



Coronary Artery Disease among Elderly Egyptian Patients: I. Socio-Demographic, Lifestyle, Psychosocial, Medical, and Biochemical Risk Factors

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Abstract

Background: Coronary Artery Disease (CAD) is a worldwide public health problem. Its prevalence rate is increasing all over the world including Egypt.

Aims: To determine the socio-demographic, lifestyle, medical and psychosocial risk factors of CAD among elderly Egyptian patients, and to determine patients' candidates to cardiac surgery.

Patients and Methods: A case-control, hospital-based study design was chosen to conduct this research. The study was conducted on 120 patients with CAD and an equal number of controls. The patients and controls were subjected to an interview, and clinical and laboratory examinations.

Results: The important significant risk factors for CAD were male gender, widow/widower, high education, profession occupations, high social class, smokers, physically inactive, high fat and salt intake, hypertension, diabetes, metabolic syndrome, chronic kidney disease, obesity, abdominal obesity, family history of CAD, stress especially general stress, depression, anxiety, aggression, absence of social support, and high levels of TG, total cholesterol, LDL-cholesterol, and low HDL-cholesterol levels (OR=4.27, 5.54, 3.06, 3.29, 2.07, 3.56, 2.49, 4.42 & 3.97, 6.44, 5.5, 4.66, 2.88, 4.38, 5.7, 4.03, 3.33 & 4.96, 3.21, 10.47, 5.03, 3.14, 3.68, 4.46, 4.88, and 7.66; respectively).

Conclusion: CAD is an important preventable health problem as many of its risk factors are modifiable. Modifications of lifestyle and psychosocial risk factors of CAD are the most important interventions to reduce morbidity and mortality of CAD.

Recommendations: It is important to pay more attention to increase people's and health care team' awareness about these modifiable risk factors. This could be achieved through health education programs. Also, routine screening of subjects above age of forty for early detection of medical risk factors and psychosocial upset for better prevention and control of CAD is recommended.

Keywords: CAD; Socio-demographic; Lifestyle; Medical; Psychological; Biochemical; Risk factors; Elder; Egypt

Introduction

Heart Disease (HD) remains a worldwide public health problem. There is remaining no cure for many forms of HD. New clues are emerging that might lead to better treatments in the future [1]. Coronary Artery Disease (CAD), the most important entity of HD; occurs when atherosclerotic plaque builds up within walls of the coronary arteries leading to narrowing and appearance of the clinical manifestations of Acute Coronary Syndrome (ACS) that include angina and Myocardial Infarction (MI) [2]. So, ACS is caused mainly due to deficient blood and oxygen flow to the heart muscle and will be the main cause of death till the year 2020 [3]. CAD has symptoms that require ongoing monitoring and treatment to prevent further complications as MI and Heart Failure (HF) [4].

In developing countries prevalence of CAD is about 11.0%, while age-adjusted prevalence is

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Received Date: 29 May 2018

Accepted Date: 21 May 2018

Published Date: 28 May 2018

Citation:

El-Moselhy EA, Mohammed A-ES, Abd
El-Aziz A, Sadek I, Hagrass SA, Farag
GAS. Coronary Artery Disease among
Elderly Egyptian Patients: I. Socio-
Demographic, Lifestyle, Psychosocial,
Medical, and Biochemical Risk Factors.
Am J Gerontol Geriatr. 2018; 1(2):
1006.

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about 9.0% [5]. In Egypt, the National Hypertension Project (NHP) found an adjusted overall prevalence of CAD is 8.3% [6]. Different reasons are postulated to this; increasing prevalence in developing countries, high expenses of surgical and other treatment modalities, side effects, and the resultant inability make CAD one of the most important medical and health issues [7].

Cardiovascular Disease (CVD) has become the largest single cause of death worldwide. It is responsible for an estimated 17 million deaths and led to 151 million disability-adjusted life years (DALYs) lost (~30.0% of all deaths and 14.0% of all DALYs lost). Also, 12.2% of global deaths (7.2 million) are caused by CAD [8], so it is a leading cause of morbidity, disability, and mortality worldwide [2]. Further, by 2020, 32.0% of the world population deaths will be caused by CVD and by 2030; it will be responsible for 33.0% of all deaths (24.2 million). At this time, 14.9% and 13.1% of deaths in men and women respectively will be caused by CAD [9].

In Egypt, WHOR showed in 2014 that CAD deaths reached 107,232 (23.14%) of all deaths. Age adjusted death rate is 186.36/100,000 population; this ranks Egypt #23 in the world [10]. CAD deaths were 78,897 (21.73%) of all deaths, which make CAD the first killer in Egypt in 2013 [11].

The high prevalence and morbidity associated with CAD is one of the most pressing health problems [12]. Data indicate that the elder population has higher prevalence of CAD risk factors [13]. CAD risk factors are classified into unmodified (e.g., age and genetic factors) and modified (e.g., smoking, obesity, psychosocial, etc). Only half of the variances of CAD are explained by unmodified risk factors [14]. Most of the CAD studies focused on the biological risk factors and lifestyle, but evidence shows psychological/psychosocial factors have important role in etiology, development, continuity and the consequence of this illness [15,16]. Psychological factors are considered as independent risk factors in CAD [14].

CAD has multi-factorial etiology, with many of the risk factors being influenced by lifestyle, so rapid changes in dietary habits coupled with decreased physical activity as a consequence of modernization may partly explain the escalation of CAD [17]. Many risk factors have been implicated in causation of CAD, but not all CAD occur in subjects with multiple risk factors. Elevated levels of Blood Pressure (BP) and cholesterol remain the leading causes of CAD [18]. While, tobacco use, obesity, and physical inactivity remain important contributors [8].

Atherosclerosis is a major risk factors for CAD, the main risk factors for atherosclerosis is gender, age, heredity, smoking, Diabetes Mellitus (DM), high BP, High Triglyceride (TG) levels, Low Density Lipoprotein (LDL) levels, Chronic Kidney Disease (CKD), alcohol abuse, overweight, insufficient exercise, excessive stress, etc [19]. Also, studies have cleared psychosocial and psychiatric factors have a great role in the etiology, development, duration, and outcome of CAD [16]. The great important factors are depression [20,21], anxiety [21-24], and stress [25,26].

Aims of the study

They are to determine the socio-demographic, lifestyle, medical, psychosocial, and biochemical risk factors of CAD among elderly patients in Assiut governorate, Egypt. Also, it is to determine patients' candidates to cardiac surgery.

Patients and Methods

Study design

A case-control, analytic, hospital-based study design was chosen to perform this research.

Administrative design

An approval to conduct this study was obtained before starting the field work.

Study setting and patients

A consecutive patients' group (n=120) who attending the Internal Medicine Outpatient Clinics (OPC) and confirmed to have CAD or admitted in Inpatients Ward or Intensive Care Unit (ICU), Assiut Hospital, Al-Azhar University were the studied group for this research. Also, an equal number (120) of normal healthy adults as controls were enrolled in this study; the controls were the visitors, relatives of non cardiac patients or unrelated visitors of CAD patients. The age range of the CAD patients was 60-76 year. Our Community Health Nurse colleague's gave the participants a session of health education about CAD risk factors especially the importance role of modification of their lifestyle in prevention and control of CAD.

Inclusion criteria

Any patient; male or female, age ≥ 60 years, confirmed to have CAD, attending on the Internal Medicine OPC or admitted in Inpatients Ward or ICU, during the study period were the study group.

Exclusion criteria

Any patient; age < 60 years, unconsciousness, refuse to participate were excluded from the study group.

Ethical consideration

The study protocol was approved by the Council of Community Medicine and Internal Medicine Department. Also, it is approved by the Ethical Committee of Assiut Faculty of Medicine, Al-Azhar University. The purpose and procedures to be performed were explained to the patients and controls, accordingly, an informed consent to participate in the study was taken from both of the patients and controls.

Study tools and methods

The patients and controls were subjected to:

1. A specially designed, comprehensive, interviewing form contains data relevant to topic of the study was used. Positive family history of CAD was defined as presence of a documented CAD patient in a first-degree relative male < 55 year or female ≤ 65 year [27]. Consumption any form of tobacco; the participant was considered smoker [28].

2. Anthropometric measurements were applied to all participants: a) Height (cm), b) Body weight (kg), and accordingly Body Mass Index (BMI) was calculated as weight in kg divided by the square of the height in meters (kg/m^2). BMI was classified into; underweight < 18.5 , normal 18.5-24.9, overweight 25-29.9, and obese $\geq 30 \text{ kg}/\text{m}^2$ [29], and c) Waist Circumferences (WC) (cm). WC made at a midpoint between the top of the iliac crest and the lower margin of the last palpable rib in the mid axillary line [30]. Patient considered has abdominal obesity if WC > 102 cm in men and > 88 cm in women [27].

3. Clinical examination: BP; hypertension was defined as ≥ 2 BP readings of 140 mmHg systolic, 90 mmHg diastolic or a patient who was already on anti-hypertensive medication. Also, all needed examinations and/or investigations to confirm the diagnosis and to assess patients' medical conditions to determine their candidates to surgery were done; echocardiography and/or coronary angiography. The patients' grading of angina pectoris was according to the New York Heart Association [31] (NYHA) that places patients in one of four categories based on how much they are limited during physical activity.

Middle Sex Hospital Questionnaire was applied on the cases and controls. The questionnaire was divided into subscales covering psychiatric symptoms, which including anxiety and depression. Response to each item is scored 2, 1 or 0. A score of ≥ 9 in any subscale indicates the subject is suffering from psychiatric disorders [32]. Also, major stressful life events questionnaire (Life Events List) [33] was used to assess the number and types of stressful life events experienced during the past year, as well as the degree of stress experienced in each. Meanwhile, Modified Overt Aggression Scale (MOAS) [34] was used to assess some aggressive behaviors; it instructs the individual to rate the patient's aggressive behaviors over the past week. In this study it is administered by our Community Health Nurse colleague's. Its items were scored on a 5-point Likert scale; scores were ranged from 0 to 40, with higher scores indicating more aggression.

4. Laboratory investigations of the patients and controls were done: **a)** Plasma glucose level: DM was defined as a patient who was already on treatment for DM or having one of the following criteria; fasting plasma glucose level ≥ 126 mg/dL, 2-hour plasma glucose level ≥ 200 mg/dL or a patient with classic symptoms of hyperglycemia with a random plasma glucose level ≥ 200 mg/dL [35]. **b)** Fasting lipid profile [serum concentration of total cholesterol, Triglycerides (TGs), Low Density Lipoprotein (LDL)-cholesterol, and High Density Lipoprotein (HDL)-cholesterol] was adopted according to the Adult Treatment Panel III (ATP III) classification levels of total cholesterol, LDL-cholesterol, HDL-cholesterol, and TGs [27]. **c)** Metabolic syndrome (MS): was defined according to the NCEP ATP III criteria by the presence of ≥ 3 of the following criteria; abdominal obesity (WC; men >102 cm and women >88 cm), TGs (≥ 150 mg/dL), HDL-cholesterol (men <40 mg/dL and women <50 mg/dL), BP ($\geq 130/85$ mmHg), and fasting plasma glucose (≥ 110 mg/dL) [27]. **d)** C-Reactive Protein (CRP).

Statistical analysis

The collected data were revised, organized, tabulated and statistically analyzed using Statistical Package for Social Sciences (SPSS) version 20 for windows. Frequency, percentage, and Odds Ratio (OR) were the statistical methods used in the analysis of data. The significance of OR was the 95% Confidence Interval (CI) or the 95% Exact Confidence Limits (ECL).

Discussion

Many risk factors have been implicated in occurrence of CAD [18]. Prevalence of CAD increases along with increasing prevalence of its risk factors [36]. Reduction occurrence of CAD was tried by primary and secondary prevention strategies; primary prevention as behavioral changes and risk factors modifications [37]. Meanwhile, secondary prevention of CAD is an important objective; it leads to reduce cardiac events especially acute MI [38]. Due to CAD high expenses of treatment and their complications; appropriate approach,

prevention, and treatment lead to save economic resources and health costs. So, it seems necessary to concentrate on the modified risk factors that are mostly the psychosocial factors and lifestyle [39]. Awareness to CAD psychological risk factors will result in achieving prevention, control, and stability. These achievements lead to lowering risk factors, treatment expenses, and improving quality of life; eventually minimize illnesses and disabilities [40,41].

In the current study we revealed that age group 65-69 year represented a significant risk factor for CAD (OR=1.85) and about half (50.8%) of CAD cases were in this age group. In Egypt, Bahnasawy et al [42] and Ibrahim et al [43] reported lower figures in CAD patients aged > 60 years; 35.4% and 26.4%, respectively (Table 1). Additionally, they reported mean age of CAD was 55.95 ± 11.04 and 54 years, respectively. Also, Egypt NHP [6] has provided the prevalence of CAD was the highest in subjects aged >50 years, 11.1%. Whereas Raymond et al [44] found 70.3% of CAD Egyptian patients were in the age >35 years. Ram Rohit and Trivedi Atul [28] reported the mean age of cases was 54 ± 10.50 years; 40.0% of cases were in the age group 51-60 years. Also, Kasper et al [19] showed that incidence of CAD was more in the age group of 51-60 years.

We observed male gender represented significant risk factor for CAD (OR=4.27); males represented 78.3% of all cases. Jayachandra et al [45] showed overall risk factors are more in males compared to females; ≥ 65 years, 69.1%. The Egypt NHP found prevalence of CAD was slightly higher in men (8.9%) compared to women (8.0%) [6]. Our result was close to figures of Ram Rohit and Trivedi Atul [28], Ibrahim et al [43], and Taha [46]; 70.4%, 77.6%, and 83.5 %; respectively, but less than Raymond et al [44]; 93.2%. On the other hand, Hadaegh et al [47] reported that CAD was more among females (59.0%).

We found widow/widower is a significant risk factor for CAD (OR=5.54). This is expected and accepted as they might be at old age, experiencing psychosocial stress, and anxiety and depression that increase the risk of CAD occurrence. Also, we showed that urban residence represented significant risk factor for CAD (OR=1.89). Overall CAD prevalence, in India, has increased from 2.06% in 1970 to 5.0% in 2002 in rural area and 1.04% in early 1960 to 13.02% in 2004 in urban area [48]. Taha [46] found CAD is more among patients from urban areas, 59.5%.

We clarified secondary and high education, professional occupation, enough handsaved income, and high social class represented significant socioeconomic risk factors for CAD (OR=3.06, 3.29, 1.95, 2.07; respectively) (Table 2). Schnohr et al [49] elicited Relative Risk (RR) of education ≤ 10 year for CAD in men and women was 1.01, 95% CI: 0.85-1.19 and 1.28, 95% CI: 0.97-1.68; respectively and RR of low or middle income for CAD in men and women was 1.14, 95% CI: 0.98-1.32 and 1.22, 95% CI: 1.0-1.5; respectively. Mohanan et al [50] observed patients with up to secondary school education had the highest prevalence of CAD (40.7%). Similar observation; the patients in the middle socioeconomic classes were more than patients from low and high socioeconomic classes. Xavier et al [51] cleared most patients (52.5%) in their study were from middle socioeconomic class. Also, our results are in agreement with Gupta et al [36]; they found patients in middle, low, and high socioeconomic classes were 61.4%, 30.9%, and 7.7%; respectively.

In the present study we elicited that current tobacco smoking, for duration >20 years, and ≥ 20 cigarettes/day were significant

Table 1: Distribution of the studied patients with Coronary Artery Disease (CAD) and control group according to demographic risk factors.

| Demographic risk factors | Patients (n=120) | | Controls (n=120) | | OR# (95% CI) |
|--------------------------|------------------|------|------------------|------|-------------------|
| | No. | % | No. | % | |
| Age (years): | | | | | |
| 60-64 | 24 | 20.0 | 52 | 43.3 | 0.33 (0.18-0.6) |
| 65-69 | 61 | 50.8 | 43 | 35.8 | 1.85 (1.07-3.21) |
| ≥ 70 | 35 | 29.2 | 25 | 20.8 | 1.56 (0.83-2.95) |
| Gender: | | | | | |
| Male | 94 | 78.3 | 55 | 45.8 | 4.27 (2.35-7.82) |
| Female | 26 | 21.7 | 65 | 54.2 | 0.23 (0.13-0.43) |
| Marital status: | | | | | |
| Married | 46 | 38.3 | 93 | 77.5 | 0.18 (0.1-0.33) |
| Widow/Widower | 74 | 61.7 | 27 | 22.5 | 5.54 (3.04-10.16) |
| Residence: | | | | | |
| Urban | 82 | 68.3 | 64 | 53.3 | 1.89 (1.08-3.31) |
| Rural | 38 | 31.7 | 56 | 46.7 | 0.53 (0.3-0.93) |

*Odds ratio. †Confidence intervals. ††Exact confidence limits.

Table (1) clears that age group 65-69 year, male gender, widow/widower, and urban residence represented significant demographic risk factors for CAD (OR=1.85, 95% CI: 1.07-3.21; OR=4.27, 95% CI: 2.35-7.82; OR=5.54, 95% CI: 3.04-10.31; 1.89, 95% CI: 1.08-3.31; respectively).

Table 2: Distribution of the studied patients with Coronary Artery Disease (CAD) and control group according to socioeconomic risk factors.

| Socioeconomic risk factors | Patients (n=120) | | Controls (n=120) | | OR# (95%CI) OR (95%ECL)* |
|--|------------------|------|------------------|------|-----------------------------|
| | No. | % | No. | % | |
| Educational level: | | | | | |
| Illiterate and read & write | 26 | 21.7 | 59 | 49.2 | 0.29 (0.16-0.52) |
| Elementary | 42 | 35.0 | 37 | 30.8 | 1.21 (0.68-2.15) |
| Secondary and university | 52 | 43.3 | 24 | 20.0 | 3.06 (1.66-5.67) |
| Occupational level: | | | | | |
| House wife | 21 | 17.5 | 45 | 37.5 | 0.35 (0.19-0.67) |
| Unskilled | 41 | 34.2 | 47 | 39.2 | 0.81 (0.46-1.41) |
| Semi-skilled and skilled | 43 | 35.8 | 23 | 19.2 | 2.36 (1.26-4.43) |
| Professional | 15 | 12.5 | 5 | 4.2 | 3.29 (1.08-11.91)† |
| Income: | | | | | |
| Not enough | 31 | 25.8 | 48 | 40.0 | 0.52 (0.29-0.94) |
| Enough | 47 | 39.2 | 46 | 38.3 | 1.04 (0.6-1.8) |
| Enough and saved | 42 | 35.0 | 26 | 21.7 | 1.95 (1.06-3.6) |
| Social class: | | | | | |
| Low | 29 | 24.2 | 54 | 45.0 | 0.39 (0.22-0.7) |
| Middle | 46 | 38.3 | 39 | 32.5 | 1.29 (0.73-2.27) |
| High | 45 | 37.5 | 27 | 22.5 | 2.07 (1.13-3.79) |

*Odds ratio. †Confidence intervals. ††Exact confidence limits.

Table (2) demonstrates that secondary and more level of education, professional occupation, enough and saved income, and high social class represented significant socioeconomic risk factors for CAD (OR=3.06, 95% CI: 1.66-5.67; OR=3.29, 95% ECL: 1.08-11.91; OR=1.95, 95% CI: 1.06-3.6; OR=2.07, 95% CI: 1.13-3.79; respectively).

Table 3: Distribution of the studied patients with Coronary Artery Disease (CAD) and control group according to lifestyle risk factors.

| Lifestyle risk factors | Patients (n=120) | | Controls (n=120) | | OR# (95% CI) OR (95% ECL)† |
|---|------------------|------|------------------|------|-------------------------------|
| | No. | % | No. | % | |
| Tobacco smoking: | | | | | |
| Current smoker | 61 | 50.8 | 27 | 22.5 | 3.56 (1.97-6.48) |
| Passive smoker | 33 | 27.5 | 29 | 24.1 | 1.19 (0.64-2.21) |
| Ex-smoker | 8 | 6.7 | 14 | 11.7 | 0.54 (0.2-1.45) |
| Never smoke | 18 | 15.0 | 50 | 41.7 | 0.25 (0.13-0.48) |
| Duration of tobacco smoking (years): | (n=102) | | (n=70) | | |
| < 10 | 9 | 8.8 | 22 | 31.4 | 0.21 (0.08-0.53) |
| 10-20 | 47 | 46.1 | 30 | 42.9 | 1.14 (0.59-2.2) |
| > 20 | 46 | 45.1 | 18 | 25.7 | 2.37 (1.16-4.87) |
| Number of cigarettes smoked/day: | (n=102) | | (n=70) | | |
| < 20 | 22 | 21.6 | 28 | 40.0 | 0.41 (0.24-0.85) |
| ≥ 20 | 80 | 78.4 | 42 | 60.0 | 2.42 (1.18-5.02) |
| Alcohol use: Yes | 6 | 5.0 | 2 | 1.7 | 3.11 (0.54-31.94)† |
| Previous physical inactivity: Yes | 57 | 47.5 | 32 | 26.7 | 2.49 (1.4-4.43) |
| Dietary habits: | | | | | |
| Low fruits and vegetables intake: Yes | 58 | 48.3 | 37 | 30.8 | 2.1 (1.2-3.68) |
| High fats intake: Yes | 74 | 61.7 | 32 | 26.7 | 4.42 (2.47-7.95) |
| High salt intake: Yes | 67 | 55.8 | 29 | 24.2 | 3.97 (2.21-7.17) |

*Odds ratio. †Confidence intervals. ††Exact confidence limits.

Table (3) elicits that significant lifestyle risk factors for CAD are current tobacco smoker's, duration >20 year of smoking, smoking ≥20 cigarette/day, physically inactive, low fruits and vegetables intake, high fat intake, high salty food intake, and chronic work stress (OR=3.56, 95% CI: 1.97-6.48; OR=2.37, 95% CI: 1.16-4.87; OR=2.42, 95% CI: 1.18-5.02; OR=2.49, 95% CI: 1.4-4.43; OR=2.1, 95% CI: 1.2-3.68; OR=4.42, 95% CI: 2.47-7.95; OR=3.97, 95% CI: 2.21-7.17, OR=4.14, 95% ECL: 1.26-17.6; respectively).

lifestyle risk factors for CAD (OR=3.56, 2.37, 2.42; respectively) (Table 3). Cigarette smoking constitutes the single most important, independent and effective risk factor of atherosclerosis in many

previous studies [19]. Jayachandra et al [45] found smoking is the most common among elder patients. Tobacco use in any form is a major etiology behind the occurrence of CAD. Smokers, especially

Table 4: Distribution of the studied patients with Coronary Artery Disease (CAD) and control group according to medical risk factors.

| Medical risk factors | Patients (n=120) | | Controls (n=120) | | OR* (95% CI) OR (95% ECL) [†] |
|-------------------------------------|------------------|------|------------------|------|---|
| | No. | % | No. | % | |
| Hypertension: Yes | 83 | 69.2 | 31 | 25.8 | 6.44 (3.54-11.8) |
| Diabetes mellitus (DM): Yes | 61 | 50.8 | 19 | 15.8 | 5.5 (2.88-10.58) |
| Metabolic syndrome (MS): Yes | 63 | 52.5 | 23 | 19.2 | 4.66 (2.52-8.68) |
| Chronic kidney disease (CKD): Yes | 27 | 22.5 | 11 | 9.2 | 2.88 (1.28-6.56) |
| Overweight/obesity: Yes: | 93 | 77.5 | 38 | 31.7 | 7.43 (4.02-13.81) |
| Overweight | 49 | 40.8 | 24 | 20.0 | 2.76 (1.49-5.13) |
| Obese | 44 | 36.7 | 14 | 11.7 | 4.38 (2.15-9.07) |
| Abdominal obesity: Yes | 72 | 60.0 | 25 | 20.8 | 5.7 (3.1-10.55) |
| Positive family history of CAD: Yes | 21 | 17.5 | 6 | 5.0 | 4.03 (1.49-12.63) [†] |

*Odds ratio. [†]Confidence intervals. [‡]Exact confidence limits.

Table (4) shows that significant medical history risk factors for CAD are hypertension, DM, MS, CKD, overweight and obesity, abdominal obesity, and positive family history of CAD (OR=6.44, 95% CI: 3.54-11.8; OR=5.5, 95% CI: 2.88-10.58; OR=4.66, 95% CI: 2.52-8.68; OR=2.88, 95% CI: 1.28-6.56; OR=7.43, 95% CI: 4.02-13.81; OR=5.7, 95% CI: 3.1-10.55; OR=4.03, 95% ECL: 1.49-12.63; respectively). Further, obese are at increased risk for CAD than overweight (OR=4.38, 95% CI: 2.15-9.07 and OR=2.76, 95% CI: 1.49-5.13; respectively). Meanwhile, positive family history of CAD is a significant risk factor for CAD (OR=4.14, 95% ECL: 1.26-17.6).

the current, were significantly more among the cases compared to controls. Also, strong relations were found between frequency and duration of smoking and CAD [28]. The risk of smokers to develop CAD is at least 2-4 times of that among non-smokers. Environmental tobacco smoke, which is also called passive smoke, is known to cause HD [52]. Schnohr et al [49] noticed RR of smoking for CAD in men and women was 1.41, 95% CI: 1.24-1.6 and 1.42, 95% CI: 1.23-1.64, respectively. Yathish et al [52] observed smokers were at risk of having CAD (OR=2.81), while the relative risk (RR) was 1.71. Also, Ram Rohit and Trivedi Atul [28] showed smoking is significant risk factor for CAD; smoking for <10 years and ≥10 years increase the risk from 2.01 to 5.12. Also, smoking up to 10 biddies and >10 per day significantly increases risk from 2.96 to 4.82. Further, we elicited that prevalence of current tobacco smokers was 50.8%. This result is similar with Gupta et al [36] and Taha [46]; they reported prevalence of 50.4% and 50.5%, respectively. While, our result is lower than Hadaegh et al [47] and Raymond et al [44]; they reported prevalence of 73.9% and 88.0%, respectively. Also, there was significant statistical difference between smokers and non smokers as regards prevalence of CAD [46].

We reported physical inactivity is significant risk factor for CAD (OR=2.49). Mohan and Deepa [17] clarified decreased physical activity might explain the escalation of CAD. Lopez et al [8] cleared physical inactivity is an important contributors of CAD. Schnohr et al [49] noted RR of physical inactivity for CAD in men and women is 1.28, 95% CI: 1.13-1.47 and 1.36, 95% CI: 1.17-1.59, respectively.

Further, we noticed low intake of fruits/vegetables, and high intake of fat and salty food were significant risk factors for CAD (OR=2.1, 4.42, and 3.97; respectively). Mohan and Deepa [17] observed changes in dietary habits could partly explain the escalation of CAD. DiClemente et al [53] showed promotes counseling on health behavior in clinical practice by advocating full insurance coverage for counseling for smoking and nicotine dependence, alcohol use, healthy diet, and physical activity among adults is important.

In the current study we showed hypertension is significant risk factor for CAD (OR=6.44). Schnohr et al [49] observed RR of hypertension for CAD occurrence in men was 1.46, 95% CI: 1.3-1.64 and in women was 2.02, 95% CI: 1.75-2.33. Also, in our study, 60.8% of our CAD patients were hypertensive. This result was close to Ibrahim et al [43] and Taha [46] figures of hypertension prevalence in CAD Egyptian patients; 56.7% and 56.0%, respectively. While our

prevalence of hypertension was higher than that reported by Xavier et al [51], Hadaegh et al [47], Gupta et al [36], Raymond et al [44], and Jayachandra et al [45]; 38.0%, 40.4 %, 28.4%, and 37.7%; respectively. On the other hand, Bahnasawy et al [41] reported higher prevalence of hypertension, 83.2%.

In the present study we elicited DM is significant risk factor for CAD (OR=5.5). Schnohr et al [49] cleared RR of DM for CAD in men and women was 1.96, 95% CI: 1.35-2.12 and 2.74, 95% CI: 1.99-3.78, respectively. Also, 50.8% of our CAD patients had DM. Our result was similar to Bahnasawy et al [42] figure; 57.5% prevalence of DM in CAD patients. On the other hand, our figure was higher than that of Raymond et al [44], Foroughi et al [54], Xavier et al [48], Gupta et al [36], Ibrahim et al [43], Fouad et al [55], Taha [46], and Jayachandra et al [45]; 22.3%, 27.5%, 30.4%, 30.3%, 34.4%, 42.0%, 46.0%, and 21.0%; respectively. Meanwhile, we cleared MS is significant risk factor (OR=4.66). We reported 52.5% of our CAD patients had MS. This result was higher than 44.6% and 18.4% that reported by Fouad et al. [55] and Gupta et al [36], respectively. While it was similar to Taha's [46] figure, 53.0%.

In this study, we showed overweight/obesity and abdominal obesity are significant medical risk factors for CAD (OR=7.43 and 5.7, respectively) (Table 4). Further, obese patients are at increased risk than overweight (OR=4.38 and 2.76, respectively). Schnohr et al [49] clarified RR of obesity for CAD in men and women was 1.2, 95% CI: 1.07-1.36 and 1.19, 95% CI: 1.04-1.37, respectively. According to population-based surveys; there are about 1.3 billion overweight adults in the world. In addition, 23.0% of the CAD burden is attributable to overweight and obesity⁽⁴³⁾. We found prevalence of obesity was 36.7%, which was similar to that reported by Taha [46] (38.5%) and Raymond et al [44] (39.2%). While, Ibrahim et al [43] found 25.8% of CAD Egyptian patients were obese. Whereas, Bahnasawy et al [42] found 96.5% of CAD of their patients were obese or overweight.

We cleared CKD is significant risk factor for CAD (OR=2.88, 22.5%). This is expected and accepted as CKD could leads to hypertension that is risk factor for occurrence of CAD. Our figure is higher than Jayachandra's et al [45] figure, 11.0%.

We noted positive family history of CAD is significant risk factor (OR=4.03, 17.5%). Our result is higher than figures of Taha [46] (11.0%), Gupta et al [36] (13.1%), and Sekhri et al. [56] (4.6%) for positive family history among CAD patients. On the other hand, our

Table 5: Distribution of the studied patients with Coronary Artery Disease (CAD) and control group according to psychosocial risk factors.

| Lifestyle risk factors | Patients (n=120) | | Controls (n=120) | | OR* (95% CI) OR (95% ECL)* |
|--|------------------|------|------------------|------|-------------------------------|
| | No. | % | No. | % | |
| Stress: Yes | 59 | 49.2 | 27 | 22.5 | 3.33 (1.84-6.06) |
| Type of stress: | | | | | |
| Stress at home | 74 | 61.7 | 47 | 39.2 | 2.5 (1.44-4.35) |
| Stress at work | 96 | 80.0 | 73 | 60.8 | 2.58 (1.39-4.79) |
| Financial stress: Moderate/severe | 89 | 74.2 | 49 | 40.8 | 4.16 (2.32-7.48) |
| Stressful life events | 75 | 62.5 | 43 | 35.8 | 2.98 (1.71-5.23) |
| General stress | 76 | 63.3 | 31 | 25.8 | 4.96 (2.76-8.97) |
| Depression: Yes: | 77 | 64.2 | 43 | 35.8 | 3.21 (1.83-5.63) |
| Anxiety: Yes | 76 | 63.3 | 17 | 14.2 | 10.47 (5.32-20.79) |
| Aggression: Yes | 83 | 69.2 | 37 | 30.8 | 5.03 (2.81-9.05) |
| Social support: No | 17 | 14.2 | 6 | 5.0 | 3.14 (1.12-10.05)* |

*Odds ratio. *Confidence intervals. **Exact confidence limits.

Table (5) illustrates that significant psychosocial risk factors for CAD are presence of stress especially general stress, depression, anxiety, aggression, and absence of social support (OR=3.33, 95% CI: 1.84-6.06; OR=4.96, 95% CI: 2.76-8.69; OR=3.21, 95% CI: 1.83-5.63; OR=10.47, 95% CI: 5.32-20.79; OR=5.03, 95% CI: 2.81-9.05; OR=3.14, 95% ECL: 1.12-10.05; respectively).

Table 6: Distribution of the studied patients with Coronary Artery Disease (CAD) and control group according to biochemical risk factors.

| Lipid profile risk factors | Patients (n=120) | | Controls (n=120) | | OR# (95% CI) |
|----------------------------|------------------|------|------------------|------|-------------------|
| | No. | % | No. | % | |
| Triglyceride (TG): | | | | | |
| Borderline high | 36 | 30.0 | 13 | 10.8 | 3.53 (1.68-7.52) |
| High | 25 | 20.8 | 8 | 6.7 | 3.68 (1.5-9.35) |
| Total cholesterol: | | | | | |
| Borderline high | 32 | 26.7 | 11 | 9.2 | 3.6 (1.63-8.1) |
| High | 29 | 24.2 | 7 | 5.8 | 4.46 (1.84-11.18) |
| HDL-cholesterol: | | | | | |
| Low | 67 | 55.8 | 17 | 14.2 | 7.66 (3.93-15.1) |
| LDL-cholesterol: | | | | | |
| Borderline high | 43 | 35.8 | 14 | 11.7 | 4.23 (2.07-8.76) |
| High | 34 | 28.3 | 9 | 7.5 | 4.88 (2.1-11.6) |

#Odds ratio. *Confidence intervals.

Table (6) demonstrates the most significant biochemical risk factors for CAD are high TG levels (OR=3.68, 95% CI: 1.5-9.35), high total cholesterol levels (OR=4.46, 95% CI: 1.84-11.18), low HDL-cholesterol level (OR=7.66, 95% CI: 3.93-15.1), and high LDL-cholesterol levels (OR=4.88, 95% CI: 2.1-11.6).

figure is lower than figures of Raymond et al [44] (33.8%), Foroughi et al [54] (38.0%), and Bahnasawy et al [42] (46.9%) for positive family history of their CAD patients.

Evidence suggests psychological and social factors are independent risk factors, they have important role in physical chronic diseases, particularly CAD [16,23,57]. So, psychological risk factors of CAD; etiology, prognosis, and mortality are important challenge in understanding and combating CAD [58]. Many of the psychosocial factors are not recognized clinically. Possible causes are; 1- Psychosocial factors are risks rather than inevitable causes, differ widely in importance, and will not be apparent in every case; 2- Psychological characteristics as aggression might be elicited under specific provocation; and 3- There is no try to search for psychosocial explanations only for patients who don't have other familiar, clear risk factors as hypertension, DM, or smoking. Also, many clinicians work based on implicit models that place biological and psychosocial causes as alternatives [39]. However, psychosocial factors may be associated with other risk factors [59]. Psychological factors as protective or risk factors have an important role in CAD; the most important of which are depression, anxiety, stress, occupational status, and social support [20,21,24,25,26,39,60].

We showed aggression is significant risk factor for CAD (OR=5.03) (Table 5). Khayyam-Nekouei et al [39] cleared aggression could be emerged only under special situation. So, it is unlikely to be expressed during an ordinary clinical practice. Also, we showed that stress is significant risk factor for CAD (OR=3.33). The relation

between CVDs including CAD and stress is not a simple probable, but tentative proof suggests a relation between the heart and mind [61]. It is has been concluded variables that are mostly viewed as components of stress include: depression and anxiety, social isolation and lack of social support, acute and chronic life events, and psychosocial work characteristics [39,62,63].

We elicited work stress is significant risk factor for CAD (OR=2.58). This result is in consistent with Chandola et al [64]; they stated chronic stress at work is associated with CAD (RR=1.68, 95% CI: 1.17-2.42). Further, they concluded it's an important determinant of CAD and it's mediated through indirect effects on health behaviors and direct effects on neuro-endocrine stress pathways. Also, we reported stressful life events is significant risk factor for CAD (OR=2.98). Research has cleared the importance of stress caused by acute and chronic life events in CAD incidence. Acute life event stressors can trigger CAD events, but it is very difficult to study and quantify the magnitude of these effects [39]. Although the deleterious physiological effects of acute stressors as CAD triggers are well documented, the role of chronic stressors in CAD onset and prognosis remains unclear [65]. Also, we observed stress at home e.g. marital is significant risk factors for CAD (OR=2.5). Balog et al [66] showed marital stress might results in CAD.

We showed absence of social support is significant risk factor for CAD (OR=3.14). Among the major protective factors for CAD is social support [39]. Many studies have shown after MI rate of depression depends upon the amount of social support. One of the

important stress variables is social support that is more important than other variables [63]. Not only the lack of social support is associated with the occurrence of CAD, but also it's an independent risk factor for mortality [67].

We noticed depression is significant risk factors for CAD (OR=3.21). Strong support of the depression's role in increasing morbidity and mortality of CAD viewed depression is an independent predictor [40]. Depression is an important disorder, which leads to an increase in cardiovascular events including CAD, hospital re-admission, and CAD mortality [68]. Depressed people are 64.0% more at risk of suffering from CAD than non-depressed people [40]. Further, it is common among CAD patients; its prevalence is 20.0% higher in HF patients compared with healthy subjects [15]. Depression is also a negative predictor for improvement of CAD [39]. Depression symptoms, accompanied with stress in marital relation among women with and without CAD, were found more among women with marital stress and results in the intensification of CAD [66]. Also, it's risk factor for morbidity and mortality in CAD patients, especially after ACS [20,21]. Finally, depression is shown to be a risk factor in the etiology of CAD [40,67-69]. The challenge on prospective association between depression and CAD is the possibility that depression and subsequent CAD are caused by subclinical manifestation of CVD [40]. The most important underlying pathophysiological mechanism of CAD, atherosclerosis, develops during the decade before early appearance of clinical symptoms. So, atherosclerosis may facilitate depressive symptoms even before clinical CAD symptoms [40,60].

We found anxiety is significant risk factor for CAD (OR=10.47). Although evidence suggests anxiety has an adverse impact on prognosis in CAD patients independent of depression, the role of anxiety as an etiological risk factor is less obvious [23,40,70]. Also, anxiety is an independent risk factor for CAD, but the link between anxiety and CAD is to somewhat less than the relation between depression and CAD. However, this connection is stronger than the association between anger and CAD occurrence [23]. Roest et al [23] cleared symptoms of anxiety in CAD patients is associated with physical factors as palpitation in absence of physical activities, anger, face redness, abnormal heart beat, and muscle tension, which increases risk of CAD. Nabi et al [22] viewed somatic symptoms of anxiety were associated with an increased risk of CAD.

Finally, most studies discussed anxiety and depression as an important disorder that results in increase of CVD episodes, re-admittance to hospital, and death in CAD patients [37]. Janszky et al [20] studied the effects of anxiety and depression on risk factors of CAD; they reported they are associated with low physical activity and high rate of smoking. Also, depression is associated with increased use of alcohol. At the same time, anxiety has connection with hypertension. Further, anxiety independently predicted subsequent CAD events of morbidity and mortality.

In the current study we demonstrated that significant biochemical risk factors for CAD are high TG level (OR=3.68), high total cholesterol level (OR=4.46), low HDL-cholesterol level (OR=7.66), and high LDL-cholesterol level (OR=4.88) (Table 6). Elevated levels of serum total cholesterol, TG and/or LDL-cholesterol and/or low level of HDL-cholesterol are called dyslipidaemia, which is a major risk factor for CAD (71). Jayachandra et al [45] observed regarding elderly patients, dyslipidemia (9.0%) was the most common risk factor for CAD. Also, Sekhri et al [56]; revealed prevalence of dyslipidemia was significantly high, 45.6% of the individuals had high total cholesterol/

Table 7: Distribution of the studied patients with Coronary Artery Disease (CAD) according to their clinical characteristics that determine their candidates to surgery.

| Variables | Number (n=120) | Percent |
|---|----------------|---------|
| Previous MI: Yes | 78 | 65.0 |
| History of previous Cardiac surgery: Yes | 6 | 5.0 |
| Diagnosis: | | |
| UA | 37 | 30.8 |
| MI | 83 | 69.2 |
| New York Heart Association grading of angina: | | |
| Grade 1 | 5 | 4.2 |
| Grade 2 | 29 | 24.2 |
| Grade 3 | 76 | 63.3 |
| Grade 4 | 10 | 8.3 |
| Peripheral vascular disease: Yes | 27 | 22.5 |
| Heart Failure: Yes | 19 | 15.8 |
| Lt Ventricular Ejection Fraction (Lt Vent Function): | | |
| ≥60.0% (normal) | 9 | 7.5 |
| ≥45.0%-59.0% (mild impairment) | 26 | 21.7 |
| ≥35.0%-44.0% (moderate impairment) | 47 | 39.2 |
| <35.0% (severe impairment) | 38 | 31.7 |
| Stenosis >50.0% in Lt main CA (n=120): Yes | 18 | 15.0 |
| No. of stenosed vessels (n=102): | | |
| 1 | 2 | 2.0 |
| 2 | 16 | 15.7 |
| ≥3 | 84 | 82.3 |
| CAD patients candidates to CABG | 58 | 48.3 |

Table (7) clarifies that history of previous MI and cardiac operations are 65.0% and 5.0%, respectively. There are 30.8% and 69.2% of the patients have UA and MI, respectively. Most of the patients (63.3%) have grade 3 according to NYHA grading. Also, 22.5% and 15.8% of them have history of peripheral vascular disease and HF, respectively. Further, most of the patients; 39.2% and 31.7%, respectively have moderate and severe impairment (left ventricular function). Also, 15.0% of the patients have stenosis >50.0% in main left coronary artery. Further, 82.3% of the patients have ≥3 stenosed vessels. Collectively, 48.3.3% of the patients are candidates for CABG surgery.

high density lipoprotein ratio. Totally, 78.6% of individuals had two or more risk factors for CAD. Schnohr et al [49] cleared RR of TG for CAD in men and women was 1.06, 95% CI: 0.95-1.19 and 1.33, 95% CI: 1.14-1.55, respectively and of high total cholesterol level was 1.22, 95% CI: 1.09-1.36 and 1.23, 95% CI: 1.06-1.43, respectively. Ibrahim et al [43] concluded dyslipidemia is common among Egyptians with CAD; low HDL-cholesterol was present in 49.2% of CAD patients, high LDL-cholesterol in 30.2%, and high TG in 45.0% of them; these figures are to somewhat similar to our figures. Whereas, Raymond et al [44] cleared dyslipidemia was found in 37.2% of their CAD Egyptian patients. Achari and Thakur [72] reported serum levels of cholesterol, LDL-cholesterol, and total cholesterol to HDL ratio were higher among CAD patients compared to controls. Also, there was a lack of association of serum TG levels with CAD. Further, Burman et al [73] found LDL-cholesterol levels and total cholesterol/HDL-cholesterol ratio were higher in CAD patients compared to controls but there was no significant difference in S.TG levels. On the other hand, Achari and Thakur [71] observed prevalence of elevated LDL-cholesterol levels is only 38.8% among CAD patients. This suggests either the cut-off used for elevated LDL-cholesterol is not appropriate among all races or >60.0% of CAD is not explained by elevated LDL-cholesterol levels [17]. Further, we reported 50.8% of our patients had borderline high/high TG level, which similar to 45.0% that observed by Ibrahim et al [43] and Taha [46]. Also, in our study, high total cholesterol was found among 50.9% of our patients, which is similar to figures of Taha [46] (47.5%) and Ibrahim et al [43] (58.7%). Meanwhile, it is less than Bahnasawy's et al [42] figure, 78.8%. Low HDL-cholesterol was present among 55.8% of our patients, which is

higher than figures' of Taha [46] (10.5%) and Bahnasawy et al [42] (21.2%). Also, high LDL-cholesterol was present in 64.1% of our patients. This result is higher than figures showed by Bahnasawy et al [42] (41.6%) and Ibrahim et al [43] (30.2%) (Table 6).

In the current study, Table 7 we reported history of previous MI and cardiac operations are 65.0% and 5.0%, respectively. Also, 30.8% and 69.2% have UA and MI, respectively. Most of the patients 63.3% have grade 3, respectively according to NYHA [31] grading. Further, 22.5% and 15.8% of them have history of peripheral vascular disease and HF, respectively. Meanwhile, 39.2% and 31.7% of the patients have moderate and severe impairment of left ventricular function, respectively. Also, 15.8% of the patients have stenosis >50.0% in main left coronary artery. Further, 82.3% of the patients have ≥ 3 stenosed vessels. Lastly, 48.3.3% of the patients are candidates for CABG surgery. Collectively, these data indicate that most of our patients have many CAD risk factors; these results are agreed with Waly et al [74]. Also, many of them were candidates for surgical intervention many years ago. However, many of the patients refused or postponed operation because of personal, cultural, socioeconomic, and other reasons (unpublished data). Further, many of these patients have severe CAD.

Conclusions

CAD is an important preventable public health problem; many of its risk factors are modifiable. Modification of lifestyle and psychosocial risk factors of CAD is the most important interventions to reduce morbidity and mortality of CAD in the community. The most important significant demographic risk factors were male gender and widow/widower; socioeconomic risk factor was profession occupations; lifestyle risk factors were current smoker, high fat and salt intake; medical risk factors were hypertension, DM, MS, obesity, abdominal obesity, and +ve family history; psychosocial risk factors were general stress, depression, anxiety, aggression, absence of social support; and biochemical risk factors were high levels of TG, total cholesterol, LDL-cholesterol, and low HDL-cholesterol level.

Recommendations

Considering the increase in CAD risk factors, it is important to pay more attention to increase people's and health care team members' awareness about the modifiable risk factors that can have an effective role in preventing and better treatment of CAD, and promoting patients health. This could be achieved through health education programs targeting the modifiable risk factors; smoking, obesity, sedentary lifestyle, bad dietary habits and soul and mind peace, and to trained patients regarding these lifestyle changes. Also, routine screening of subjects above age of forty for early detection of medical and psychosocial upset for prevention and better control of CAD is recommended. Further, establishing a national program to target this problem is a priority. More studies on bigger samples of all ages, in addition to community based surveys to better understanding of the real epidemiology of CAD in Egypt are needed. Also, prospective studies are needed to clear the effects of modifying lifestyle in reducing the risk and prevalence of CAD.

Acknowledgment

The authors want to thank Professor Dr Mohamed Salah, MD Cardiology for his great assistance in the diagnosis and assessment of CAD studied patients for their candidates for cardiac surgery.

References

- Hajar R. Risk factors for coronary artery disease: Historical perspectives. *Heart Views*. 2017; 18(3):109-14.
- Williams RA. Cardiovascular disease in African American women: A health care disparities issue. *J Natl Med Assoc*. 2009; 101(6): 536-40.
- Barth J, Schneider S, von Känel R. Lack of social support in the etiology and the prognosis of coronary heart disease: a systematic review and meta-analysis. *Psychosom Med*. 2010;72(3):229-38.
- Leal J, Luengo-Fernández R, Petersen S, Rayner M. Economic burden of cardiovascular diseases in the Enlarged European Union. *Eur heart J*. 2006; 27(13):610-9.
- Mohan V, Deepa R, Shanthirani S, Premalatha G. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India. The Chennai Urban Population Study (CUPS No. 5). *J Am Coll Cardiol*. 2001;38(3):682-7.
- Ibrahim MM, Rizk H, Appel LJ, el Aroussy W, Helmy S, Sharaf Y, et al. Hypertension prevalence, awareness, treatment, and control in Egypt: Results from the Egyptian national hypertension project. *Hypertension*. 1995;26(6):886-90.
- Strik JJ, Denollet J, Lousberg R, Honig A. Comparing symptoms of depression and anxiety as predictors of cardiac events and increased health care consumption after myocardial infarction. *J Am Coll Cardiol*. 2003;42(10):1801-7.
- Lopez AD, Begg S, Bos ED. Demographic and epidemiological characteristics of major regions 1990-2001. Global burden of disease and risk factor. 2006;P.17-45.
- Mackay J, Mensah G. Global burden of coronary heart disease. In: *The Atlas of Heart Disease and Stroke*. 1st ed. Ann H editor. Geneva, WHO Publications, 2004; P. 46-8.
- WHOR (World Health Organization Rankings). Egypt, coronary heart disease. 2014.
- WHOR (World Health Organization Rankings). Egypt, coronary heart disease. 2013.
- Nozari Y, Hashemlu A, Hatmi ZN, Sheikvatan M, Iravani A, Bazdar A, et al. Outcome of coronary artery bypass grafting in patients without major risk factors and patients with at least one major risk factor for coronary artery disease. *Indian J Med Sci*. 2007;61(10):547-54.
- Hatmi ZN, Tahvildari S, GafarzadehMotlag A, Sabouri Kashani A. Prevalence of coronary artery disease risk factors in Iran: A population based survey. *BMC Cardiovasc Disord*. 2007;7:32.
- Rutledge T, Linke SE, Krantz DS, Johnson BD, Bittner V, Eastwood JA, et al. Comorbid depression and anxiety symptoms as predictors of cardiovascular events: results from the NHLBI sponsored Women's Ischemia Syndrome Evaluation (WISE) study. *Psychosom Med*. 2009;71(9):958-64.
- Bunker SJ, Colquhoun DM, Esler MD, Hickie IB, Hunt D, Jelinek VM, et al. Stress and coronary heart disease: psychosocial risk factors. *Med J Aust*. 2003;178(6):272-6.
- Albus C. Psychological and social factors in coronary heart disease. *Ann Med*. 2010;42(7):487-94.
- Mohan V, Deepa R. Risk factors for coronary artery disease in Indians. *JAPI*. 2004;52:95-7.
- Gaziano JM, Ridker PM, Libby P. Primary and secondary prevention of coronary heart disease. In: Braunwald's heart disease: A textbook of cardiovascular disease. Bonow RO, Mann DL, Zipes DP, and Libby P editor. 9th ed. Philadelphia, Saunders. 2012;P. 1010-33.
- Kasper DL, Fauci AS, Hauser S, Longo D, Jameson JL, Loscalzo J, et al. Coronary artery disease. In: *Harrison's Principles of Internal Medicine*.

- 19th Ed, 2015; Mc Graw Hill.
20. Janszky I, Ahnve S, Lundberg I, Hemmingsson T. Early-onset depression, anxiety, and risk of subsequent coronary heart disease: 37-year follow up of 49,321 young Swedish men. *J Am Coll Cardiol*. 2010;56(1):31-7.
 21. Stapelberg NJ, Hamilton-Craig I, Neumann DL, Shum DH, McConnell H. Mind and heart: Heart rate variability in major depressive disorder and coronary heart disease - A review and recommendations. *Aust N Z J Psychiatry*. 2012;46(10):946-57.
 22. Nabi H, Hall M, Koskenvuo M, Singh-Manoux A, Oksanen T, Suominen S, et al. Psychological and somatic symptoms of anxiety and risk of coronary heart disease: The health and social support prospective cohort study. *Biol Psychiatry*. 2010;67(4):378-85.
 23. Roest AM, Martens EJ, de Jonge P, Denollet J. Anxiety and risk of incident coronary heart disease: A meta-analysis. *J Am Coll Cardiol*. 2010;56(1):38-46.
 24. Khayyam-Nekouei Z, Yousefy A, Manshaee G, Nikneshan S. Comparing anxiety in cardiac patients' candidate for angiography with normal population. *ARYA Atheroscler*. 2011;7(3):93-6.
 25. Roohafza HR. Stress and heart. *ARYA Atheroscler*. 2012;2(2):60-1.
 26. Steptoe A, Kivimaki M. Stress and cardiovascular disease. *Nat Rev Cardiol*. 2012;9(6):360-70.
 27. Grundy SM, Becker D, Clark LT, Horn LV. Third report of the national cholesterol education program expert panel on detection, evaluation, and treatment of high blood cholesterol in adults. *Circulation*. 2002;106(25):314-21.
 28. Ram Rohit V, Trivedi Atul V. Smoking, smokeless tobacco consumption and coronary artery disease: a case control study. *Natl J Community Med*. 2012;3(2):264-8.
 29. WHO [World Health Organization]. Obesity: preventing and managing the global epidemic. Report of a WHO Consultation, WHO Technical Report Series. 2000;894:1-253.
 30. Ross R, Berentzen T, Bradshaw AJ, Snijder MB. Does the relationship between waist circumference, morbidity and mortality depend on measurement protocol for waist circumference? *Obes Rev*. 2008;9(4):312-25.
 31. The New York Heart Association (NYHA). NYHA Functional classification. At: 2017.
 32. El-Shinnawy HA. A study of the impact of stress in chronic illness on children and their parents. MD thesis in: Psychiatry. 2001.
 33. Henderson AS, Byrne DG, Duncan-Jones P. Neurosis and the social environment. New York: Academic Press, 1981.
 34. Kay S, Wolkenfeld F, Murrill L. Profiles of aggression among psychiatric patients. I. Nature and prevalence. *J Nerv Ment Dis*. 1988;176(9):539-46.
 35. Inzucchi SE, Bergenstal RM, Buse J, Matthews DR. Standards of medical care in diabetes – 2013. *Diabetes Care*. 2013;36(sup 1):11-66.
 36. Gupta S, Gupta VK, Gupta R, Arora S. Prevalence of risk factors in CAD patients. *J Preventive Cardiol*. 2012;1:164-72.
 37. Khayyam-Nekouei Z, Yousefy AR, Khayyam-Nekouei AR, Sadeqhi M. The relation between anxiety and quality of life in heart patients. *Health Inf Manage*. 2009;5(1):19-24.
 38. Khayyam-Nekouei Z, Yousefy AR, Manshaee G. Cognitive-behavioral therapy and quality of life: An experience among cardiac patients. *J Edu Health Promot*. 2012;1:2.
 39. Khayyam-Nekouei Z, Neshatdoost H, Yousefy A, Sadeghi M, Manshaee G. Psychological factors and coronary heart disease. *ARYA Atheroscler*. 2013;9(1):102-9.
 40. Lett HS, Blumenthal JA, Babyak MA, Sherwood A, Strauman T, Robins C, et al. Depression as a risk factor for coronary artery disease: evidence, mechanisms, and treatment. *Psychosom Med*. 2004;66(3):305-15.
 41. Yousefy A, Khayyam-Nekouei Z. Basis of Cognitive-Behavioral Trainings and its Applications in Recovery of Chronic Diseases. *Iran J Med Educ*. 2011;10(5):792-800.
 42. Bahnasawy MH, Habbak LZ, Al-Ashry MA, Al-Maie MM. Risk factors for coronary artery disease in Egyptian women. *Egypt J Hospit Med*. 2013;53:827-36.
 43. Ibrahim MM, Ibrahim A, Shaheen K, Nour MA. Lipid profile in Egyptian patients with coronary artery disease. *Egyptian Heart J*. 2013;65:79-85.
 44. Raymond R, Thabet SS, Refaat HM, Kader MA. Characteristics and in-hospital outcome of young Egyptian patients with coronary artery disease. *Egypt J Hypert Cardio Risk*. 2013;9:1-10.
 45. Jayachandra S, Agnihotram G, Rao RP, Murthy VCR. Risk-factor profile for coronary artery disease among young and elderly patients in Andhra Pradesh. *Heart India*. 2014;2(1):11-4.
 46. Taha M. Demographic profile and prevalence of risk factors among patients with coronary artery disease attending Bab El-Sheria University Hospital. Master Thesis in Community Medicine, Faculty of Medicine, Al-Azhar University, 2016.
 47. Hadaegh F, Harati H, Ghanbarian A, Azizi F. Prevalence of coronary heart disease among Tehran adults: Tehran lipid and glucose study. *East Mediterranean Health J*. 2009;15:157-66.
 48. Gupta R. Burden of coronary heart disease in India. *Indian heart J*. 2004;57:632-8.
 49. Schnohr P, Jensen JS, Scharling H, Nordestgaard BG. Coronary heart disease risk factors ranked by importance for the individual and community: a 21 year follow-up of 12000 men and women from the Copenhagen City Heart Study. *Eur Heart J*. 2002;23(8):620-6.
 50. Mohanan PP, Mathew R, Harikrishnan S, Krishnan MN. Presentation, management, and outcomes of 25748 acute coronary syndrome admissions in Kerala, India. *Eur Heart J*. 2013;34(2):121-9.
 51. Xavier D, Pais P, Devereaux PJ, Joshi P. Treatment and outcomes of acute coronary syndromes in India (CREATE): a prospective analysis of registry data. *Lancet*. 2008; 371(9622):1435-42.
 52. Yathish TR, Manjula CG, Deshpande SR, Gayathree L. A study on the association of coronary artery disease and smoking by a questionnaire method. *J Clinic Diagnos Res*. 2011;5(2):264-8.
 53. DiClemente CC, Lianov LS, Moeller SM, Williams J, Yoast RA. Healthier life steps: a clinician-patient guide from the AMA.
 54. Foroughi M, Ahranjani S, Ebrahimian M, Saieedi M. Coronary artery disease in Iranian young adults' similarities and differences. *OJEpl*. 2014;4:19-24.
 55. Fouad K, Rifaie O, Abo-Elala A. Assessment of the correlation between waist circumference and presence and severity of coronary artery disease in Egyptians. *Heart Mirror J*. 2012;6:160-5.
 56. Sekhri T, Kanwar RS, Wilfred R, Chugh P, Chhillar M, Aggarwal R, et al. Prevalence of risk factors for coronary artery disease in an urban Indian population. *BMJ Open*. 2014;4:e005346.
 57. Rafia R, Naumana A. Psychosocial factors as predictors of early onset ischemic heart disease in a sample of Pakistani women. *Internatl J Res Stud Psychol*. 2012;1(2):17-27.
 58. Jiang G, Wang D, Li W, Pan Y, Zheng W, Zhang H, et al. Coronary heart disease mortality in China: age, gender, and urban-rural gaps during epidemiological transition. *Rev Panam Salud Publica*. 2012;31(4):317-24.
 59. Kop WJ. Chronic and acute psychological risk factors for clinical manifestations of coronary artery disease. *Psychosom Med*. 1999;61(4):476-87.

60. Strike PC, Steptoe A. Psychosocial factors in the development of coronary artery disease. *Prog Cardiovasc Dis.* 2004;46(4):337-47.
61. Rozanski A, Blumenthal JA, Davidson KW, Saab PG, Kubzansky L. The epidemiology, pathophysiology, and management of psychosocial risk factors in cardiac practice: The emerging field of behavioral cardiology. *J Am Coll Cardiol.* 2005;45(5):637-51.
62. Kubzansky LD, Kawachi I. Going to the heart of the matter: Do negative emotions cause coronary heart disease? *J Psychosom Res.* 2005;48(4-5):323-37.
63. Frasure-Smith N, Lesperance F, Gravel G, Masson A, Juneau M, Talajic M, et al. Social support, depression, and mortality during the first year after myocardial infarction. *Circulation.* 2000;101(16):1919-24.
64. Chandola T, Britton A, Brunner E, Hemingway H, Malik M, Kumari M, et al. Work stress and coronary heart disease: what are the mechanisms? *Eur Heart J.* 2008;29(5):640-8.
65. Rozanski A, Blumenthal JA, Kaplan J. Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation.* 1999; 99(16): 2192-217.
66. Balog P, Janszky I, Leineweber C, Blom M, Wamala SP, Orth-Gomer K. Depressive symptoms in relation to marital and work stress in women with and without coronary heart disease- The Stockholm Female Coronary Risk Study. *J Psychosom Res.* 2003;54(2):113-9.
67. Rudisch B, Nemeroff CB. Epidemiology of comorbid coronary artery disease and depression. *Biol Psychiatry.* 2003;54(3):227-40.
68. Jiang W, Krishnan RR, O'Connor CM. Depression and heart disease: evidence of a link, and its therapeutic implications. *CNS Drugs.* 2002;16(2):111-27.
69. Alboni P, Favaron E, Paparella N, Sciammarella M, Pedaci M. Is there an association between depression and cardiovascular mortality or sudden death? *J Cardiovasc Med.* 2008;9(4):356-62.
70. Shibeshi WA, Young-Xu Y, Blatt CM. Anxiety worsens prognosis in patients with coronary artery disease. *J Am Coll Cardiol.* 2007;49(20): 021-7.
71. WHO [World Health Organization]. Obesity and overweight. 2013.
72. Achari V, Thakur AK. Association of major modifiable risk factors among patients with coronary artery disease: A retrospective study. *J Assoc Physicians India.* 2004;52:103-8.
73. Burman A, Jain K, Gulati R, Chopra V, Agarwal DP, Vasisht S. Lipoprotein (a) as a marker of coronary artery disease and its association with dietary fat. *J Assoc Physicians India.* 2004;52:99-102.
74. Waly HM, Elayda MAA, Lee V-V, El-Said G, Reul GJ, Hall RJ. Risk factor analysis among Egyptian patients who underwent coronary artery bypass surgery. *Tex Heart Inst J.* 1997;24(3):204-8.