Coronary Artery Disease in Overweight and Obese Women in Gaza- Palestine: An Observational Study

Amal Jamee[1,*], Yehia Abed[2]

[1]AL Shifa Hospital, Cardiology department, Gaza, Palestine
[2]Al Quds University, Faculty of Public Health, Gaza, Palestine
*Corresponding author: dr_amal08@yahoo.fr

Abstract Coronary artery disease risk factors are increasing worldwide, the increase is more prominent among young women due to increase of unfavorable coronary risk factors mainly related to increase in Body mass index rates(BMI). Coronary events predominate in obese women with other associated coronary risk factors. Increase BMI increases risk of fatal or non-fatal coronary events 1.5 to 3 times. Our study aimed to identify risk factors for coronary artery disease among obese and overweight Palestinian women, to plan for interventions policies. The study design is an observational based on 500 overweight and obese women (BMI greater than or equal 25 kg/m^2). Coronary angiography was performed for all the study population, and revealed 250 patients with approved CAD, the rest of the study population consist of 250 cases with normal coronary. Socio demographic data, traditional cardiovascular risk factors, blood glucose, hemoglobin and clearance creatinine measurement were collected. We excluded all patients with history of prior cardiac surgery or percutaneous coronary intervention. Statistical analysis was performed using SPSS version 20.0. Our findings indicate that the mean age for cases is (63.5 ±8.7) vs. (58.2±9.8) for control and the difference is statically significant (Pvalue= 0.001). Other risk factors include rise of systolic and diastolic blood pressure, high blood sugar and impaired clearance creatinine are present in overweight and obese women with documented coronary artery disease. Regression analysis shows that advancing ages, and diabetes, are the main factors for development of coronary artery disease in obese women. **Conclusion:** Diabetes Mellitus is the major risk factor for the development of CAD and measures to control diabetes will minimize the chances of CAD among overweight and obese women in Palestine.

***Keywords:** women, coronary artery disease, overweight, obesity, diabetes, gaza*

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1. Introduction

Coronary artery disease (CAD) is a leading cause of cardiovascular mortality in Palestine and others developing countries [1,2]. Females in Gaza are about 49.2% of the population [2]. The Cardiovascular disease (CVD) has become number one killer of women in United States and one of two females die of heart disease or stroke compared with one in 25 females who die of breast cancer [3]. The rate of public awareness of CVD, as the leading cause of death in females has doubled between 1997and 2005 from 30% to 55% [4]. Most cardiovascular events in female are caused by coronary disease. The older age, at onset of CVD in female correlates, with an increase in co morbidity, resulting in mortality increase [5]. The National Institute of Health (NHI) and WHO define individuals with BMI values between 25 and 29.9 kg/m^2 as overweight and those with BMI $\geq$ 30 as obese, by these criteria 65% of the world`s population live in countries where obesity and overweight kills more people than underweight [6]. In 1997, the WHO introduced obesity in women as one the major health problems in many countries [7]. Obesity is still an independent risk factor for CAD mortality in female and is associated with numerous co morbidities. For this reason, it should be aggressively treated [8]. The prevalence of obesity is increasing rapidly worldwide across all ages, race and educational levels [9]. The mounting epidemic of obesity has major public health implication, because excess weight is associated risk of disease such as type 2 diabetes mellitus, hypertension and cardiovascular disease [10]. Obesity has been shown to be associated with an increased risk of CAD in female [11,12]. In a number of cohort studies, increase body weight or body mass index (BMI) increases the risk of fatal or non-fatal coronary event 1.5 to 3.0 times in female [13]. Obesity has been implicated in the pathogenesis of CAD, congestive heart failure, stroke, arrhythmias and sudden cardiac death [14]. For every 1kg/m^2 in BMI, the risk for heart failure increase 5% in male and 7% in female, obesity is independent risk factors for the development and progression of sub clinical target organ damage [15]. Information from the Framingham heart study identifies that any initial manifestation of CAD occur about 10 year later for female than male[16,17].

In the present study, we investigate the prevalence of CAD in obese and overweight women, and describe the most common risk factors associated with CAD.

2. Methodology

Eight hundred women with clinical symptom related to coronary artery disease were examined in private center of coronary angiography (ALHAYAT Center) during the years 2010 - 2013. The women were examined clinically, underwent resting electrocardiogram and echocardiography. BMI is calculated as weight (kg) /high (m^2). According to National Institutes of Health (NIH) and WHO guidelines values between 25 and 29.9 kg/m^{2}are considered overweight and greater than 30kg/m2 are obese. Both obese and overweight women were considered. In this study, we included all cases presented to the center to perform coronary angiography for the first time therefore we excluded all patients with history of prior cardiac surgery or percutaneous coronary intervention. These examinations revealed 500 positive cases with overweight or obesity among women for which coronary angiography were performed. CAD was defined as coronary stenosis more than 50% in at least one vessel in angiography. A total of 250 overweight and obese women were found to have documented CAD, and the control group consists of 250 overweight and obese women with normal coronary. Data on traditional risk factors includes age, Hypertension, Diabetes, cigarette smoking, family history of coronary artery disease, systolic and diastolic blood pressure, Dyslipedemia, fasting blood glucose, hemoglobin and clearance creatinine level were measured in all study population. Clearance creatinine is calculated according to Cockgroft-Gault equation (140-age) ×weight (kg) / 72xserum creatinine (mg/dl) multiply by 0.85. The ethical committee (Helsinki) in Gaza approved this study. Student`s t test and chi square test were used to compare values between the two groups of normal and coronary subjects. Logistic regression analysis was performed to determine the independent predictor of CAD. Pvalue less than 0.05 were considered as significant. Analyze were performed using statistical package SPSS software version 20.0.

3. Results

Characteristics of the study population and comparison of means between coronary patients and controls are summarized in (Table 1). The mean age in study population is 60.8years, the mean age of patients with CAD tends to be higher than control group (63.5years vs. 58.2years) and the difference between the two means reaches statistical significant level (Pvalue < 0.001). There is no difference in the mean BMI between the two groups indicating that the severity of obesity was the same keeping in mind that originally the 2 groups are obese or overweight. Systolic blood pressure and diastolic blood pressure tend to be higher in subject group than control group and this difference is statically significant (Pvalue < 0.001). Minor differences are reported in mean hemoglobin, and serum level of cholesterol between two groups, while patients with coronary artery disease have

statistically significant higher serum level of triglycerides and fasting blood glucose than patients with normal coronary. However, CAD Subjects have impaired clearance creatinine than control group and this difference is statically significant (0.003).

Table 1. Characteristics of the study population Comparison of the means between two groups

	CAD Subject (N = 250)	CAD control (N = 250)	P value
Age (y)	63.48 ± 8.7	58.20 ± 9.8	0.001
BMI (kg/m^2)	35.18 ± 5.4	35.64 ± 6.3	0.391
SBP mmhg	149.3 ± 19.9	142.5 ± 21.7	0.001
DBP mmhg	83.4 ± 9.8	81.3 ± 11.3	0.014
Hemoglobin (g/dl)	11.7 ± 1.3	11.8 ± 1.2	0.507
Cholesterol (mg/dl)	197.2 ± 53.1	191.6 ± 43.9	0.451
Triglyceride (mg/dl)	219 ± 111	186 ± 99.3	0.031
FBS (g/dl)	170.6 ± 70.2	144.2 ± 57.6	0.001
Clearance create(mg/dl)	94.9 ± 51.9	108.7 ± 51.4	0.003

To continue the summary of our estimations we conclude in (Table 2) that 83.2% of the study population has BMI more than 30kg/m^2 vs. 16.8% were overweight. The analysis of age group, showed the higher rate of CAD prevalence, in population with age group older than 60years (62%) compared to (38%) in patients with normal coronary, this difference is statically significant (Pvalue < 0.001). The chance of getting CAD in the older group is 3 times higher than the young people (OR = 0.34). In addition, our data shows that 60.8% of overweight and obese women have diabetes, and 57.9% of them were diagnosed CAD vs. 42.1%with normal coronary, with a risk of 2.3 times higher among diabetic and these differences are statistically significant (p value <0.001). Hypertension is found in 82.8% of the study population with 52.9% in subject group vs. 47.1% in control group, with a OR of 1.99, the differences is statically significant (Pvalue < 0.004). Menopause is found among 54.8% of subject group vs. 45.2% in control group and our data found that menopause women have the chance 3.6 times to develop CAD. In addition our findings demonstrate that chances of CAD was two folds higher among patients with impaired creatinine clearance (p value <0.001), clearance creatinine is impaired because 60.8% of study population were diabetics and as known diabetic's patients develop early diabetic nephropathy.

Also 62.6% of study populations are anemic. However, minor difference is observed in hemoglobin level, cholesterol level, triglyceride level and family history of coronary artery disease between the two groups but does not reach statistical significant level. Smokers are reported as 1.4% in the study population and it is worthy to mention that smoking is not socially accepted for women in Gaza.

All the variables proved to have statistical significance association with the occurrence of CAD are included as independent variables in the logistic regression analysis demonstrated in (Table 3) and the results in this study shows that among the entire measured variable in the model, advancing age, and diabetes were independent predictors of CAD in overweight and obese women.

Table 2. Risk factors of study population distributed by presence or absence of CAD

	CAD Subject (N = 250)		CAD control (N = 250)		Total		OR CI 95%	P value
	NO	%	NO	%	NO	%		%
Age group								
33-60y	82	35.8	147	64.2	229	45.8	0.34(0.2-0.5)	0.00
60y and more	168	62	103	38	271	54.2		
Body mass index								
Overweight(BMI25-29.9)	42	50	42	50	84	16.8	1(0.6-1.6)	1.00
Obese (BMI>30)	208	50	208	50	416	83.2		
Hypertension								
Yes	219	52.9	195	47.1	414	82.8	1.99(1.2-3.2)	0.04
No	31	36	55	64	86	17.2		
Diabetes								
Yes	176	57.9	128	42.1	304	60.8	2.3(1.6-3.3)	0.00
No	74	37.8	122	62.2	196	39.2		
Menopause								
Yes	230	54.8	190	45.2	420	84	3.6 (2.1-6.2)	0.00
No	20	25	60	75	80	16		
smoking								
Yes	3	42.9	4	57.1	7	1.4	0.74 (0.2-3.3)	0.70
No	247	50.1	246	49.9	493	98.6		
Family history of CAD								
Yes	69	56.1	54	43.9	123	24.6	1.3 (0.2-2.0)	0.12
No	181	48.1	196	52	377	75.4		
Haemoglobine level								
Hb<12g/dl anemic	157	50.2	156	49.8	313	62.6	1.0 (0.8-1.5)	0.93
Hb≥12g/dl not anemic	93	49.7	94	50.3	187	37.4		
Clearance creatinine								
impaired	126	60.6	82	39.4	208	41.6	2.0 (1.4-2.9)	0.00
normal	124	42.5	168	57.5	292	58.4		
Triglyceride level								
TG<150	22	37.3	37	62.7	59	32.1	0.6(0.3-1.2)	0.17
TG≥150	60	48.0	65	52.0	125	67.9		
Cholesterol level								
Ch <200	43	39.8	65	60.2	107	58.4	0.6(0.34-1.1)	0.10
Ch ≥200	40	51.9	37	48.1	77	41.6		

Table 3. Logistic regression analysis with coronary artery disease as dependent variable And other risk factors as independent variables

Variable	B	P value	OR (95%CI)
Age group	0.942	0.000	2.7 (1.7-3.9)
Diabetes group	0.758	0.000	2.1(1.4-3.2)
Clearance creat	0.295	0.162	1.3 (0.9-2.0)
Hypertension	0.215	0.432	1.2(0.7-2.1)
constant	-1.906	0.000	

4. Discussion

Prospective studies that have reported follow up data over more than two decades such as Framingham study, Manitoba, and Harvard of public health nurse have documented that obesity is independent predictor of CAD [11,18]. The impact of obesity on the development of CAD appears to be greater in female than male [18]. Raised BMI is a great public health concern, as it is associated with a number of non-communicable diseases such as, Hypertension, Diabetes, Dyslipedemia and CVD [6,19,20]. Obesity exacerbates CVD through a variety of mechanism including systemic inflammation, hypercoagulability, and activation of the sympathetic million adults die each year of being overweight or obese, in addition 44% of diabetes and 23% of ischemic heart disease are attributed to overweight and obesity [6]. In Framingham study, obesity increased the relative risk of CAD by 64% in females opposed to 46% in men [18]. In a study in urban Palestinian population, the prevalence of obesity was41 % (49%in female, 30% in male) [23].

To our knowledge there is no prior study in Palestine has evaluated whether a greater burden in overweight and obese individual may be a risk marker for CAD. This study showed that 82.8%, 60.8% were hypertensive and diabetics respectively. This results is the same found in Palestine 2013 in patients with CAD which showed high prevalence of hypertension and diabetes in women than men, 74.3% of female were hypertension vs. 55% male and 65.7%of female were diabetics compared to 48.3% male [24]. In Framingham, study obese persons have 3.5-fold increased chance of having Hypertension, and 64% of hypertension cases in female were attributed to obesity [25,26]. Another study in southeast Scotland in 2005 estimated that 85% diabetics had BMI over 25kg/m^2 [27]. In the Nurse`s health study involving more than 120,000 middle- aged women, the risk of CAD was twice as high in mildly to moderately overweight women (BMI:25-28.9) as in very thin women (BMI<18.5), even after accounting for the influence of other risk factors [11]. Our study indicates the increasing age, diabetes are the only predictors of CAD in overweight and obese population. While other major risk factors, as hypertension, menopause and clearance creatinine are higher in patients

with CAD than group with normal coronary. Our finding come in according with a data in a study in Iran (2006) about CAD in overweight and obese women showed that increasing age and diabetes were the most predictor's factors [28].

5. Conclusion

According to the results of this study, CAD in overweight and obese patients was associated with certain risk factors especially diabetes, and older subjects. Weight reduction is a key strategy for simultaneous improvement in global cardiovascular risk with improvement in quality of life. Our study highlighted the importance of proper management of diabetes mellitus to minimize the chances of occurrence of CAD in obese women. Such measure need to be integrated in primary health care and at different community levels.

Competing Interests

The authors declare that they have no competing interests.

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