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Risk Factors for Cardiovascular Diseases among School Teachers in Benghazi, Libya

Azza SH Greiw*¹, Zahira Gad², Ahmed Mandil², Mervat Wagdi³, Ali Elneihoum⁴

¹Department of Family & Community Medicine, Faculty of Medicine, Gar-Younis University, Libya

²Department of Epidemiology, High Institute of Public Health (HIPH), University of Alexandria, Egypt

³Department of Family Health, High Institute of Public Health (HIPH), University of Alexandria, Egypt

⁴Department of Medicine, Faculty of Medicine, Gar-Younis University, Libya

*Corresponding author: Azza S. H. Greiw Email: azza_sad@yahoo.com

Published: 01 July 2010

Ibnosina Journal of Medicine and Biomedical Sciences 2010, 2(4):168-177

Received: 03 December 2009

Accepted: 12 May 2010

This article is available from: <http://www.ijmbs.org>

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Abstract

Background: Cardiovascular diseases (CVD) are considered major health and economic burdens throughout the world. This study was conducted to estimate the magnitude of three major CVD (hypertension, ischemic heart diseases (IHD) and stroke), their risk factors, prevention and, control plan. **Methods:** The study design was cross-sectional. Multi-stage random sampling technique was used at different schools in Benghazi, Libya. A sample of 1200 teachers was randomly selected. Three formats were used for data collection. These included a self-administered questionnaire, a standardized Rose CVD interview questionnaire, as well as a special form for collecting data on the following: anthropometric measurements, blood pressure, clinical examination, as well as results of laboratory findings, and ECG tracings. **Results:** The prevalence of hypertension and IHD were 15.1% and 2.7% respectively while no cases of stroke could be detected in the study-sample. The selected CVD were found to be independently predicted by age, gender, family history of hypertension, BMI, smoking index,

fasting blood sugar level, and HDL (CI 95%). **Conclusion:** Risk factors for hypertension & IHD among schoolteachers in Benghazi, Libya included age, BMI, fasting blood sugar, gender, smoking index, HDL, & family history of hypertension. There is thus an urgent need for intensive health education interventions for this group. There is also a need to initiate an implementation of a national program for CVD risk factors assessment, as well as promotion of an overall healthy lifestyle for school teachers through the use of health education which should be directed to smoking health related problems.

Keywords: Prevalence, hypertension, IHD, school teachers, Libya, and risk factors.

Introduction

Cardiovascular diseases are the leading causes of morbidity and mortality worldwide. By 2020, the estimated deaths due to CVD are expected to reach 25 million deaths worldwide (1). In developed countries, the epidemic

is leveling off at different levels (2-4). In developing countries, there is an escalating CVD epidemic, according to different stages of epidemiological transition. As CVD usually start affecting people in their mid-life, they result in undermining the socioeconomic development, not only of affected individuals but also that of families and nations. Lower socioeconomic groups generally have a greater prevalence of risk factors, diseases, and mortality in developed countries. A similar pattern is emerging as the CVD epidemic matures in developing countries (5,6). In the Eastern Mediterranean Region (EMR), especially in Arab countries, the morbidity and mortality burden of CVD and their related risk factors have not been thoroughly investigated. The objectives of this study were to estimate the magnitude of three major CVD (namely: hypertension, IHD and stroke) and their possible risk factors as well as to suggest a prevention and control plan for these diseases.

Materials and Methods

The survey was performed during the school year 2004-05. The study design was cross sectional. The target population comprised a total of 17,109 teachers distributed among different levels of education. Epi info 2000 program was used to calculate sample size taking into consideration the confidence limit of 95% and the minimal 5% estimated prevalence rate of risk factors of CVD. A sample size of 1167 teachers was calculated. To compensate for dropouts, a total sample of 1200 teachers in Benghazi, a city in Libya, were screened for CVD risk factors. Multi-stage stratified random procedure was used. Schools in all regions of Benghazi were stratified according to their stage and type of education into five groups: essential boys' school, essential mixed school, essential girls' school, intermediate boys' school, intermediate girls' school.

In the first stage, a sampling frame was constructed for schools in each stratum (Essential boys' schools=85, Essential girls' schools= 51, Essential mixed schools= 26, Intermediate boys' schools= 31, and Intermediate girls' schools=35) then selection of schools from this frame using simple random technique. The sample size of schools was 30 schools (Essential boys' schools= 11, Essential girls' schools= 7, Essential mixed schools=3, Intermediate boys' schools= 4, intermediate girls' schools= 5). In the second stage sampling, simple random technique was used to select equal number of male and female teachers in each stage. Only thirty-four teachers (2.8%) refused to participate. All of them expressed fear and apprehension about being screened. A comparable number selected at random from the following school replaced such teachers.

The investigator had to carry out necessary preparatory administrative communication with key personnel needed to facilitate implementation of the study. An official letter was addressed to the Secretary of Education, Benghazi, to obtain the required information regarding a list of schools, level, type, total number of and gender of teachers in each school. An official letter directed from the General Secretary of Education to directors of selected schools was sent asking them to cooperate with the investigator. Consent from each participant was obtained. Ministry of Higher Education funded the project in full.

Laboratory testing was performed at the 7th October Hospital laboratories. Different formats were used for collection of data for study purposes. A self – administered questionnaire was used to inquire about personal data, data related to risk factors for CVD such as: smoking, dietary habits, physical activity, medical history of participants and his/ her family and menstrual history (female teachers). The translated Arabic version of the modified Jenkins Activity Survey (JAS) (7) was used for quantitative assessment of behavior pattern. The Rose questionnaire (RQ) is a standardized method of measuring angina and myocardial infarction in population surveys. It defines angina as chest pain that limits exertion, is situated over the sternum or in the left chest and left arm, and is relieved within ten minutes by rest. The RQ has been widely used in its original and modified forms and in translation to study the prevalence and natural history of ischemic heart disease, response to interventions, and to compare populations. Validation studies have generally reported high specificity (80 – 95%) but variable sensitivity (19–83%) (8). The investigator administered the questionnaire herself.

In addition, a special form was used for recording anthropometric measurements and clinical data such as: waist / hip ratio, weight, height circumferences in addition to heart rate and blood pressure. Also, it was used for recording results of laboratory tests such as fasting serum glucose (FBS), total serum cholesterol, triglyceride level, HDL cholesterol, LDL cholesterol, serum uric acid, serum creatinine, serum urea, and ECG findings.

Statistical Analysis

Analysis was done using SPSS (Chicago, USA). Analysis included the following: Descriptive and bivariate analysis, Cross tabulation of different qualitative characteristics and risk factors by sex, Cross tabulation of different qualitative characteristics and risk factors by disease status (with CVD or without CVD), Computation of mean and standard deviation of different

quantitative variables by disease status (with CVD or without CVD). Comparison between teachers with and without CVD regarding different risk factors was done using the appropriate test of significance (t test, Pearson's χ^2 , at 95 % level of confidence.

Multivariate Analysis: Bivariate analysis provides information on ways in which different variables are related to the dependent variable response. However, multivariate analysis provides information on how these variables interact with one another, allowing the determination of which of the many potential predictors actually affects the dependent variables. It also includes the assessment of the overall contribution of various factors that are mutually present. The Logistic Regression Analysis, stepwise method was used where the dependent variable was either teachers with CVD or teachers without CVD. The procedure began by selecting a group of variables that were statistically associated significantly with the disease state by the bivariate analysis. The first variable was selected for regression model, then coupled with the next variable, and so on. The procedure continued until all variables were selected or no additional variables provided an improvement in the model. Ischemic heart disease (IHD) has been defined by the World Health Organization (WHO) as "impairment of heart function due to inadequate blood flow to the heart compared to its needs, caused by obstructive changes in the coronary circulation to the heart." It is also commonly known as coronary heart disease (CHD) or coronary artery disease (CAD). Ischemic heart disease is related mainly to atherosclerosis of the coronary arteries. The confirmation was based on clinical diagnosis as an ECG was done for the participants. The standard WHO stroke definition is that it is a focal (or at times global) neurological impairment of sudden onset, lasting more than 24 hours (or leading to death), and of presumed vascular origin. This clinical definition is similar: a neurological impairment or deficit of sudden onset, lasting more than 24 hours (or leading to death), and of presumed vascular origin. The WHO standard definition excludes: Transient Ischemic Attack (TIA), defined as focal neurological symptoms but lasting < 24 hours, subdural hemorrhage, epidural hemorrhage, poisoning, and symptoms caused by trauma. "Global" refers to patients with subarachnoid hemorrhage or deep coma, but excludes coma of systemic vascular origin such as shock, Stokes-Adams syndrome, and hypertensive encephalopathy. Stroke is a clinical diagnosis and not based on radiological findings.

$$\text{Smoking Index (SI)} = \frac{\text{No of cigarettes}}{\text{day} \times \text{years of regular smoking}} \times 365$$

1000

Some of smokers in the study were water pipe smokers. They were transformed into cigarette smokers. The weight of a packet of used material is 24 g. containing 7 gram of tobacco. The weight of one cigarette is 1 gram, thus one pack of this material is equal to 7 cigarettes. In cigarette smoking, there is a washed amount of tobacco equal to one cigarette every 7 cigarettes, thus one packet of this material is equal to 8 cigarettes (9).

Results

The study sample included 1200 teachers (response rate 97.2%). Their ages ranged from 23-61 years, with a mean of 36.96 ± 8.63 years, with an equal proportion of males and females. The ever-married teachers were 52.1%. Teachers having an intermediate graduation constituted 41.6%. However, more than half of the sample (56.9%) held a university degree, and a minority (1.5%) obtained a postgraduate degree. It is evident from the table that less than half (44.1%) were working for < 9 years. Less than one fifth of teachers (17.2%) worked for 20 to < 30 years, and 9.2% of them worked for ≥ 30 years. With regard to total working hours/week, less than two fifth of the teachers (39.7%) worked 10-19 hours per week. Nearly similar proportions (16.6% & 13.3%) of teachers were working for 20-29 hours & 30-39 hours per week respectively. A minority (5.2%) worked 40 hours or more (Table 1). There was no missing information about these variables in Table 1.

Table 2 presents the prevalence of different types of cardiovascular diseases among the teachers evaluated. In this study, it was found that 181 (15.1%) of the teachers had hypertension, 63 (5.2%) had angina. Among angina cases, 4.3% & 0.9% had definite angina and possible angina respectively, according to criteria of the Rose Angina Questionnaire. The relevance of ischemic heart disease was noticed among 2.7% of teachers while no cases of stroke were detected among the sample.

Table 3 presents the history of current smoking. The proportions of males who were present smokers and ex-smokers were nearly equal (27.5% and 26.8% respectively). Less than half (45.7%) were non-smokers.

With respect to age at time of initiation of smoking, it ranged from 10- 35 years with a mean of 19.39 ± 4.49 years. The duration of smoking ranged from 1-44 years with a mean of 20 ± 9.58 years. The number of cigarettes smoked/day ranged from 1-120, with a mean of 22.14 ± 15.31 cigarettes/day. The smoking index ranged from 0.37- 540.2 with a mean of 162.1 ± 110.53 cigarettes (Table 4).

Using the Logistic Regression Analysis, it was found that

Table 1. Personal characteristics of the school teachers, Benghazi, Libya		
Personal characteristics	%	N=1200
<u>Age in years</u>		
< 30 years	20.2	242
30 - 39	48.4	581
40 - 49	20.3	244
50 - 59	8.8	106
60 - 61	2.3	27
Mean± S.D (in years)	38.636.96 ±	
<u>Marital status</u>		
Single	47.9	575
Married	47.7	572
Divorced	3.2	39
Widowed	1.2	14
<u>Family size</u>		
Mean± S.D	7.51±3.31	
<u>Level of education</u>		
Intermediate	41.6	499
University	56.9	683
Postgraduate	1.5	18
<u>Years of experience</u>		
< 10 years	44.1	529
10-19	29.5	354
20-29	17.2	207
30 - 42	9.2	110
Mean± S.D (in years)	13.19±10.09	
<u>Total working hours (per week)</u>		
< 10 hours	25.2	
10-19	39.7	
20-29	16.6	
30-39	13.3	
40 - 49	5.2	
Mean± S.D (in hours)	17.42± 11.12	

age, gender, family history of hypertension, BMI, smoking index, fasting blood sugar level, and HDL were significantly and independently associated with the occurrence of CVD (Table 5).

Teachers with CVD were referred to physicians for management and follow up. Referrals also included a health educator for proper disease prevention education. No information was collected about aspirin use (or other

drugs in general). Information regarding diet was asked regarding the foods eaten daily, weekly, or monthly, and there was no significant difference between the two groups.

Discussion

Teachers comprise a large and growing segment of the workforce in many countries. Schoolteachers and other school personnel may be exposed to a wide variety of

Table 2. Prevalence of cardiovascular diseases among the studied teachers, Benghazi-Libya

Type of cardiovascular disease	No=1200	%
Hypertension	181	15.1
Angina:	63	5.2
Definite angina	52	4.3
Possible angina	11	0.9
Ischemic heart disease	32	2.7

Table 3. Smoking history of males with cardiovascular diseases, Benghazi-- Libya

History of smoking	No	%
Never smoked	65	45.7
Smoker	39	27.5
Ex smoker	38	26.8
Total	142	100.0

Table 4. Selected tobacco consumption indices smoking among male teachers with cardiovascular diseases, Benghazi, Libya

Variable	male smokers with cardiovascular diseases (Mean ± S.D)
Age of starting regular smoking (in years)	19.39± 4.49
Duration of smoking (in years)	20.0± 9.58
Number of cigarettes / day	22.14±15.31
Smoking index (in cigarettes / year)	162.10± 110.53

Table 5. Distribution of male teachers with and without cardiovascular diseases according to history of active smoking, Benghazi -2005

History of smoking	Teachers with CVD		Teachers without CVD		Test
	N=142	%	N=458	%	
Ever smoked	77	54.2	206	45.0	OR=1.45 CI=1.10- 2.12
Never smoked	65	45.8	252	55.0	

Table 6. Mean and standard deviation of; age of starting smoking, duration of smoking and number of cigar cigarettes smoked per day among male teachers with and without cardiovascular diseases, Benghazi -2005.

Variable ± SD	Teachers with CVD	Teachers without CVD	T test	P value
Duration of smoking in years	20 ±9.58	13.03±7.69	6.33	< 0.001
Number of cigarettes/day	22.14±15.31	17.18±12.28	2.82	0.05
Age of start smoking in years	19.39±4.49	19.08±3.64	0.6	0.55
Smoking Index	162.1±110.53	84.31±74.63	6.79	< 0.001

recognized physical, chemical, biological, and other occupational hazards. In fact, teaching is an occupation that is often characterized by a high degree of stress, absenteeism, and burnout. There are many sources of teacher stress, which may vary with grade level. They include administrative and curriculum concerns, career advancement, student motivation, work overload due to large class size, intensive verbal communication, and prolonged standing. Faced with severe time constraints, teachers are often overwhelmed by the multiplicity of tasks on hand, role conflict, and job security. Stress may

also arise from dealing with children's misbehaviors in addition to physical or environmental hazards such as noise. Moreover, the fact that the majority of teachers are women raises the question of how the dual role of full time employment together with being a home maker may affect women's health.

Only thirty-four teachers (2.8%) refused to participate as mentioned previously. They were replaced by a comparable number selected at random from the following school.

In Libya, the urban populations represent 85% of the total population according to the national figures. As the sample

Table 7. Independent predictors of cardiovascular diseases among school-teachers, Benghazi, Libya

†					
Reference category					
Independent predictors	B (SE)	Adjusted OR	95% CI		P-value
Age group (<40 †)					
≥ 40	1.698 (0.189)	5.464	3.775	7.909	0.000
BMI (<30 †)					
≥ 30	1.371 (0.197)	3.938	2.678	5.790	0.000
Fasting blood sugar (<120mg/dl †)					
≥ 120 mg/dl	0.896 (0.331)	2.449	1.281	4.683	0.007
Gender (Women †)					
Men	0.821 (0.229)	2.274	1.452	3.561	0.000
Smoking index (Non smokers †)					
Smoking index ≥ 85	0.756 (0.261)	2.129	1.277	3.550	0.004
HDL (≥ 35mg/dl †)					
<35mg/dl †	0.580 (0.194)	1.786	1.221	2.614	0.003
Family history of hypertension (Negative †)					
Positive	0.571 (0.184)	1.770	1.235	2.538	0.002
Constant					
	-3.901(0.332)	.020			
R²					
	0.362				

was representative of the working teachers in Benghazi, the results could reflect a profile of the urban population of Libya. That could be used to some extent comparatively with figures from other countries.

The follow up occurred during the collecting of data. This took six months for cases discovered to have any of the CVD mentioned previously. They were referred to the primary care physicians for management & follow up.

In this study, it was found that 15.1% of teachers in Benghazi had HBP, with an age range of 36.96 ± 8.63 years. Another Libyan study was conducted in the Tajoura area, which reported that the prevalence of HBP was 21.6%. Of that group, 89.3% were ages 20-59, and 10.3% were 60- 70 (10).

Another study of teachers in Alexandria revealed that 23.26 % were diagnosed as hypertensive (11). The older group in the Tajoura study could explain the difference in the prevalence of HBP, while the rather comparative age group in the Alexandria study yielded a higher HBP prevalence

compared to the current study (10,11).

In Tunisia, an epidemiological survey of a representative household sample was conducted of adults living in Sousse City (12). The prevalence of HBP was 28.8%, higher than the results of the present study. This higher prevalence was contributed to the adoption of new dietary habits, the lack of physical activity, and the stresses of working conditions in urban areas. Studies carried out by Gulf Cooperation Council (GCC) nations and Egypt, reported increased HBP prevalence compared to the present study, ranging from 25–32 %. This could be due to the wide age ranges in these studies, as they are primarily community based, including older sectors of the population and retired people (13-18). Overall population HBP prevalence has been shown to be higher in developing countries (i.e. China) compared to developed nations (i.e. Canada), even when including different age sectors of the population, as shown in two recent studies. Thus, in 2000-01, the Canadian cross-sectional data on health status and chronic conditions was

derived from the Canadian Community Health Survey (CCHS) Cycle (19,20).

According to the criteria of the Rose Angina Questionnaire, angina was prevalent among 5.2% of the teachers evaluated. This could be due to the younger age of the sample averaging 36.96 ± 8.63 years. Angina was more prevalent (12.12%) among schoolteachers in Alexandria (1992) (11). IHD was prevalent among 2.7% of schoolteachers studied, while in India it was estimated to be much higher in urban areas (8–10%) compared to rural areas (3–4%) during 2003 (21). This may be attributed to a higher prevalence of CVD risk factors among urban inhabitants, including: increased intake of energy-dense foods, low physical activity, and higher levels of psychosocial stress.

During the follow-up period of the present study, no stroke cases were reported, which could be attributed to the fact that the mean age of the sample was relatively young (36.96 ± 8.63 years). Stroke is usually more prevalent among older age groups as reported by the multi-country WHO/MONICA study, where 75 % of all reported strokes from 21 nations occurred after age 65 (22). Smoking is one of the strongest CVD predictors. In this study, female teachers were not reported to be smokers in Libya where smoking among females is generally not practiced nor socially acceptable. The estimated risk of having the selected CVD among male teachers who smoked was nearly one and half times more compared to non-smoking teachers (OR: 1.45, CI: 0.99-2.12). The results of the INTERHEART study, which was carried out during 2004 and which included more than 29,000 people in 52 countries, revealed that overall, current smoking was associated with a three-fold increased odds of non-fatal AMI (23).

The results revealed that there is a possible association between higher levels of BMI mean values and CVD occurrence. Similar trends of the escalating problem of obesity are noticed globally, which is usually correlated with increased risk of both CVD and the metabolic syndrome (24-26).

The present study showed that there was a significant association of lower levels of HDL and teachers having CVD. Multiple studies revealed the role of HDL as an antioxidant and anti-inflammatory agent in addition to its inhibiting effect for the process of atherogenesis (27-31).

The current study revealed that the mean FBS of teachers with CVD was significantly higher than teachers without CVD. The increased risk of CVD in type II diabetes is well recognized and is associated with both diabetes specific risk factors and increased frequency of conventional risk factors for CVD (32).

Established CVD risk factors that have consistently been demonstrated to be correlated between relatives include HTN and hypercholesterolemia. Because family history can be used to predict risk of future disease and to identify the subset of families that account for the majority of prevalent cases in the population, it is an excellent tool that combines population and high-risk approaches to disease prevention (33-35). Recommendations are to design and implement a national program for CVD risk factor assessment. Next, promote an overall healthy lifestyle for schoolteachers through the use of health education. This should be directed toward smoking cessation and identifying and managing other health related problems. Health education should include the importance of a balanced diet and the role of physical activity in cardio-respiratory fitness and healthy hearts. Furthermore, attention should be focused on the effect of work load, stress and the environment on teachers' health.

The importance of other sectors in the community in enforcing legislation to ban smoking in public places as is done in many cities in the West, as well as proper labeling of canned foods cannot be underestimated. Periodical medical check-ups for school teachers to detect CVD and its related risk factors should be done as early as possible. A community-based prospective study should be conducted to allow the estimation of the magnitude of the problem of major CVD, as well as risk assessment of different factors responsible for such diseases.

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