Original research article

Effect of Smoking on Serum Lipid Profile among University`s Students in Dhamar City, Yemen

ABSTRACT

A cross sectional study was performed to evaluate the changes on serum lipid profile and associated risk factors in apparently healthy smoker and non-smoker students at the University of AlHikma Dhamar city, Yemen during the period between November 2021 to March, 2022. Two hundred five students were randomly selected, 104 students were smokers and 101 nonsmokers. Sociodemographic data were collected using a self-administered questionnaire. Anthropometric measurements and laboratory analysis for lipid profile were assessed using standard techniques. The results revealed that smokers had significantly ($P<0.05$) higher levels of TC (164.93mg/dl), TG (149.63 mg/dl), LDL (71.60 mg/dl) and VLDL (29.58 mg/dl) and lower level of HDL (64.70mg/dl) compared to the non-smokers group. Duration and numbers of cigarette smoked were positively correlated with lipid profile values of participants (r= .300; P= .000 and r= .317; P.000) and (r= .210; P= .003 and r= .213; P.002) for TG and VLDL respectively; while none with other values. Significant association was observed between weight (r= .235; P=.001 and r=.145; P= .000); heartbeat (r= .205; P=.003 and r=.256; P=.000); diastolic (r=. 151; P=.030) and BMI (r= .155; P=.027) indices and lipid profile (TG and VLDL); (TC and LDL); (HDL and TC) of the participants respectively; whereas, none with height and systolic indices. In conclusion, smoking induces alteration in serum lipid levels of participants. These results may be helpful in developing preventive legislative laws for prohibit smoking among the University students.

Keywords: Lipid, Serum, Smoking, Students, University, Yemen

1. INTRODUCTION

Smoking has been practiced in one form or the other since ancient times, dating back to 6000 BC where tobacco was first grown in America [1]. Cigarette smoking is now acknowledged to be one of the leading causes of preventable morbidity and mortality and is one of the largest single preventable causes of ill health in the world [2, 3].

Smoking represents an important and rapidly growing global cause of cardiovascular mortality worldwide. Evidence since the early 1950s indicates that more 25 diseases are now known or strongly suspected to be related to smoking. The World Health Organization (WHO) estimates the number of smoking individuals as 1.1 billion, globally [4, 5]. Percentage of smokers in developing countries is 48% in males and 7% in females, while it is 42% and 24% for males and females, respectively in developed countries [6]. WHO estimated that unless the current smoking pattern is reversed, tobacco would be responsible for 10 million deaths per year, by 2030 with 70% of deaths occurring in developing countries [7].

A household survey conducted by the WHO in some Arab countries in 2012 stated that the prevalence of smoking any tobacco product among those aged ≥15 years in 2009 was 24% and 1% in the Kingdom of Saudi Arabia (KSA), 46% and 31% in Lebanon, 47% and 6% in Jordan, 35% and 4% in Kuwait, 34% and 8% in Bahrain, 58% and 5% in Tunisia, and 35% and 11% in Yemen, among males and females, respectively [5,8]

Smoking is most likely to begin during adolescence and there is a common reported that children smoke their first cigarette while they were attending primary school [9]. The reasons for smoking include the inadequate understanding the harmful effects of smoking; attractive tobacco advertising; the presence of so many other smokers; young people's rebelliousness and lack of mature

judgment, inadequate legislation to control smoking, addiction, unhealthy ideas of consumption, the use of tobacco in social life and pleasure [10].

Lipids play an important role virtually in all aspects of biological life. Some of these roles include serving as hormones or hormone precursors, helping in digestion, providing energy, storage function and metabolic fuels; acting as functional and structural compounds in biomembranes and forming insulation to allow nerve conduction or to prevent heat loss [11].

Cigarette smokers have a high risk of coronary heart disease than nonsmokers. Several possible explanations have been offered for this association altered blood coagulation, impaired integrity of the arterial walls, changes in the blood lipid and lipoprotein concentration [12]. Cigarette smoking leads to increased serum level of total cholesterol (TC), Low density lipoprotein (LDL), Triglyceride (TG) levels and decreased level of anti-atherogenic High density lipoprotein [13,14].

The association between smoking and lipid profile of among the students in Yemen is not fully studied, particularly smoker students in Universities and Colleges. Therefore, this study was designed to assess the effect of cigarette smoking in lipid profile and associated risk factors among students at the AlHikma University students in Dhamar city, Yemen.

2. MATERIALS AND METHODS

2.1. Study area

This cross-sectional observational study was carried out on students of Al-Hikma University in Dhamar city during the period between November 2021 to March 2022. Dhamar governorate is located approximately 100 km south to Sana`a, the capital of Yemen. It is situated at 14°.58′N latitude, 44° 43′E longitude and at an altitude of 2425 meter above sea level. The climate remains hot during the day with temperature ranged between 25 and 30 °C (77 and 86 °F), and frosty at night particularly during the winter months. Majority of population working in Agriculture.

2.2. Study population/Subjects

Students of Al-Hikma University of both genders and different ages were invited to participate in this study. The students/subjects were volunteer and all given informed consent to participated in the study. A total of 205 students were selected randomly. The participants were located into two groups. Group-1 comprising clinically healthy smoker students (n=104), who are smoking one cigarette and above per day with an age ranged between 19 to 30 years; whereas, group-2 comprising non-smoker students(n=101).

2.3. Inclusion criteria

All student/subjects were evaluated and selected by detailed medical history, physical examination, systemic examination and routine investigations to rule out any underlying diseases. Healthy smoker students and nonsmokers with age ranging between 19-30 years, students with no family history of dyslipidemia and enrolled in AlHikma University were included in this study.

2.4.Exclusion criteria

All Students having diseases, which are known to influence the blood lipids or patients on lipid lowering drugs or a diet restriction for any reason and persons chewing tobacco, ex-smokers, obese persons, and having risk factors like hypertension, diabetes mellitus and who did not enroll in AlHikma University were excluded**.**

2.5. Sample size

The proposed sample size was based on previously published studies on serum lipid profile of smokers and nonsmokers[15,16]. A single population proportion formula was used[17] to determine the sample size with the assumption of the prevalence of dyslipidemia among the students is 16%, 95% level of confidence, 5% margin of error using the statistics and samples size calculator[17]. Thus, the calculated sample size was 205 students.

2.6. Data collection and processing

2.6.1. Socio-demographic characteristics collection

Data related to socio-demographic characteristics and self-management behaviors were collected using self-administered questionnaire. Questionnaire forms were delivered to students in their classrooms during breaks and were collected as soon as they completed. Students had been informed that questionnaire participation is voluntary, their identity would not be recorded on the form, all the data in the questionnaire would be used for research purposes as guidance given by **Nasser et al. [5**]

2.6.2. Anthropometric indices measurements

Body weight, height and Body mass index (BMI) of students were measured during interview. Height and weight was measured twice using a height-weight scale that had been calibrated before students stood with bare feet and wore light clothing, and then the averages were calculated. Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared according the keys given by Qi et al. [18]

Blood pressure was measured using a digital sphygmomanometer (Omron M6, Omron, Kyoto, Japan). The participant was seated on a chair and the feet firmly rested on the floor. The measurement was taken from the left hand which rested on a desk with the antecubital fossa level with the heart and palm facing upwards. The measurements were repeated twice more, with two minutes between each interval. The mean of the last two measurements were used to calculate the systolic blood pressure (SBP) and diastolic pressure (DBP) of the participant. High blood pressure was defined as SBP>140mmHg or DBP>90mmHg [19].

2.6.3. Blood samples analysis

Blood samples were obtained in the morning. The biochemical parameters were measured at the laboratory of The Department of Medical Laboratory, AlHikma University, Dhamar. The TC, TG, HDL, LDL and VLDL levels were measured using automated spectrophotometer according to manufactures instructions. The concentration of LDL was calculated using the Friedewald formula [20].

2.7. Statistical analysis

Statistical analyses were performed with SPSS software (Version 21.0, SPSS, Inc., Chicago, IL). Means, standard deviations, and percentages were used for descriptive statistics. Chi square was used for measuring the relationships between smoking and sociodemographic characteristics. Pearson correlations were calculated to describe the unadjusted relationships between the smoking and lipoprotein parameters, anthropometric indices and number & duration of cigarette smoking. All results were considered statistically significant when the P-value <0.05 and 0.01.

3.RESULTS

3.1. Sociodemographic characteristics and anthropometric measurements of Participants

Two hundred five students from AlHikma University were participated in this study. The sociodemographic characteristics of participant are presented in Table 1. As shown**,** the age of participated students were ranged between 19-30 years old, 177(86.3%) were males; whereas, 28(13.7%) were females, 177(86.3%) were single; whereas, 28(13.7%) were married, 68(33.2%) were residing rural areas; while, 137(66.8%) Urban areas, 189(92.2%) Qat-chewing; 16(7.8%) none; the income of individuals was ranged between <5000-16000 Yemeni Rials and above, 104(50.7%) were smokers while; 101(49.3%) were none, the number of cigarettes smoked by different groups of participants was ranged between 1-11 and above per day; the onset period (duration) of smoking was ranging from 1-11 years, majority of participants rarely practices exercises(59.5%) and 105(51.2%) consumed meat weekly**.**

Table 1. Sociodemographic characteristics of participated students

Characteristics	Frequency	Percentage %

Age	19≤-20	66	32.2
	21-22	93	45.4
	23-24	35	17.1
	25-26	5.0	2.4
	27-28	3.0	1.5
	29-30	3.0	1.5
SeX	Male	177	86.3
	Female	28	13.7
Social status	Sigle	177	86.3
	Maried	28	13.7
Residence	Rural	68	33.2
	Urban	137	66.8
Qatchew	Yes	189	92.2
	No	16	7.8
Income	<5000-10000YR	138	67.3
	11000-15000	26	12.7
	16000>	41	20.0
Smoking	Smokers	104	50.7
	Non-Smokers	101	49.3
Number of cigarettes / day	1-5cs	46	22.4
	6-10cs	40	19.5
	11>	18	8.8
Duration of smoking / years	1≤- 2Yrs	70	34.1
	3-4Yrs	18	8.8
	5-6Yrs	14	6.8
	7-8Yrs	5.0	2.4
Exercises	Daily	44	21.5
	Weekly	39	19.0
	Rare	122	59.5
Consuming meat	Daily	44	21.5
	Weekly	105	51.2
	Rare	56	27.3

Cigarette= cs, Yrs. =Years, YR= Yemeni Rial

There were no significant association($P<0.05$) between smoking and the age, sex, social status, residence and meat consuming characteristics of participants; while observed with Qat-chewing, income and exercises factors as depicted in Table 2.

Table 2. Association between sociodemographic characteristics of participated students and smoking

Characteristic		Smokers		Non-Smokers		P value
		No	%	No.	%	0.203
Age	19≤-20	34	32.7	32	31.7	
	21-22	44	42.3	49	48.5	
	23-24	17	16.3	18	17.8	
	25-26	4	3.8	1	1.0	
	27-28	2	1.9	1	1.0	
	29-30	3	2.9	0	0.0	

Sex	Male	90	86.5	87	86.1	0.547
	Female	14	13.5	14	13.9	
Social status	Sigle	87	83.7	90	89.1	0.258
	Maried	17	16.3	11	10.9	
Residence	Rural	36	34.6	32	31.7	0.383
	Urban	68	65.4	69	68.3	
Qatchew	Yes	104	100.0	85	84.2	0.000
	No	0	0.0	16	15.8	
Income	<5000-10000YR	71	68.3	67	66.3	0.001
	11000-15000	14	13.5	12	11.9	
	16000 >	19	18.3	22	21.8	
Exercises	Daily	15	14.4	29	28.7	0.01
	Weekly	17	16.3	22	21.8	
	Rare	72	69.2	50	49.5	
Consuming meat	Daily	25	24.0	19	18.8	0.213
	Weekly	56	53.8	49	48.5	
	Rare	23	22.1	33	32.7	

The Means ± SD of Anthropometric measurements, duration and intensity of smoking of participants are presented in Table 3. As shown, the Anthropometric measurements means of smoker's students were higher ($P<0.05$) compared to nonsmoker's students with exception, the weight and BMI values which were low.

3.2. Effect of smoking on blood lipid profiles of participated students

The effect of smoking on blood lipid profiles of participated students are presented in Table 4. As shown, the results revealed that there were significant differences ($P<0.05$) between smokers and non-smokers serum lipid profile values of students subjected to investigation. Smokers had higher levels of TC (164.93mg/dl), TG (149.63 mg/dl), LDL (71.60 mg/dl) and VLDL (29.58 mg/dl) and lower level of HDL (64.70mg/dl) compared to the non-smokers group. The mean values of TC, TG, HDL, LDL and VLDL in nonsmokers were 153.96, 111.52, 66.17, 65.61 and 23.41 mg/dl respectively.

Table 4. Effect of smoking on blood lipid profiles of participated students (Mean ± SD)

Table 3. Means ± SD of anthropometric measurements, duration and intensity of smoking of participated students

Variable	Smokers Mean ±SD	Non-Smokers Mean ±SD	P value
Systolic BP (mmHg)	117.88 ± 1.68	118.13 ± 1.53	0.916
Diastolic BP(mmHg)	72.35 ± 1.21	71.49 ± 1.27	0.621
High (cm)	166.03 ± 0.81	164.00 ± 0.92	0.105
Weight (kg)	59.91 ± 1.02	55.11 ± 0.79	0.004
Pulse (beats /min)	91.17 ± 1.47	87.33 ± 1.36	0.063
BMI (kg/m^2)	21.48 ± 0.38	20.69 ± 0.39	0.141
Number of Cigarettes	8.14 ± 0.67	0.00 ± 0.00	0.000
Duration of smoking	2.63 ± 0.20	0.00 ± 0.00	0.000

Variable	Smokers	Non-Smokers	P value
TC mg/dl	164.93 ± 36.95	153.96 ± 31.30	0.023

TG mg/dl	149.63 ± 46.50	111.52 ± 34.86	0.000
HDL mg/dl	64.70 ± 19.31	66.17 ± 14.54	0.357
LDL mg/dl	71.60 ± 32.26	65.61 ± 30.90	0.176
VLDLmg/dl	29.58 ± 9.11	23.41 ± 10.85	0.000

3.2. Correlation between lipid profile of participated students and number of cigarette & duration

Table 5. Correlation coefficient between number of cigarettes, duration and lipid profile of participated students

Lipid Profile	Number of cigarettes		Duration of smoking	
	(r)	*P value*	(r)	*P value*
TG mg/dl	.300**	.000	.317**	.000
TC mg/dl	.012	.886	.115	.101
HDL mg/dl	-.134	.055	-.062	.376
LDL mg/dl	.031	.664	.064	.360
VLDL mg/dl	.210**	.003	.213**	.002

Pearson's correlation coefficient(r),* P < 0.05, ** P < 0.01

The results of correlation between number of cigarettes per day and onset or duration of smoking demonstrated that, lipid profile values of participants were positively correlated with duration and number of cigarettes smoked per day (r = .300; P = .000 and r = .317; P=.000) and (r = .210; P = .003 and r = .213; P=.002) for TC and VLDL respectively; while none with other lipid profile values of participants as presented in Table 5.

3.3. The correlation of anthropometric measurements with lipid profile of participants

The association between anthropometric measurements and blood lipid profile of the participants such as height, weight, heartbeat, systolic, diastolic and body mass index (BMI) are presented in Table 6. As shown,

Table 6. Correlation coefficient between anthropometric indices and blood lipid profile of participated students

Measurement	TC		TG		HDL		LDL		VLDL	
	r	*P*	r	*P*	r	*P*	r	*P*	r	*P*
Height (kg)	-.098	.170	-.096	.163	-.070	.322	-.054	.441	.060	.000
Weight (Cm)	.022	.635	.234**	.001	.051	.446	.031	.848	.145*	.000
Pulse (beat /mint)	.205**	.003	.111	.112	-.116	.098	.256**	.000	.093	.184
Systolic BP(mmHg)	.033	.527	.111	.643	0.066	.346	.050	.479	-038	.263
Diastolic BP (mmHg)	.068	.332	.002	.982	.151*	.030	.019	.790	-.038	.593
BMI (kg / m^2)	.155*	.027	.089	.202	-.006	.931	.048	.498	.095	.175

Pearson's correlation coefficient(r), * P < 0.05, ** P < 0.01 1)

Significant association was observed between weight (r = .234; P =.001 and r =.145; P= .000); heartbeat (r = .205; P=.003 and r =.256; P =.000); diastolic (r =. 151; P =.030) and BMI (r = .155; P =.027) indices and blood lipid profile (TG and VLDL); (TC and LDL); (HDL and TC) respectively of the participants; whereas, none with height and systolic indices.

4. DISCUSSIONS

Smoking with its increasing prevalence is a common public health problem in developed and developing countries and a major contributing factor to the development of many diseases. A cross sectional study was performed to evaluate the changes of the serum lipid profile in apparently healthy smoker and non-smoker students and associated risk factors at the University of AlHikma Dhamar city, Yemen.

In this, study socio-demographic of participated students such as age, sex, social status, residence, Qatchew, income, exercises, consuming meat were investigated in relation to smoking. The results of this study are partially or completely in agreement with previous studies carried out in Yemen [5]; in Saudi Arabia [6]; in China [18, 20]; in Yemen[21]; in USA [22]; in Brazil [23]; in Ethiopia [24]; in Turkey[25, 26]; in Nigeria [27]; in Ethiopia [28] and in Bosnia [29] who studied similar or more socio-demographic characteristics of smokers and nonsmokers in their studies. The reasons behind consistent or contrary between the results of current study and findings of above workers may attributed to behavior, culture, lifestyle or prestige among the investigated subjects in different regions. In this study, Khat (Qatchewing), results revealed that there were significant differences between Qat chewing and smoking, these results are in line with findings of Al-Zubairi et al. [21] who found significant association($P<0.05$) between smoking and Qat-chewing through alter the Plasma triglycerides, total cholesterol, and LDL values. This association can be explained as the amphetamine-like sympathomimetic effects of cathinone, which favors lipolysis mediated through stimulation of adrenergic receptors of smokers [30].

The results of current study displayed that smoking is influencing adversely on blood lipid profiles of participated students and significant differences($P<0.05$) were observed between smokers and non-smokers in the mean values of total cholesterol (TC), triglycerides(TG), High density lipoprotein HDL, Low density lipoprotein (LDL) and low-density lipoproteins (VLDL) of participants. These results are in consistent with findings of previously studies in different countries of the world [1, 6, 7, 14, 27, 28, 31, 32, 33, 34]. The probable explanation for this alteration on lipid profile of smoker might be related to the effect of nicotine. Nicotine stimulates sympathetic nerve activity leading to enhanced release of catecholamine from adrenal medulla, which in turn causes increased rate of lipolysis. This effect results in raised plasma concentration of free fatty acid, triglyceride and increased hepatic production of endogenous VLDL [27, 33, 35, 36]. In addition, Muscut et al. [36] proposed the physiological change in appetite in smokers resulting in difference in dietary intake between smokers and nonsmokers is also responsible. Moreover, Mehta and Salat [14] suggested, fall in oestrogen levels occurs due to smoking, which further leads to decreased HDL; Presence of hyperinsulinaemia in smokers leads to increased cholesterol, LDL and TG due to decreased activity of lipoprotein lipase.

The association between anthropometric indices and blood lipid profile of participated students also were investigated. The results of Pearson ‘s correlation coefficient analysis revealed that, height, weight, heartbeat, and diastolic and BMI were correlated positively with VLDL, TG&VLDL, TG&LDL, HDL and TC respectively. These results are in agreement with finding of Gossett et al. [22]; Fisberg et al. [37]; Freitas et al. [38] and Gebreegziabiher et al. [28]; whereas, no correlation was found with Systolic biomarker indices. These results are in contrast with findings of Jung et al. [32]. The consistent and contrary in the results of anthropometric indices and lipid profile of participated students may be attributed to diet, genetic variability and physiological factors.

The results of the effect of duration and numbers of cigarette smoked are presented in Table 5. Results demonstrated that blood lipid values positively correlated with smoking (r=.300; P=.000 and r.317; P.000) and (r=.210; P=.003 and .213; P.002) for TC and VLDL values respectively; while, none with TG, HDL, LDL values of participants. Similar studies conducted by Gossett et al. [22] and Chandala and Kilim [39] showed that smoking alters the lipid profile adversely causing dyslipidemia in smokers and the change becomes more marked with the number of cigarettes smoked and duration of smoking. This could be explained by longer smoking duration means fewer calories are being burned, which might lead to storage of calories in the form of lipids.

CONCLUSION

It could be concluded from this study that smoking induces alteration in serum lipid levels of participated students in AlHikma University and other education establishments. These results may be helpful in developing preventive legislative laws for prohibit smoking among the University and college`s students.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee in AlHikma University, Dhamar, Yemen and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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