Unhealthy nutritional habits in university students are a risk factor for cardiovascular diseases

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ABSTRACT

الأهداف: تقييم العلاقة بين العادات الغذائية لطلاب الجامعة والمعايير الصحية المرتبطة بأمراض القلب والأوعية الدموية.

الطريقة: أجريت هذه الدراسة في قسم علوم الأغذية والتغذية بكلية علوم الأغذية والزراعة، جامعة الملك سعود، الرياض، المملكة العربية السعودية، وقد اُختيرت لهذه الدراسة العينة العشوائية المكونة من 312 مشاركاً من الطلبة وذلك خلال العام الدراسي 2008م-2009م (180 طالبة، و132 طالباً، متوسط أعمارهم 21.1±2.8 عاماً). لقد تم إعداد الاستبيان الذاتي التعبئة والذي يحتوي على العناصر التالية: مسح للعادات الغذائية، والعادات الصحية، وأسلوب الحياة، وقد تم تسجيل الاستهلاك الغذائي اليومي، وأُجري تحليل للأغذية المتناولة، بالإضافة إلى قياس ضغط الدم.

النتائج: أوضحت الدراسة بأن ربع الطلبة تقريباً كان يعاني من زيادة الوزن (21%) أو السمنة (6.5%)، وكانت نسبة الطلاب الذكور الذين يعانون من زيادة الوزن (23%) والسمنة (7%) أعلى من نسبة الإناث اللاتي يعانين من من زيادة الوزن (19%) والسمنة (6%). لقد كانت هناك علاقة طردية بين استهلاك الدهون ومؤشر كتلة الجسم، وكذلك بين استهلاك الدهون وضغط الدم في كلي الجنسين، بالإضافة إلى وجود علاقة بين الحالة الاقتصادية ومؤشر الكتلة (p=0.05)، وبين استهلاك الأطعمة المالحة وضغط الدم (p=0.05). وبالمقابل فقد كان هناك علاقة عكسية بين تناول كلاً من الألياف، والحبوب الكاملة، والخضار، والفواكه، والبقول من جهة ومؤشر كتلة الجسم وضغط الدم من جهة أخرى وذلك في كلي الجنسين (p=0.05).

خاتمة: تشير نتائج الدراسة إلى أهمية تعديل أسلوب الحياة اليومي وخصوصاً لدى الفئات العمرية الشابة، كما ويجب على برامج التدخل التوعوي ألا تركز على مشكلة السمنة فحسب بل أيضاً يجب عليها التطرق إلى الأمراض المرتبطة بها. ونحن بحاجة إلى وضع الاستراتيجيات المناسبة، وتنسيق الجهود من أجل الحد من مشكلتي زيادة الوزن والسمنة بين طلبة الجامعة.

Objective: To evaluate the relationship between the nutritional habits of university students with health parameters related to cardiovascular risk.

Methods: Three hundred and twelve students (180 females and 132 males; mean age 21.1 ± 2.8 years) attending King Saud University, Riyadh, KSA were randomly selected from the university register and invited to participate in the study during 2008-2009. Students who consented to participate completed a self-reported questionnaire including: nutritional screen, health habits, and lifestyle practice. Daily food consumption was recorded, and nutritional analysis was performed. Blood pressure (BP) was also measured.

Results: A quarter of students was found to be overweight (21%) or obese (6.5%). The percentage of overweight and obese male students was 23% and 7% compared with female students who were 19% overweight and 6% obese. There was a positive correlation between fat consumption and BMI as well as BP in both genders, between economical status and BMI (p=0.05), and between salty food and BP (p=0.05). There was a negative correlation between consumption of fiber, grains, vegetables, fruits, beans, and BMI as well as BP in both genders (p=0.05).

Conclusion: Our findings suggest that lifestyle modification is important especially in young age groups. The preventive interventions should focus not only on obesity, but also on related diseases. There is a need for strategies and coordinated efforts to reduce the tendency of overweight and obesity among college students.

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Obesity is a public health problem worldwide with significant adverse health outcomes. The prevalence of obesity has doubled over recent decades in several developing countries as well as in the USA, and most western countries.[1] Its increasing prevalence has compelled the WHO to include obesity on the list of the essential habit problems in the world.[2] Economic development in Saudi Arabia during the last 30 years has changed nutritional and lifestyle habits.[3] College students are highly exposed to unhealthy eating habits leading to body weight gain.[4] According to the WHO, obesity is generally more common among women than men.[5] However, studies on college students revealed higher rates of obesity in males than in females.[6,7] Several variables are involved in the etiology of obesity including genetic, lack of physical activity, and consumption of high fat, energy dense foods that are readily accessible, inexpensive, heavily advertised, and palatable.[8] Unhealthy eating habits are major reasons for obesity and cardiac diseases that cause morbidity and mortality.[9] People's lifestyle in developed countries with associated social changes and technological advances have led to an increase in the intake of high fat food with less energy expenditure or physical activity, which is fueling an epidemic of obesity and other chronic diseases.[10] Cardio vascular diseases have been reported to constitute one of the main causes of mortality in developed countries.[2] Poor nutritional habits, such as inadequate consumption of macronutrients, represent a very important component in the etiology of chronic diseases including cardio vascular disease and obesity.[11] It is well established that healthy habits are vital to prevent diseases in adulthood. However, few studies have reported the relationship between nutritional patterns in the young and health parameters related to cardio vascular risk, such as body composition, and blood pressure. Thus, there is an urgent need for comprehensive nutritional assessment studies to describe contemporary health and nutritional behavior in university students. Results may assist public health professionals in the development of optimal nutrition education programs in universities, the community, and even in the government, to prevent diet related disease.[12] The purpose of this study was to evaluate the relationship between the nutritional habits of university students with health parameters related to cardiovascular risk, and to evaluate if poor nutritional habits are associated with cardiovascular risk factors.

Methods.

Subjects. Three hundred and twelve students (180 female and 132 males; with mean age 21.1 ± 2.8 years) attending King Saud University, Riyadh, Kingdom of Saudi Arabia were invited to participate in the study. Students were randomly selected from the university register from October 2008 to October 2009. All the participants were Saudi Arabian, and a written informed consent was obtained. Ethical approval was obtained from the Medical Research Ethics committee of the Faculty of Medicine, King Saud University, Kingdom Saudi Arabia. At the beginning of the study, all students were free from any acute infections and those with diseases known to affect nutritional status (heart failure, renal failure, liver cirrhosis, chronic infection, and diabetes mellitus) or those on special diets were also excluded from the study.

Data collection. A self-reported questionnaire was administered to all students who agreed to participate. Information obtained included: 1. Personal and socio-economic data, age, marital status, education, and occupation of their father and mother, economic status, and history of obesity in their father and mother. 2. Nutritional screening (11-items): questions on frequency of their meals and snacks, questions on their consumption of vegetables, fruits, beans, grains, questions on their consumption of fatty foods, sugars, salty food, questions on dairy products, questions on their consumption of meats, and questions related to their lifestyle practice, such as physical activity (exercise). 3. A dietary sheet of food intake record over 3 consecutive days (Saturday, Sunday, and Monday). The students were informed about the study and were given instructions on how to fill out the questionnaire completely and truthfully. We gave the students a list of foods included in categories: high fat foods, high salt foods, and high sugar foods

Measurements. Anthropometry. Anthropometry measurements were taken by the same operator in the university clinic, according to standard criteria and measuring procedures.[13] Body weight (BW, Kg) and body height (BH, cm) were measured to the nearest 1.0 kg and 0.5 cm. Body weight was measured by a beam balance scale, and BH was measured with a stadia-meter. Body mass index was calculated as BMI (Kg/m^2) = BW ($Kg)/BH^2$ (m^2). Body mass index categorizes were used to diagnose weight status. According to the National Institutes of Health, adults were classified based on their BMI to normal (BMI = 18.5-24.9), overweight (BMI = 25-29.9), or obese (BMI ≥ 30).[14] The corresponding BMI z-scores, relative to the British 1990 Growth Chart References, were determined in order to obtain comparable values across both genders and all ages.[15] The BMI z-score is the number of standard deviation units that a person's BMI deviates from a mean or reference value.

Blood pressure. To measure resting BP, subjects were seated in a semi reclined position with arms relaxed, supported, and with the midpoint of the arm at the level of the heart. After a resting period of at least 5

minutes, BP was measured with a mercury manometer. Blood pressure was measured twice on different days. It was categorized according to BP tables from the Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents,[16] using age and height percentiles, with normotension defined as a BP under the 90th percentile, pre-hypertensive 90-95th percentile, and hypertension greater than 95th percentile or an absolute systolic BP (SBP) of ≥120 mm Hg or diastolic BP (DBP) of ≥80 mm Hg. Also, students were hypertensive if they were taking antihypertensive medication or had been diagnosed with hypertension previously.

Nutrient analysis. Daily dietary record over 3 consecutive days was used to assess typical student intake of macro- and micro-nutrient, including food and beverages in the home and outside; energy and nutrient intake were measured. To properly record the weight of food consumed, each student was provided with a weighing scale and a questionnaire to write down the type and quantity of food that was eaten. The software program, ESHA[17] was used to analyze the nutrient content of the diet consumed by subjects under study after supplements with information about Saudi dishes were loaded in the program after referring to its ingredients. Detailed information about the intake of food producing energy, protein, carbohydrates (CHO), fat, dietary fiber, and basic food groups (for example, cereals, vegetables, fruits, milk-bean products) was obtained. The dietary reference intakes (DRIs) used were recommended values for the general population by age and gender.[18] The average dietary energy intake was estimated to maintain energy balance in a healthy person, adjusting for practice location, gender, age, weight, height, and physical activity level. The values used were based on a sedentary and active person at the reference up to the age of 19 years.

Statistical analysis. Data were expressed as mean ± SE and were analyzed statistically using the Statistical Package for Social Sciences version 12.0 (SPSS Inc, Chicago, IL, USA). All of the analyzed variables were non-parametric and were tested using Chi-squared tests. *P*-values were made on the basis of 2-tailed tests. Differences were considered statistically significant at p=0.05.

Results. Characteristics of the study sample are presented in **Table 1**. There was no statistically significant difference between the female and male students regarding the education of father and mother. On describing the family income, most of the families of both genders were sufficient. The results of this study indicated that most of the students' mothers were obese (**Table 1**). Characteristics of the participating students, BMI, and BP are represented in **Table 2**. The mean BMI of females was 22.2±3.9, and of males was 23.30±2.1. It was observed that the percent of male obesity was higher compared with female obesity. **Table 2** also shows the distribution of the studied group according to BP

Table 1 - Socio-economic characteristics of the studied university students.

Variables	Female students (n = 180)	Male students (n = 132)	*P*-value
	n (%)		
Education of the father			>0.05
Illiterate	61 (34)	44 (33)	
Preparatory and secondary	68 (38)	48 (36)	
University and postgraduate	51 (28)	40 (31)	
Education of the mother			>0.05
Illiterate	80 (44)	55 (42)	
Preparatory and secondary	62 (34)	48 (36)	
University and postgraduate	38 (22)	29 (22)	
Father's occupation			>0.05
Manual	80 (44)	52 (39)	
Employee	89 (49)	72 (54)	
Professional	11 (7)	8 (7)	
Mother's occupation			>0.05
Working	39 (22)	29 (22)	
Non-working	141 (78)	103 (78)	
Family income			>0.05
Sufficient and saving	92 (51)	80 (60)	
Sufficient	79 (44)	45 (34)	
Insufficient	9 (5)	7 (6)	
Father's obesity			>0.05
Yes	80 (44)	52 (39)	
No	100 (56)	80 (61)	
Mother's obesity			>0.01
Yes	130 (72)	39 (29)	
No	50 (28)	93 (71)	

Table 2 - Anthropometric characteristics, blood pressure value (BP) distribution of the study groups according to body mass index (BMI) and BP values.

Variables	Female students (n = 180)		Male students (n = 132)	
	n (%)			
Mean age	21±2.8			
Weight	58.6 ± 12.2*		75.52 ± 10	
Height	162.0 ± 10*		177.7 ± 1	
SBP (mm Hg)	118 ± 10.4*		126.5 ± 13	
DBP (mm Hg)	72.5 ± 6.3*		76.9 ± 9.1	
BMI				
Normal (non obese) (18.5-24.9)	135	(75)	92	(70)
Pre obese (over weight) (25-29.9)	34	(19)	30	(23)
Obese (≥30)	11	(6)	10	(7)
BP (mm Hg)				
Normal (120/80) mm Hg	125	(70)	90	(69)
Pre-hypertensive, Syst (120-139), Diast (80-89)	40	(22)	30	(23)
Hypertensive Syst >139, Diast >89	15	(8)	12	(9)

Values are expressed as mean ± SD, SBP - systolic blood pressure, DBP - diastolic blood pressure, BMI - body mass index classification according to the WHO,[5,13] Syst - systolic, Diast - diastolic, *p=0.05

Table 3 - Students' response to questions related to their dietary habits and exercise.

Questions	Female students (n = 180)		Male students (n = 132)		*P*-value
	n (%)				
Do you take your meals regularly?					0.05
Always irregular	103	(57.2)	75	(56.8)	
Regular	77	(42.8)	57	(43.2)	
How many times do you eat meals					0.05
1 time/day	32	(17.8)	16	(12.1)	
2 time/day	45	(25.0)	32	(24. 2)	
3-4 time/day	93	(51.7)	54	(40.9)	
5 time/day	10	(5.5)	30	(22.8)	
How often do you eat snacks?					0.05
Daily	79	(43.9)	56	(42.4)	
3 or 4/day	38	(21.2)	32	(24.2)	
1 or 2/day	38	(21.2)	22	(16.7)	
Rarely	25	(13.7)	22	(16.7)	
How often do you eat vegetables?					0.05
Daily	43	(23.9)	39	(29.6)	
3 or 4/week	52	(29.2)	40	(30.3)	
1 or 2/week	55	(30.3)	40	(30.3)	
Rarely	30	(16.6)	13	(9.8)	
How often do you eat fruits?					0.05
Daily	30	(16.6)	36	(27.3)	
3 or 4/week	53	(29.4)	30	(22.7)	
1 or 2/week	55	(30.6)	36	(27.3)	
Rarely	42	(23.4)	30	(22.7)	
How often do you eat fatty & fried foods?					0.05
Daily	13	(7.2)	12	(9.1)	
3 or 4/week	66	(36.6)	58	(43.9)	
1 or 2/week	55	(30.6)	42	(31.8)	
Rarely	46	(25.6)	20	(15.2)	
How often do you eat salty foods?					0.05
Daily	66	(36.6)	58	(43.9)	
3 or 4/week	55	(30.5)	42	(31.8)	
Once or 2/week	46	(25.5)	20	(15.2)	
Rarely	13	(7.4)	12	(9.1)	
What type of milk do you drink?					0.05
Full cream	65	(36.1)	53	(40.2)	
Low fat	60	(33.4)	44	(33.3)	
Free fat	45	(25.0)	23	(17.4)	
No drinking	10	(5.5)	12	(9.1)	
How often do you eat Beans?					0.05
Daily	10	(5.5)	15	(11.4)	
3 or 4/week	49	(27.2)	36	(27.3)	
1 or 2/week	55	(30.6)	33	(25.0)	
Rarely	66	(36.7)	48	(36.3)	
How often do you eat sugars?					0.05
Daily	74	(41.1)	50	(37.9)	
3 or 4/week	50	(27.8)	42	(31.8)	
Once or 2/week	46	(25.5)	32	(24.2)	
Rarely	10	(5.6)	8	(6.1)	
How often do you eat grains?					
Daily	12	(6.7)	10	(7.6)	0.05
3 or 4/week	55	(30.6)	42	(31.8)	
Once or 2/week	67	(37.2)	60	(45.5)	
Rarely	46	(25.5)	20	(15.2)	
How often do you do exercise?					0.05
Daily	14	(7.7)	12	(9.1)	
3 or 4/week	54	(30.0)	42	(31.8)	
Once or 2/week	52	(29.0)	20	(15.2)	
Rarely	60	(33.3)	58	(43.9)	

Table 4 - Energy and macronutrient micronutrient and intake of female and males university students.

Variables	Female students (n=180)		Male students (n=132)	
	% g/d	DRI	% g/d	DRI
Energy per day (KJ/d)	11500±310	8736/9908[a]	1449±301	11711/13188[a]
CHO				
% energy from CHO	39	45-65[b]	38	45-65[b]
Fat				
% energy from fat	46.8	20-35[b]	46.1	20-35[b]
Saturated	14.6		14.0	
Poly unsaturated	11.2		11.1	
Mono unsaturated	21.0		21.0	
Protein				
% energy from protein	15	10-35[b]	17	10-35[b]
Dietary fiber per day (g/d)	16±0.1	26[c]	18.9 ± 2	36[c]
Vitamins				
Vit. A (µg)[a]	650±219.8*	700	811.4±111.2	900
Vit. C (mg)[a]	201±12	65	290±1	75
Vit. D (µg)[b]	4.1±26	5	4.9±5	5
Vit. E (mg)[a]	17	15	19	15
Folic acid (µg)[a]	250.9±66*	400	240.9±99	400
Minerals				
Calcium (mg)[b]	800.2±33*	1300	990.9±5	1300
Phosphorus (mg)[a]	1270±11	1250	1280±5	1250
Magnesium (mg)[a]	311±40	360	301±9	410
Iron (mg)[a]	15.0±2	15	16.18±4	11
Zinc (mg)[a]	9.8±2	9	11.2±5	11

Values are expressed as mean ± SD, [a]based on sedentary and active people, [b]acceptable macronutrient distribution range, [c]adequacy intake index, *p=0.05. CHO - carbohydrates, DRI - dietary reference intake

values, the percent of normotensive females were higher compared with males, while pre-hypertension was the same in both genders. The percentage of hypertensive female students lower compared with male students. There with a statistically significant difference between SBP and DBP of females and males (p=0.05).

Table 3 illustrates the students' response to the questionnaire related to their lifestyle practice including eating habits. The majority of the students followed unhealthy eating habits; 51.7% of females and 40.9% of males eat meals 3 times/day, and 43.9% of females and 42.4% of males often eat snacks daily. Also, 30.3% of both genders consumed vegetables once to 2 times/week, the majority of male students eat fatty foods 3-4 times/week). A high percentage of female and male students consumed sugar and salty foods daily, rarely ate beans, and ate grains once to 2 times/week. There were no statistically significant differences found between females and males for all items in **Table 3**. The highest percentage of females and males rarely undertake exercise, as also shown in **Table 3**. It was observed that the mean energy intake was 11500±310 KJ/day for female students and 14490±301 KJ/day for male students (p=0.05; **Table 4**). Based on DRI, percentage of energy from CHO was found to be above the recommended intake, however, a

Table 5 - Correlation (R) between energy and macronutrient intake, food group serving intake, BMI, and blood pressure measured in female and male university students.

Variables	Female students (n = 180)			Male students (n = 132)		
	BMI (Kg/m²)	Systolic BP (mm Hg)	Diastolic BP (mm Hg)	BMI (Kg/m²)	Systolic BP (mm Hg)	Diastolic BP (mm Hg)
Energy (Kj/d)	0.287*	0.039	0.112	0.319**	0.122	0.101
% energy from fat	0.312**	0.344**	0.343**	0.351**	0.394**	0.351**
% of fiber consumption	-0.292*	-0.322**	-0.441**	-0.299*	-0.295*	0.351**
Grain group	-0.311**	-0.373**	-0.313**	-0.363**	-0.289*	-0.344**
Vegetables group	-0.292*	-0.286*	-0.258*	-0.300**	-0.302**	-0.289*
Fruits group	-0.3 28**	-0.2 76*	-0.30 4**	-0.316**	-0.355**	-0.2 73*
Meats group	0.020	0.015	0.043	0.021	0.163	0.192
Bean group	-0.301**	-0.286*	-0.333**	-0.300**	-0.279*	-0.322**
Fatty and oil group	0.317**	0.28 9*	0.29 7*	0.307**	0.283*	0.286*
Salty group	0.112	0.344**	0.351**	0.051	0.394**	0.389**
Sugar group	0.090	0.011	0.044	0.240	0.185	0.145
Exercises	-0.392**	-0.142	-0.027	-0.315**	-0.135	-0.214
Level of the education of the mother	-0.300**	-0.019	-0.022	-0.307**	-0.173	-0.155
Economic status	0.301**	0.132	0.045	0.311**	0.157	0.132

Pearson correlation was used for all variables, *p=0.05, **p=0.01, BMI - body mass index, BP - blood pressure

comparison between each gender group and the normal population revealed an excessive contribution of fat to total energy intake. The fat profiles for both studied groups showed a high intake of mono-unsaturated and saturated fats. The mean daily intake of fiber in both genders was statistically different (p=0.05) and below the recommended intake. The mean protein intake for students was found to be 15% in females and 17% in males. The data concerning dietary intake of vitamins and minerals showed that the students' diet might be at risk of low intake of vitamin A and folic acid as well as calcium, however, the mean intake of other vitamins and minerals was found to be adequate (**Table** 4). **Table** 5 shows the correlation between nutrient intake and relevant health parameters (BMI and BP). There was a positive significant correlation between energy from fatty food group consumption and BMI as well as BP in both genders (p=0.05). A positive significant correlation was found between economical status and BMI (p=0.05). Also, a positive correlation was found between salty food and BP (SBP and DBP) in both genders (p=0.05). A negative correlation was found between consumption of fibers, grains group, vegetables, and beans and BMI as well as BP (SBP and DBP) in both genders (p=0.05). The exercise level of both genders was negatively correlated with BMI (p=0.05).

Discussion. Poor nutritional behavior is associated with many risks that endanger health not only during later life but also during early adulthood. Despite the high level of the education of university students, they still have poor nutritional habits, more so than the general population.[19]

In the present study, the prevalence of overweight (23%) and obese (7%) male students were increased compared to overweight (19%) and obese (6%) female students. These results are in agreement with several studies,[20,21] which reported that obesity was more common among male students than females. This was expected because females are more cautious about their weight status than males due to society perceptions, which encourages females to be slender. In KSA, Al-Rethaiaa et al[22] reported that the prevalence rate of overweight and obesity of male Health Sciences College students were 21.8% and 15.7%. They were eating 2 meals per day including breakfast, together with frequent snacks and fried food consumption, whereas, vegetables and fruits were not frequently consumed by most students. Most males as they are usually outdoors, are exposed to outdoor eating, which usually contains excess fat and CHO, and less fiber.[23] Musaiger et al[24] reported that the prevalence rate of obesity was 35.7% in males and this figure was higher than the rate in females in the United Arab Emirates. In contrast, in Iranian male college students, only 7.9% of them were above the normal body weight.[25] Among Chinese college students, this rate decreased to 2.9% with a percentage of obesity as low (0.4%).[26]

In the present study, there was no significant difference between the male and female students as regards socio economic status and all students had a high economic status, and these results were in accordance with Al-Qauhiz[3] who reported that economic development in Saudi Arabia during the last 30 years has changed nutritional and lifestyle habits.

Regarding BP classification, 22% of both genders were pre-hypertensive, whereas 8% of females, and 9% of males were hypertensive (**Table 2**). Irozusta et al,[21] studied the relationship between the nutritional pattern of late adolescence and health parameters related to cardiovascular risk in university students in Spain, they reported that 30.6% females and 38.9% males were pre-hypertensive whereas 1.4% of females and 19.4% of males were hypertensive. This result was supported by King et al,[27] who reported that unhealthy eating habits were a major cause of morbidity and mortality in the U.S.

Table 3 clarifies the students' response to questionnaires related to their dietary habits. Most students followed unhealthy eating habits, they often eat snacks daily, and this may be due to their palatability, availability, and convenience. A previous survey by the American Dietetic Association indicated that obesity or being severely overweight was a fast food related issue.[20,28] Moreover, the present study revealed that most students had a lower frequency of vegetables, beans, and grains consumption, but higher frequency of fatty and salty food. These present findings were in accordance with several authors,[20,27,29] who stated that obesity was associated with an unhealthy diet, high intake of fast foods and other foods high in fat, and a low intake of fruits and vegetables.

According to the DRI, students have high energy intake for sedentary people (**Table 4**). However, a comparison between each gender group and the normal population revealed an excessive contribution of fat to total energy intake, which exceeded the recommended intake. The fat profiles for both study groups showed a high intake of monounsaturated and saturated fat. These results showed that students' diet might be at risk of low intake of vitamin A and folic acid as well as calcium (**Table 4**), and this is in agreement with Irazusta et al.[21] Also, in our study, most of the students presented an inadequate folic acid intake (**Table 4**). Folate is essential for homocysteine metabolism and a suboptimal level of this vitamin was the most frequent reason for elevated plasma homocysteine, which is an independent risk factor for cardio vascular disease.[30,31]

Table 5 showed that there was a positive significant correlation between energy from fatty food consumption and BMI as well as BP in both genders. Also, a positive significant correlation was found between salty food and BP (SBP and DBP) (p=0.05). A negative correlation was found between consumption of fiber, grains, vegetables, fruits, and beans, and BMI as well as BP (SBP and DBP) in both genders (p=0.05). Similar findings were obtained by several research studies,[32-36] which indicated that there was a significant correlation between overweight and cardiovascular disease in children and adolescents, and a strong association between energy expenditure and BMI.

In the present data, it was observed that a positive correlation exists between fatty and salty foods consumption and BP in both genders. A diet high in saturated fat and hydrogenation unsaturated fat can increase serum low density lipoprotein cholesterol (LDL-C) levels,[28] and can precipitate on the walls of the arteries resulting in clogged or blocked arteries. Also, fatty foods can medicate inflammation within the coronary arteries, which further increase the risk for heart disease and hypertension.[37]

The present results showed that all students in both genders consumed high fat intake, low grains and beans as well as low vegetable and fruit intake with higher values of SBP and DBP. A negative correlation was detected between BMI and exercise in both genders. These data are consistent with those of Gillman et al,[38] who reported that regular participation in physical activity with eating a healthy diet strongly influences health status and reduces the risk of obesity and overweight, which are related to cardiovascular disease. Exercise improves blood circulation and increases activity of the muscles, with loss of calories, and hence reduction in weight.

In conclusion, irregular and infrequent meals together with a low vegetable and fruit intake were the most common unhealthy eating habits of the participants. Lifestyle modification is important, especially in young age groups to improve healthy habits earlier in life. The University and College arenas represent the opportunity for nutritional education of a large number of students. Our findings suggest that preventive interventions should focus not only on obesity, but also to related diseases. This requires strategies and coordinated efforts at all levels (family, university, community, and government) to reduce the tendency of overweight and obesity among college students, and to promote healthy eating habits and physical activity in adulthood.

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