Archives of Medical Research 46 (2015) 233–239

Archives of Medical Research

ORIGINAL ARTICLE

Increased Cardiovascular Risk Using Atherogenic Index Measurement Among Healthcare Workers

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Received for publication October 17, 2013; accepted March 9, 2015 (ARCMED-D-14-00583).

Background and Aims. Cardiovascular diseases are one of the leading causes of death worldwide. This burden of disease is particularly high among healthcare workers. The aim of the study was to identify determinants that increase atherogenic index among healthcare workers.

Methods. In 1,678 healthcare workers, cardiovascular risk factors were analyzed: body mass index, waist-to-hip ratio, systolic and diastolic blood pressure, glucose, total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides. Atherogenic index was calculated and determinants were identified.

Results. Mean (SD) age was 41.2 (8.4) years; body mass index 28.4 (4.8); waist-hip-ratio 0.88 (0.07); glucose 96.6 (22.2) µg/dL; TC 195.3 (50.3) mg/dL; HDL 49.0 (16.3) mg/dL; LDL 112.7 (35.0) mg/dL; triglycerides 171.7 (121.2) mg/dL; and atherogenic index 3.3 (1.5). Overweight and obesity prevalence was 77.2%. In the multiple linear regression model, the coefficients for AI were being a physician $\beta = 0.381$, male gender = 0.443, BMI $\beta = 0.35$, waist-to-hip ratio $\beta = 2.15$, age = 0.014, and triglycerides $\beta = 0.915$.

Conclusions. The main contributors to atherogenic index increase were male sex, increased age, waist-to-hip ratio increase, overweight and obesity, high triglyceride levels and working as a physician. Although waist-to-hip ratio was the most powerful determinant, the physician occupational category added risk factors such as stress and adverse psychosocial working conditions, which may potentiate cardiovascular diseases.

Key Words: Cardiovascular diseases, Risk factor, Health personnel, Physicians.

Introduction

Globally, cardiovascular diseases (CVD) account for ~17 million deaths per year—9.4 million deaths from hypertension complications (1). Therefore, if cardiovascular risks were reduced, global life expectancy would increase by nearly 5 years (2).

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0188-4409/$ - see front matter.
http://dx.doi.org/10.1016/j.arcmed.2015.03.002

CVD is the leading cause of death in Mexico among the general population (3), and ischemic heart disease is responsible for more than half of all CVD-related deaths. These diseases cause disability, early death, and excessive economic burden due to their treatment and compensation (4). Several risk factors for CVD have been identified such as personal or familiar history of hypertension or diabetes mellitus, smoking, chronic stress, high cholesterol levels, physical inactivity, obesity, overweight, and a high waist-to-hip ratio. Yet, other suggested risk factors comprise sex, age, alcohol intake, elevated homocysteine and C-reactive protein levels, hyperuricemia, proteinuria and workplace stress (5,6).

Faced with this public health problem, proposals have been developed to assess cardiovascular risk profile and to establish preventive measures in high-risk populations such as healthcare workers (HCWs) who have a high prevalence of CVD due to excessive work shifts, work-related stress, and unhealthy lifestyle (7,8). As blood lipids serve as markers for CVD risk and its evaluation only with LDL is insufficient, some screening profiles have been proposed, i.e., total cholesterol/high-density lipoproteins (TC/HDL) ratio, low-density lipoprotein cholesterol/high-density lipoproteins ratio (LDL/HDL), and apolipoprotein B/apolipoprotein A1 ratio (ApoB/ApoA1). Although the utility of other ratios has been described, they are mainly aimed at selected populations and for treatment of individual patients. Surveillance for high-risk and general populations along with Castelli's atherogenic index—TC/HDL-has proved to be efficient (9–11).

The purpose of this research was to identify cardiovascular risk factors (CRF) that increase Castelli's atherogenic index (AI) among HCWs in a Mexican hospital during 2007.

Materials and Methods

Study Design

A cross-sectional study was performed in a sample of 1515 employees from a high-specialty medical unit affiliated with the Mexican Institute of Social Security (IMSS-HSMU). Participation was voluntary and part of the hospital's epidemiological health surveillance program during 2007.

Variables Definition

Five occupational categories were identified: nurses, physicians, administrative workers, professional workers, and general services. Sex, age (years), height (cm) weight (kg), waist circumference (cm), hip circumference (cm), body mass index (BMI) (weight/height^2), waist-to-hip ratio (WHR), blood pressure (mmHg), glucose (mg/dL), total cholesterol (TC) (mg/dL), high-density lipoproteins (HDL) (mg/dL), low-density lipoproteins (LDL) (mg/dL), and triglycerides (TG) (mg/dL) were obtained.

BMI was categorized as normal 18.5–24.9, overweight 25–29.9, obesity I 30–34.9, obesity II 35–39.9, and obesity III >40. Regarding waist measurements, normal values were <90 cm for men and <80 cm for women. WHR normal values were <1 for men and <0.85 for women. Hypertension was considered when the patient had >140 mmHg systolic blood pressure (SBP) and >90 mmHg diastolic blood pressure (DBP). The following cut-off points as proposed by NCEP/ATP III in 2002 were considered: TC > 200 mg/dL; triglycerides ≥ 150 mg/dL; HDL <40 mg/dL in men and <50 mg/dL in women; and LDL <155 mg/dL. Glucose was considered as altered fasting blood glucose between 100 and 125 mg/dL and hyperglycemia >126 mg/dL. The AI was calculated using TC/HDL and categorized as normal <5 and high >5.

Statistical Analysis

STATA v13 was used for statistical analysis. After analyzing the variables for normality through Shapiro Wilk test, means, standard deviations and minimum and maximum values were calculated for continuous variables. Bivariate analysis was done with Student's t test and

Table 1. Biological characteristics among workers according to gender from a High-Specialty Medical Unit (IMSS 2007)

Variables	Total n = 1678 Mean (SD) [min–max]	Women n = 1265 Mean (SD) [min–max]	Men n = 413 Mean (SD) [min–max]	p[a]
Age (years)	41.2 (8.4) [17–76]	40.2 (8.8) [20–76]	39.7 (9.3) [17–71]	<0.001
BMI (weight/height^2)	28.4 (4.7) [16.6–65.0]	28.5 (4.8) [17.7–48.2]	28.2 (4.6) [16.6–65.0]	0.39
WHR (waist/hip)	0.88 (0.07) [0.64–1.1]	0.87 (0.07) [0.64–1.08]	0.94 (0.05) [0.69–1.1]	<0.001
SBP (mmHg)	121.6 (14.03) [87–210]	120.8 (14.0) [87–190]	124.4 (14.5) [90–210]	<0.001
DBP (mmHg)	80.3 (9.9) [50–150]	79.8 (9.7) [50–150]	81.7 (10.5) [50–140]	0.004
Glucose (mg/dL)	96.6 (22.1) [65–326]	95.8 (20.6) [65–326]	99.0 (26.0) [68–324]	0.02
TC (mg/dL)	195.3 (50.1) [38–1333]	193.6 (49.5) [84–1333]	200.5 (52.5) [38–968]	0.016
HDL (mg/dL)	49.0 (16.3) [8–280]	50.6 (15.7) [8–249]	44.05 (17.4) [18–280]	<0.001
LDL (mg/dL)	112.7 (34.9) [3–400]	111.4 (34.1) [11–388]	116.7 (37.1) [3–400]	0.01
TG (mg/dL)	171.7 (121.2) [15–1646]	157.0 (96.3) [29–1207]	218.0 (169.7) [15–1646]	<0.001
AI	4.3 (1.5) [0.24–25.5]	4.1 (1.35) [0.62–24.24]	4.93 (1.8) [0.24–25.5]	<0.001

BMI, body mass index; WHR, waist-hip ratio; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; HDL, high-density lipoprotein; LDL, low-density lipoprotein; TG, triglycerides; AI, atherogenic index.
[a]Student's t test used for mean difference.