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EARLY DETECTION OF MODIFIABLE CARDIOVASCULAR RISK FACTORS AMONG HIGH SECONDARY SCHOOL STUDENTS IN BAGHDAD/AL-RUSAFA 2019

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ABSTRACT

Objectives: The aim of the study is to estimate the prevalence of modifiable cardiovascular disease risk factors (smoking, unhealthy diet, physical inactivity, overweight/obesity, high blood pressure and high blood sugar), their co-occurrence patterns and underlying determinants among high secondary school students aged 15- 17 years. **Methods:** We developed a questionnaire to gather basic and clinical data, along with anthropometric, blood pressure and fasting blood glucose measurements. In addition to descriptive statistics, chi-square and fisher's exact test were performed alternatively to determine the association between modifiable risk factors and demographic characteristics. **Results:** 870 students were included in the study. The most common modifiable cardiovascular disease risk factors were low fruit and vegetable intake (90.6%), physical inactivity (90.5%) and overweight/obesity (37.4%). Among the participants, 47.9% and 40.8% had 2 and ≥3 risk factors respectively. The most common co- occurrence pattern was low fruit/vegetable intake with physical inactivity (49.5%). Older age, male gender and positive family history of cardiovascular disease were significantly associated with increased number of cardiovascular disease risk factors ($p<0.05$). **Conclusions:** The prevalence of most of the studied modifiable cardiovascular risk factors was high and most of the participants had at least two risk factors. Reinforcement of comprehensive school-based program targeting modifiable cardiovascular risk factors is recommended to reduce future cardiovascular disease associated morbidity and mortality.

KEYWORDS: Cardiovascular disease; Modifiable; Risk factors.

INTRODUCTION

Cardiovascular Diseases (CVDs) represent the leading cause of death around the world and the burden of these diseases fall principally on developing countries.[1] The rate of CVD associated deaths in the Middle East is one of the highest rates globally.[2] Although CVD usually appears clinically in the adult period, early atherosclerotic changes begins in childhood and adolescence.[3] Modifiable risk factors like smoking, obesity, physical inactivity, high blood pressure, high blood sugar, abnormal lipid profile and dietary habits are responsible for the majority of the cases of CVD[4]. Logically controlling the classic modifiable risk factors in an early age can significantly reduce the prevalence of adult CVD and it's related morbidity and mortality.[5]

The underlying determinants of global deaths due to CVD are estimated as: high blood pressure 13%, smoking 9%, high blood sugar 6%, physical inactivity 6% and overweight and obesity 5%.[6] In Iraq (2012) and according to Global School-based Health Survey (GSHS) among students aged 13-15 years, those who were currently smoking cigarettes constituted 8.7% and 53.5% usually drank carbonated soft drinks at least one time per day. Nearly 20% of the students were physically active and 25.6% had sitting activities more than 3 hours daily while 33.2% of them were overweight/obese.[7] In addition to this, there is a positive direct relationship between the severity of atherosclerosis and the number of cardiovascular risk factors even in children and adolescents.[8] Iraq is undergoing an epidemiological transition with increasing burden of chronic non-communicable diseases including CVD.[9] More than 50% of deaths are due to chronic Non-Communicable Diseases (NCDs) and CVD is number one among those causes according to national statistics in Iraq.[10] Also, people aged 15-19 years constituted 11% of the total population and 51% were below 20 years[11] which means that the country has a high childhood and adolescent percentage and early prevention programs will be very effective.

Schools are suitable places to make efficient prevention interventions, since they can reach huge numbers of young people through different ways as classroom curriculum, physical and sport education classes and school meals. However, sources are limited on high-school students.[12] This study aim is to develop a rational basis for school-based prevention programs of cardiovascular disease by estimation the prevalence of modifiable cardiovascular risk factors, determination of their co- occurrence patterns and possible underlying determinants.

MATERIALS AND METHODS

Study design and sample inclusion

A cross-sectional study with analytic elements was conducted among high secondary school students aged 15-17 years old belonging to the three educational directorates of Al-Rusafa side (twin of Al-Karkh side) of Baghdad from 1st of October to 31st of December 2019.

The sample size was calculated by using an equation ($n= z^2pq/ d^2$) used for sample proportions.[13] A multistage stratified random sampling method was used. The first stage included all the three directorates of Al-Rusafa side to make the sample representative. In the second stage, simple random sampling among male and female schools strata was applied, two schools for boys and two schools for girls were selected from each directorate. In the third stage, also a simple random sampling was done among students in order to choose the required number from each school. The researcher asked the participants to answer a self-administered questionnaire, did physical examination (blood pressure, height and weight) and biochemical measurement (fasting blood glucose). All governmental high secondary school students belonging to the three educational Rusafa side directorates who themselves and their caregivers signed an informed consent in order to participate were included in the study. On the other hand, the study excluded any student who had a history of any chronic disease, had incomplete records and/or physical, biochemical measurements.

Questionnaire

The questionnaire included socio-demographic information; age, sex, family history of hypertension, diabetes and CVD in first degree relatives, socioeconomic index calculated by the researcher through application of a special equation and the total score was then divided into three equal numerical parts (high, middle and low socioeconomic status).[14] According to Global School-based Health Survey (GSHS) core questionnaire modules and core-expanded questions[15], tobacco use, dietary behavior and physical activity were assessed by a number of questions.

Translation and the data collection

The socioeconomic part of the questionnaire was translated into Arabic using a process of forward and backward translation. The whole questionnaire was pre-tested through choosing a sample of 20 students which were then excluded from the study.

The researcher collected the data through a self-administered questionnaire in about 15-20 minutes.

Physical measurements

Physical measurements were taken for all the participants; blood pressure and anthropometric measurements (height, body weight and Body Mass Index; BMI)

Biochemical measurements

Fasting Blood Glucose (FBG) was measured for all the participants using a standard calibrated portable blood glucose measuring device. The blood sample was taken at early morning of a school day after overnight fasting for at least 8 hours.

Modifiable risk factors definition

-Smoking: current tobacco user (using any tobacco product on one or more days during the past 30 days at the time of data collection).[16]

-Dietary behavior: eating less than 5 portions of fruits and vegetables daily.[17]

-Physical activity: not accumulated at least 60 minutes of moderate to vigorous intensity physical activity daily for the past 7 days.[18]

-BMI: Overweight/Obesity was defined as BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median.[19]

-Blood pressure: Elevated blood pressure (Prehypertension)/Hyperension was defined as having blood pressure ≥120/≥80 mm Hg.[20]

-Fasting blood glucose: Prediabetes/Diabetes was defined as fasting blood glucose ≥100 mg/dl.[21]

Statistical analysis

The description for each variable was made on the Statistical Package for Social Sciences (SPSS) version 23. The number of risk factors ranged from 0 to 6 and were presented for the following categories: none, one, two and three or more risk factors, suggesting increased future risk for CVD. Co-occurrence patterns of CVD risk factors were presented for participants who had more than one risk factor.

Descriptive statistics was done for all the variables. Chi-square test and fisher's exact test of significance were performed alternatively to determine the association between the study variables. P-value equal or less than 0.05 was considered significant.

RESULTS

A total of 870 students were included in the study. In **Table 1,** the demographic characteristics of the participants were shown. More than 39% of them belonged to middle socioeconomic status. Regarding family history, more than one- half had family history of hypertension, less than one-half had family history of diabetes and nearly one-forth had family history of CVD.

Table 1: Demographic characteristics of the participants(n=870)

	Frequency	Percent(%)
Age		
15	290	33.3
16	291	33.4
17	289	33.2
Gender		
Male	435	50
Female	435	50
Socioeconomic status		
High	272	31.3
Middle	342	39.3
Low	256	29.4
Family history		
HT	486	55.9
DM	383	44
CVD	203	23.3

The study's first objective was to estimate the prevalence of the modifiable CVD risk factors. The most common risk factor found was low fruit and vegetable intake, followed by physical inactivity, exceeding 90% for each, overweight/obesity (37.4%) and the least common risk factor was high FBG (prediabetes/diabetes) among nearly one-tenth of the participants **(Figure 1)**.

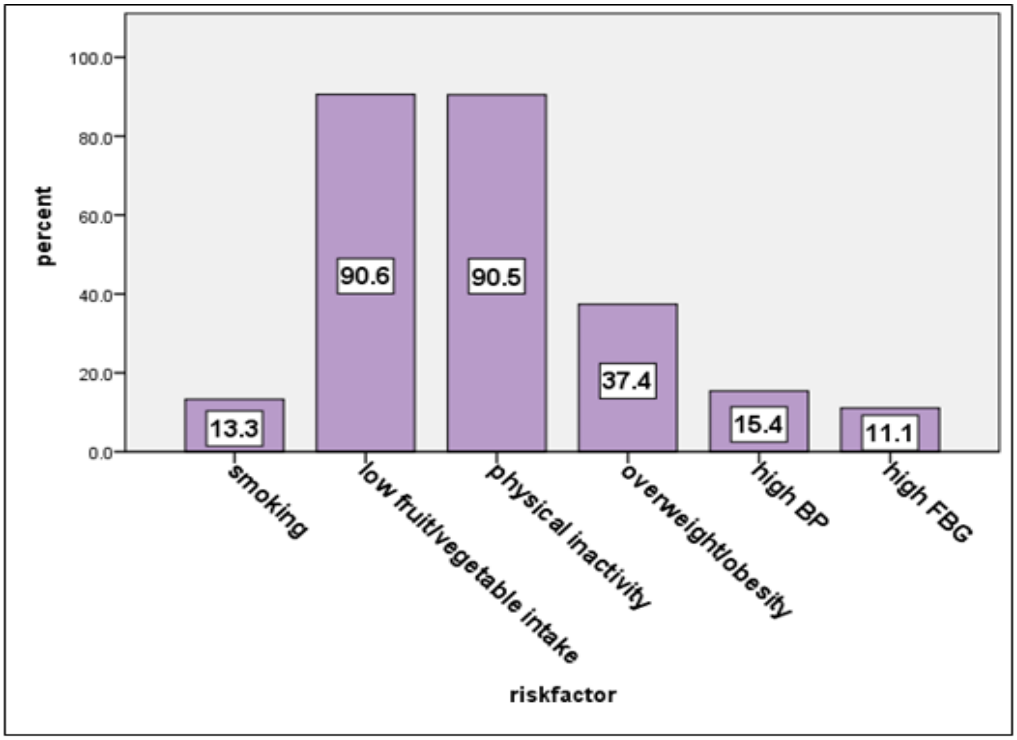

Figure 1: Distribution of participants according to modifiable CVD risk factors.

Estimating the number and co-occurrence patterns of modifiable CVD risk factors was the second objective. About the number (No.) of risk factors, only 4 participants (0.5%) had no risk factor while more than 40% had 3 or more risk factors suggesting increased future risk for CVD **(Figure 2).** Regarding participants who had more than one risk factor, the most common co-occurrence pattern for CVD risk factors was (low fruit/vegetable intake +physical inactivity) which was detected among one-half of the participants (**Table 2).**

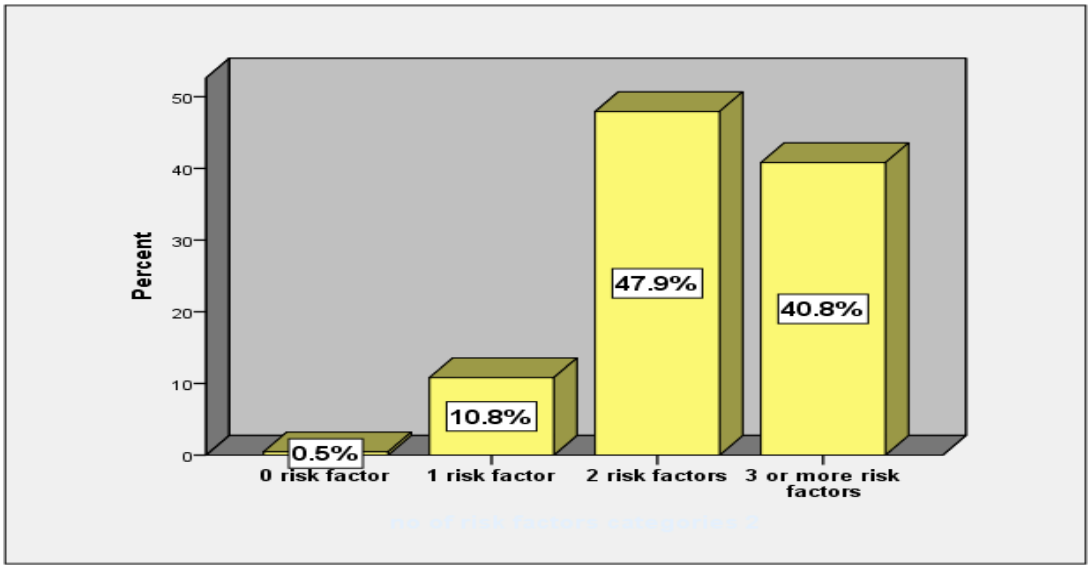

Figure 2: Distribution of participants according to No. of risk factors.

Table 2: Most common CVD risk factors co-occurrence patterns (n=772)		
	Frequency	**Percent(%)**
Low fruit/vegetable intake+physical inactivity	382	49.5
Low fruit/vegetable intake+physical inactivity+obesity	93	12
Low fruit/vegetable intake+physical inactivity+obesity+high blood sugar	64	8.3
Low fruit/vegetable intake+physical inactivity+obesity+high blood pressure	57	7.4

Table 3 and **Table 4** show the relationship between modifiable CVD risk factors and their number with demographic characteristics of the participants using chi- square/fisher's exact tests and by which it matches the third objective in this study. Older age was significantly associated with current tobacco use, less than recommended daily fruit/vegetable intake, physical inactivity and increased number of risk factors each participant had. Male gender was significantly associated with current tobacco use, physical activity, high blood pressure, high blood sugar and increased number of risk factors. Higher socioeconomic status was significantly associated with overweight/obesity. Positive family history of hypertension, diabetes and CVD was significantly associated with high blood pressure, high blood sugar and increased number of risk factors respectively.

Table 3: Relationship between behavioral modifiable risk factors and demographic characteristics (n=870)								
	Current tobacco use		<recommended daily fruit/vegetable intake		Physical inactivity		Overweight/ obesity	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Age								
15	22*	19	247*	31.3	256*	32.5	116	35.7
16	31	26.7	279	35.4	259	32.9	99	30.5
17	63	54.3	262	33.2	272	34.6	110	33.8
Gender								
Male	91*	78.4	402	51	381*	48.4	221*	68
Female	25	21.6	386	49	406	51.6	104	32
SES								
High	35	30.2	247	31.3	245	31.1	115*	35.4
Middle	56	48.3	305	38.7	306	38.9	127	39.1
Low	25	21.6	236	29.9	236	30	83	25.5
*P value <0.05								

Table 4: Relationship between high blood pressure, high blood sugar, number of risk factors and demographic characteristics

	High blood pressure		High blood sugar		≥3 risk factors	
	n	%	n	%	n	%
Age						
15	31	23.1	26	26.8	103*	29
16	51	38.1	29	29.9	110	31
17	52	38.8	42	43.3	142	40
Gender						
Male	82*	61.2	61*	62.9	228*	64.2
Female	52	38.8	36	37.1	127	35.8
SES						
High	38	28.4	39	40.2	118	33.2
Middle	59	44	33	34	138	38.9
Low	37	27.6	25	25.8	99	27.9
Family history						
HT	100*	74.6				
DM			62*	63.9		
CVD					104*	29.3

*P value <0.05

DISCUSSION

The current study showed higher prevalence of low daily fruit/vegetable intake, physical inactivity and overweight obesity than other similar studies. In Emirates (2018), 28% of the participants had recommended daily fruit and vegetable intake.[22] In another study conducted among adolescents in Lebanon (2017) at the American University of Beirut, half of the participants were physically inactive.[23] The prevalence of overweight obesity in Mosul-Iraq (2016) was 25.4%.[24] This may bedue to loss of access at school canteen regarding healthy dietary choices and also poor practicing of physical activity inside and outside the school. On the other hand, the result was agreed with many other studies regarding smoking, high blood pressure and high blood sugar. Those who were currently using any tobacco products in Morocco (2016) were 12.5%.[25] Among United States adolescents during 1999-2008 period, 14% had high blood pressure (prehypertension/hypertension).[26] In another study among American adolescents (2009), 10.6% of those aged 16-19 years had impaired fasting glucose.[27]

In the current study, 0.5%, 10.8%, 47.9% and 40.8% had 0,1,2 and ≥3 risk factors respectively. This was higher than a result of a study done among adolescents from 52 low and middle income countries which showed that the pooled prevalence of 3 or more CVD risk factors was ranging from 3.8% in the Southeast Asian region to 18.6% in the Western Pacific region.[28] The most common co-occurrence patterns of CVD risk factors

for participants who had more than one risk factor were (low fruit/vegetable intake+ physical inactivity) followed by (low fruit/vegetable intake+ physical inactivity+ overweight/obesity). According to Brazilian study (2014), it was found that (unhealthy diet and physical inactivity) was the most prevalent combination.[29]

Regarding the relationship with demographic characteristics, it was found that older age was significantly associated with current tobacco use, less than recommended daily fruit/vegetable intake, physical inactivity and increased number of risk factors. This result agreed with the results conducted in Iraq (2011)[30], Canada (2007)[31], Lebanon (2017).[23] Male gender was significantly associated with current tobacco use, physical activity, overweight/obesity, high blood pressure, high blood sugar and increased number of risk factors. Several studies.[32,33,34,27,35] conducted showed that males had higher prevalence of individual and multiple risk factor(s). In Slemani city in Iraq (2014), overweight/obesity was significantly associated with higher monthly family income and a higher educational level of the parents[36] which agreed with this study result. Positive family history of hypertension, diabetes and CVD was significantly associated with high blood pressure, high blood sugar and increased number of risk factors as in the studies conducted in Egypt (2011)[37], Qatar (2014)[38] and Brazil (2018)[39] respectively.

Strengths and limitations

One important strength of this study was the limited studies conducted on cardiovascular disease risk factors in this important age group in Iraq. Another one is that using blood pressure and fasting blood glucose measurements in a school-based study.

A main limitation in this study was recall bias regarding behavioral risk factors. Another limitation was the selection bias due to the school-based nature of the current study which may affect generalizability of the results to all adolescents of the same age group.

CONCLUSION

The principal finding was that the prevalence of most of the studied modifiable CVD risk factors was high in comparison with similar studies in the region and other parts of the world. For participants who had more than one risk factor, the most common co-occurrence pattern for CVD risk factors was (low fruit/vegetable intake +physical inactivity). The majority of the participants had at least two risk factors. Older age, male gender and positive family history of cardiovascular disease were significantly associated with increasing number of

risk factors each participant had.

Recommendations

Reinforcement of comprehensive school-based health literacy promotion program for modifiable CVD risk factors is recommended. Conducting multiple preventive activities in order to attain a better lifestyle was advised. Those may include enhancement of tobacco control activities and tobacco free schools initiative, encouraging of school canteens and nearby shops for offering fresh fruits and vegetables and healthy food items, increasing physical exercise sessions and competitive sports' activities at schools, strengthening school screening services for anthropometric measurements and introduction of blood pressure measurements. Further prospective study is required in order to determine the scope and fate of this problem in Iraq.

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