0.473	261 (88.2%)	35 (11.8%)	0.187
	1 - 2 a wk	472 (23.3%)	79 (16.9%)	265 (56.6%)	57 (12.2%)	67 (14.3%)		410 (87%)	61 (13%)	
	never	878 (43.3%)	132 (15.1%)	512 (58.6%)	133 (15.2%)	97 (11.1%)		787 (89.6%)	91 (10.4%)	
Total			303 (15.1%)	1157 (57.5%)	293 (14.6%)	26 (12.9%)		1808 (89.3%)	217 (10.7%)	

Freq. (%) = Frequency (percentage); wk = week.

Table 4. Effects of eating habits on body mass index and waist circumference.

		Freq. (%)	Body mass classification					Waist Circumference		
			Under-wt	Normal-wt	Over-wt	OB	*P*-value	No risk	Risk	*P*-value
Meat intake	Daily	425 (21%)	65 (15.4%)	234 (55.3%)	63 (14.9)	61 (14%)		381 (89.9%)	43 (10.1%)	
	1 - 2 awk	757 (37.3%)	108 (14.4%)	447 (59.5%)	106 (14.1%)	90 (12%)		676 (89.3%)	81 (10.7%)	
	3 - 4 awk	495 (24.4%)	87 (17.7%	266 (54.1%)	67 (13.6%)	72 (14.6%)	0.283	430 (86.9%)	65 (13.1%)	0.144
	5 - 6 awk	209 (10.3%)	29 (14%)	116 (56%)	38 (18.4%)	24 (11.6%)		187 (89.9%)	21 (10.1%)	
	Never	137 (6.8%)	14 (10.3%)	92 (67.6%)	18 (13.2%)	12 (8.8%		130 (94.9%)	7 (5.1%)	
Liver intake	Daily	37 (1.8%)	6 (16.2%)	19 (51.4%)	5 (13.5%)	7 (18.9%)		34 (91.9%)	3 (8.1%)	
	1 - 2 awk	780 (38.5%)	142 (18.3%)	419 (53.9%)	107 (13.8%)	109 (14%)		673 (86.4%)	106 (13.6%)	
	3 - 4 awk	193 (9.5%)	34 (18%)	109 (57.7%)	27 (14.3)	19 (10.1%)	<0.001	172 (89.1%)	21 (10.9%)	0.027
	5 - 6 awk	190 (9.4%)	28 (14.8%)	99 (52.4%)	35 (18.5%)	27 (14.3%)		170 (89.9%)	19 (10.1%)	
	Never	820 (40.5%)	93 (11.4%)	510 (62.7%)	118 (14.5%)	93 (11.4%)		753 (91.8%)	67 (8.2%)	
Egg intake	≥12 awk	164 (8.1%)	30 (18.3%)	90 (54.9%)	17 (10.4%)	27 (16.5%		147 (9.6%)	17 (10.4%)	
	8 - 11wk	110 (5.4%)	14 (12.8%)	56 (51.4%)	26 (23.9%)	13 (11.9%)		96 (87.3%)	14 (12.7%)	
	5 - 7 awk	237 (11.7%)	33 (13.9%)	140 (59.1%)	34 (14.3%)	30 (12.7)	0.084	207 (87.3%)	30 (12.7%)	0.24
	2 - 4 awk	465 (22.9%)	70 (15.2%)	269 (58.2%)	59 (12.8%)	64 (13.9%)		403 (86.9%)	61 (13.1%)	
	<2 awk	651 (32.1%)	93 (14.4%)	373 (57.8%)	95 (14.7%)	84 (13%)		594 (91.2%)	57 (8.8%)	
	Never	393 (19.4%)	59 (15.2%)	227 (584%)	62 (15.9%)	41 (105%)		355 (90.6%)	37 (9.4%)	
Fish & seafood intake	1 - 2 month	780 (38.5%)	115 (14.8%)	441 (56.9%)	120 (15.5%)	99 (12.8%)		687 (88.2%)	92 (11.8%)	
	3 - 4 month	464 (22.9%)	73 (15.9%)	260 (56.5%)	62 (13.5%)	65 (14.1%)		412 (88.8%)	52 (11.2%)	
	5 - 6 a month	197 (9.7%)	27 (13.8%)	121 (61.7%)	23 (11.7%)	25 (12.8%)	0.629	178 (90.4%)	19 (9.6%)	0.573
	>6 a mo	282 (13.9%)	36 (12.8%)	169 (60.1%)	37 (13.2%)	39 (13.9%)		257 (91.5%)	24 (8.5)	
	Never	293 (14.5%)	84 (16.6%)	161 (55.5%)	50 (17.2%)	31 (10.7)		265 (90.4%)	28 (9.6%)	
Fried food intake	Daily	294 (14.5%)	37 (12.7%)	17 (61.2%)	34 (11.7%)	42 (14.4%)		273 (92.9%)	21 (7.1%)	
	1 - 2 awk	871 (43%)	126 (14.5%)	498 (57.5)	124 (14.3%)	118 (13.6%)		769 (88.5%)	100 (11.5%)	
	3 - 4 awk	535 (26.4%)	92 (17.3%)	311 (58.3%)	75 (14.1%)	55 (10.3%)	0.009	481 (89.9%)	54 (10.1%)	0.257
	5 - 6 awk	212 (10.5%)	30 (14.4%)	112 (53.8%)	42 (20.2%)	24 (11.5%)		185 (87.3%)	27 (12.7%)	
	Never	96 (4.7%)	10 (10.4%)	50 (52.1%)	17 (17.7%)	19 (19.8%)		84 (87.5%)	12 (12.5%)	

Freq. (%) = Frequency (percentage); awk = a week.

on daily basis compared to 14.7% of OW and 12.5% of obese children, the difference was statistically insignificant (p = 0.732). Vegetables intake was uncommon since 945 (46.6%) of participants had them 1 - 2 times per week or 234 (11.5%) never ate vegetables in their meals (Table 5).

Table 5. Effects of eating dairy products, vegetables and grains habits on body mass index and waist circumference.

		Freq. (%)	Body mass classification					Waist Circumference		
			Under-weight	Normal weight	Over-weight	OB	*P*-value	No risk	Risk	*P*-value
Milk intake	Daily	691 (34.1%)	108 (15.7%)	391 (57.0%)	101 (14.7%)	86 (12.5%)	0.732	621 (90%)	69 (10%)	0.256
	1 - 2 awk	530 (26.1%)	79 (15.0%)	309 (58.5%)	75 (14.2%)	65 (12.3%)		472 (89.2%)	57 (10.8%)	
	3 - 4 awk	332 (16.4%)	48 (14.5%)	184 (55.6%)	51 (15.4%)	48 (14.5%)		287 (86.4%)	45 (13.6%)	
	5 - 6 awk	199 (9.8%)	30 (15.1%)	105 (52.8%)	36 (18.1%)	28 (14.1%)		176 (88.4%)	23 (11.6%)	
	Never	265 (13.1%)	35 (13.5%)	163 (62.9%)	30 (11.6%)	31 (12.0%)		244 (92.1%)	21 (7.9%)	
Vegetables intake per day	≥5	429 (21.2%)	51 (12%)	264 (62.0%)	58 (13.6%)	53 (12.4%)	0.424	395 (92.1%)	34 (7.9%)	0.012
	3 - 4	409 (20.2%)	70 (17.2%)	215 (52.7%)	66 (16.2%)	57 (14%)		364 (89.2%)	44 (10.8%)	
	1 - 2	945 (46.6%)	152 (16.2%)	538 (57.4%)	132 (14.1%)	115 (12.3%)		838 (88.8%)	106 (11.2%)	
	Never	234 (11.5%)	28 (12.1%)	135 (58.2%)	35 (15.1%)	34 (14.7%)		205 (87.6%)	29 (12.4%)	
Consumption of grains per day	≥5	473 (23.3%)	64 (13.6%)	284 (60.4%)	64 (13.6%)	58 (12.3%)	0.293	437 (92.4%)	36 (7.6%)	0.002
	3 - 4	447 (22.1%)	72 (16.2%)	255 (57.3%)	68 (15.3%)	50 (11.2%)		409 (91.5%)	38 (8.5%)	
	1 - 2	958 (47.3%)	146 (15.4%)	536 (56.4%)	140 (14.7%)	128 (13.5%)		825 (86.3%)	131 (13.7%)	
	Never	137 (6.8%)	16 (11.8%)	77 (56.6%)	21 (15.4%)	22 (16.2%)		125 (91.2%)	12 (8.8%)	

Freq. (%) = Frequency (percentage); awk = a week.

4. Discussion

The prevalence of OW+ OB was 27.5%. Similar results were reported from different areas of KSA. For example, AL-Oboudi [12] reported that the combined prevalence of OW and OB (26%) among school girls in Riyadh. In the eastern Province, Abahussain [6] showed that 28% of school girls were OW and obese. El-Hazmi and Warsy [10] showed that the highest percentage of OW + OB was reported in the Eastern Province of Saudi Arabia [10]. Farghly *et al.* [11] found that the combined OW and OB (26.9%) in a Abha area (high altitude city similar to Taif City), which was very close to our figure (27.5%). Recently, higher rates of OW (19.5%) and OB (24.1%) were reported among secondary male students in three main cities of KSA [19].

Although BMI is the most common indicator of OB worldwide, but recently body fat percent could be considered as a more desirable indicator of OB than BMI [7]. Results presented here showed that 27.5% of participants were obese or overweight (*i.e.* one in every four schoolchildren is obese or overweight, while 20 years earlier, Al-Nuaim *et al.* [20] reported that one in every 6 children were obese).

There were significant associations ($P < 0.001$) between participants' gender and their BMI classification, 31.9% of males and only 21.9% of females were overweight and obese. This may could be due to awareness of female students

toward their body appearance than males [11], and boys and girls are different with regard their lifestyle. Similar results were reported by Al-Hazzaa *et al.* [19]. Results of this study are inconsistent with those of Farghly *et al.* [11] who found higher rates among female schoolchildren (29%) than males (23.9%) in Abha area. Waist circumference presented in this study showed that 15.8% of boys were at risk of developing health problems compared to only 4.3% of girls. Our results disagreed with those of Al-Hazzaa *et al.* [19] who found that the mean W_C of school girls in three major cities in KSA was higher than males.

Results presented here showed that socio-economic status had an effect on rates of OW and OB, which agreed with those of Amin *et al.* [8] and Al-Hazzaa *et al.* [19]. On the other hand, our results are inconsistent with Katzmarzyk [21] who cited that Canadian children from low income families have higher rates of OW compared to their counterparts in high income families.

Results showed that location of residency had a significant ($P < 0.001$) effect on BMI. Southern part of Taif City is highly populated compared to other areas, it is the place where a significant number of restaurants and fast food outlets are located. These factors might be behind high prevalence of OW + OB. However, further study should be conducted to investigate effects of location of residency on rates of OW and OB.

Smoking in the current study neither affected BMI ($P = 0.10$) nor W_C ($P = 0.587$). Farghly *et al.* [11] found 8.6% of male intermediate schoolchildren in Abha smoke.

It is well known that physical activity is of great significance for normal growth and development of healthy children and youths. Moderate level of physical activities when the heart rate exceeds 139 beat per minute, while the vigorous one when the heart rate tops 159 beat per minute [22]. American Heart Association recommends that these two levels to be conducted by children and youths for at least 1 hour a day [22]. Physical inactivity is considered a major coronary artery disorder risk factor. Furthermore, it also raises the risk of stroke and other main CVD, such as adiposity, high blood pressure, low level of good cholesterol (HDL-c) and diabetes mellitus [22]. More than half of participants were physically inactive. Recent published data showed that majority of children (60%) and 71% of Saudi adolescents were physically inactive [22]. Omer *et al.* [2] reported much higher rates of physical inactivity (91.7%) among schoolchildren. Collison *et al.* [5] found that frequency of physical activity decreased as the age increases in both sexes. There are many reasons for high rate of physical inactivity, including dependence of children and adolescents on cars for daily activities, high rates of air pollution and high temperatures especially during summer times discourage performing outdoor activities. It was shown that levels of physical activities were lower and levels of TV viewing were higher among OW youths than lean youths aged 10 - 16 years of 34 countries worldwide [23]. Additionally, physical activity not only affects rates of OW and OB, but it was found that it affects blood lipid profile, For example, AL-Hazzaa [22] found that inactive Saudi boys have unfavorable blood lipid profile compared to active boys.

Results showed that the time spent on TV watching had insignificant effect on BMI ($P = 0.252$) or W_C ($P = 0.057$). Similar effect was reported by Omer *et al.* [2]. In Abha region, schoolchildren were not occupied with TV watching or playing video [11].

Sleeping during the daylight or at night had no considerable effect on both indicators ($P > 0.05$). Our results contradicted those of Collison *et al.* [5] who found negative relationship between BMI and W_C and hours of night sleep among boys, while among girls only sleep at night had an impact on both anthropometric indicators.

Many reasons are behind considering breakfast as the most important meal during the day. It provides schoolchildren with a sufficient amount of energy for appropriate brain functions, thus, it improves learning skills. Without it, energy reserves would be depleted overnight, thus, it resulted in a decline in the level of blood glucose. If this decrease is considerable, it disturbs functions of cerebral [12]. Furthermore, Niklas and his colleagues [24] argued that eating breakfast at regular basis could control body mass, possibly due to low fat diet and lower consumption of high caloric snacks. Breakfast intake had insignificant effect on BMI ($P = 0.121$) and W_C, which agrees with those of Omer *et al.* [2], and with those of Al-Rethaiaa *et al.* [7]. Abalkhail and Shawky [25] found that almost 15% of schoolchildren in Jeddah City skipped their breakfast. Similarly, 16.5% of school girls in Riyadh skipped their breakfast [26]. Amin *et al.* [8] indicated that 47.8% of obese and overweight male primary schoolchildren in Al-Hassa (KSA) skipped their breakfast. Farghly *et al.* [11] found that 28% of schoolchildren in Abha area skipped their breakfast, and it was more alarming as 17% of female high school students never ate breakfast. Results of this study disagreed with others. For example, Al-Aboudi [12] found that obese females were more likely to skip breakfast. Several reasons could be behind high rate of skipping breakfast in this study; in KSA, the school day begins too early, thus, the schoolchildren could not have enough time or appetite to have their breakfast [11] and it is well known that teenagers are skipping their breakfast at higher rates compared to other age groups.

Results of this study support initial assumption that eating with a family has an impact on BMI and W_C. It is a rational to propose that frequent consumption of meals with a family would be associated with low prevalence of OW/OB. Many probable mechanisms were cited by Utter and his colleagues [27] for the positive relationships between eating with a family and nutrition of the youths, such as availability of healthy food options, constructive family debate regarding food and nutrition, and/or parental influence on eating habits. Amin *et al.* [8] indicated a positive link between food intake away from family and BMI. Results presented in this study contradicted findings of Al-Rethaiaa *et al.* [7].

Avoiding or minimizing fast foods intake is a healthy practice that needs to be encouraged for the following reasons; firstly, the nutritional value of fast foods is questionable; secondly, children may select unbalanced fast foods; thirdly, fast foods are deficient in many essential elements, have high caloric intake, and high

contents of fats and sodium. This could be explained via the fact that majority of the participants are living with their families, thus, families play a crucial role in affecting children eating habits and food choices. Collison *et al.* [5] showed that schoolchildren in Riyadh consumed at an average of 4.5 fast food meals every week.

One probable explanation of positive link between soft drinks intake and BMI could be that consumption of excessive sugars deposited as fat in the body, leading to body weight increase and, thus, increased OB rate [28]. Furthermore, diets with high sugars have contributed to the development of metabolic dyslipidemia and insulin resistance diabetes [29]. Collison *et al.* [5] showed positive link between uptake of sugary drinks and both indicators (BMI and W_C). In a large cross-sectional study (~24,000 US citizens) indicated that 19% of overweight and 22% of obese participants consume diet beverages [30]. It also found that obese and overweight adults who drink diet drinks tended to have more food [30]. Researches of this study offered two possible hypothesis; sugar-free drinks still stimulate the mind's "sugar reward" pathways, thus, it causes the person to snack more since he has a "sweet tooth" [30]; and the person might simply transfer the energy uptake he used to have from beverages to increase food consumption [30].

There is an increasing evidence that, an increase in dairy consumption by almost 2 serving a day could decrease the risk of being OW by a percent up to 70% [31]. Furthermore, high intake of calcium every day was found to be related to reduce adiposity among children that have been investigated longitudinally [31]. Another health benefit of higher calcium uptake was shown in a study conducted by Pereira *et al.* [32]. Farghly *et al.* [11] found that 51.5% of schoolchildren in Abha (KSA) consumed milk on daily basis. The same trend was noted in this study results when considering W_C. Amin *et al.* [8] noted that overweight and obese boys consumed less milk and dairy products. While Collison *et al.* [5] found milk intake by schoolchildren inversely associated with BMI and W_C.

It is well known that fruits and vegetables play a crucial role in reducing overall caloric intake, since their contents of water and fiber are high. Therefore, adding fruits and vegetables to meals is beneficial in weight management. In the present study vegetables intake was uncommon. This could be explained as; in Saudi society, consumption of raw fruits and vegetables during the course of a meal is not common, and the fruits and vegetables constituents in majority of the Saudi meals are too little to affect the overall energy intake [7], also most of Saudis eat fruits at the end of their meals as treats, therefore, resulting in losing their "satiety impact" that decreases the overall caloric intake of the diet [7]. In the present study, when W_C was used to assess nutritional status, it was found that 92.1% of participants were at least health risk linked with excess abdominal lipids since they consumed 5 or more servings of fruits and vegetables per day. Amin and his team [8] found that overweight and obese schoolchildren consumed less serving of fresh fruits (26.5% vs. 41.4% in lean) and vegetables (36.8% vs. 39.4%) compared to their normal fellows.

5. Conclusions

The current study revealed that prevalence of combined OW and OB was 27.5%. It was significantly higher among boys than girls (31.9% vs. 21.9%), and among schoolchildren from high income families. Smoking of a family member and stress have considerably related to W_C. Unfortunately, more than half 52.2% of students were physically inactive. Regular soft or diet drinks had significant effects on BMI; the other investigated eating habits had no such effects on BMI. The association between liver intake and BMI and W_C was statistically significant. Furthermore, results showed considerable link between consumption of fruits/vegetables and grains and W_C. The prevalence of OW and OB reported in this study and other studies in the kingdom showed the prevalence of OW and OB approaching or even exceeding rates in several developed countries. OW and OB were the main prevalent nutritional problem among schoolchildren in Taif area, an overall prevalence (27.5%) is very alarming. Reasons for poor nutritional status among schoolchildren in KSA are: poor eating habits, namely skipping breakfast, low consumption of fruits and vegetables, low milk uptake, increase consumption of soft drinks and high-caloric drinks. Thus, an intervention national wide program is urgent to revert or decrease the increasing rates of OW and OB and the probable health hazards which could result in grave consequences on adult populations and health care system.

Limitation of this study could be attributed to precision of the self-reported data concerning dietary intake and lifestyle of the participants. This is an attribute shared by several studies of the same nature (cross-sectional).

Ethical Consideration

This study had obtained ethical approval (No: 83056) from the Ethical Committee at Taif University, KSA. Informed verbal consent was obtained from every student before filling the study tool.

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