

Original Article

The Association between Socio–Economic Factors and Coronary Artery Disease in Yazd Province: a Case-control Study

Mohammad Hasan Lotfi¹, Fatemeh Amiri^{* 2}, Seyed Khalil Forouzannia³, Hossein Fallahzadeh⁴, Haniyeh Shekari⁵

¹ Department of Biostatistics and Epidemiology, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

² MSc Student of Epidemiology, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

³ Department of Cardiovascular Surgery, Afshar Hospital, Shahid Sadooghi University Of Medical Sciences, Yazd, Iran

⁴ Department of Biostatistics and Epidemiology, Shahid Sadoughi University Of Medical Sciences, Yazd, Iran

⁵ B.S in Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

Received: 2014/9/19

Accepted: 2014/11/8

Abstract

Introduction: This study was conducted in Yazd province to investigate the relation between socio-economic factors and CAD.

Materials and Methods: This retrospective case-control study based on hospital was performed from January 2011 to October 2012 in Yazd province. The total sample size achieved from the statistical software was 500 patients (n=250 in case and n=250 in control group). The data were collected using a questionnaire (face to face interviews), laboratory and anthropometric measurements and physical examination. To analyze the results, statistical tests such as chi-square, student T-test and Conditional Multiple Logistic Regression were conducted.

Result: Elementary education and total family monthly income <500 thousand Tomans were considerably higher in the case group than the control group. Moreover, the frequency of families with rural insurance and with >6 member in the case group was statistically and significantly higher. After checking the simultaneous effect of socio–economic variables in the logistic regression model, elementary education still showed a significant relation (OR=10.462, 95%CI: 1.68-65.33). Also the findings indicate that families with 700,000-1,000,000 Tomans of monthly income were in lower risk of getting CAD (OR=0.275, 95%CI: 0.078- 0.97). In addition, the risk of getting CAD in city residents was 9.3 (95%CI: 1.220-71.041) times higher than that of rural residents.

Conclusions: Overall, it seems that urbanization, poor education and low income can play a role in the causation of CAD in Yazd province. So for the prevention of CAD, promoting healthy lifestyles, alleviating poverty, increasing knowledge about CAD risk factors and national policy changes seem to be necessary.

Keywords: Socio–economic status, CAD, case-control, Yazd Province

* Corresponding author; Tel : 351-8203410-11 E-mail: fatemeh.amiri42@yahoo.com

Introduction

One of the strongest and most consistent predictors of morbidity and mortality of an individual is socio-economic status (SES) ^[1]. Systematic differences in prevalence or incidence of health problems can be due to socio-economic inequalities in the field of health. SES is specified by levels of education, occupational class and income ^[2]. Although all SES levels are related to each other, each of them reflects a different individual. For example, income reflects affordability, housing, diet and medical care; or occupation indicates responsibilities; or physical activity and occupational exposures and education show necessary skills for acquiring positive psychological and socio-economical resources ^[1]. Socio-economic and health status have become a research priority for National Institute of Health and Sciences Foundation of Europe. Coronary artery disease (CAD) is the most prominent and important disorder caused by socio-economic inequality in developed countries such as the United Kingdom, the United States of America and other countries ^[3,4]. The most common cardiovascular disease is CAD which is due to artery stenosis caused by cholesterol and fat deposition in Vessels ^[5] and from the standpoint of economic issues, it is considered the most important disease in the world by 2020 ^[6]. Like other non-communicable diseases, CAD is rapidly becoming a major cause of mortality in the developing world ^[7]. It is one of the main causes of death in aging so that it claims 80%

of the cause of death in patients above 65 years ^[8]. According to (WHO), in the United States of America, about 1.6 millions of deaths are due to cardiovascular disease (30% of all deaths). It is estimated that 54% of deaths from non-communicable diseases in the Eastern Mediterranean Region is due to cardiovascular disease ^[9]. Heart disease in Iran, specifically CAD, is presented as the first and most common cause of death in all ages and both sexes ^[10].

In the past 40 years, studies conducted in developed countries have shown a significant inverse association between the incidence of and mortality from cardiovascular disease (mostly CAD) ^[11]. For instance, some of these studies include studies done in America (12, 13), Finland (14), France (15) and the Netherlands (16), which have shown that the risk of coronary artery disease is associated with poor socioeconomic status (income and low education level). However, studies in developing countries have failed to demonstrate such an association, so that the prevalence is higher in the upper and middle class of socio-economic groups ^[12]. Studies by Lotfi in East Delhi (18) and Singh in north India (19), represents this results. So the impact of socio-economic factors (SEF) varies in developed and developing countries. This paradox is because of different stages of epidemiological and economic transition in different countries ^[13]. But in Iran, studies showed different results with developing

countries. Descriptive studies in the city of Tabriz (2) and Qazvin(21) showed that most patients have lower levels of education and income and also majority of deaths from this disease is associated with low socioeconomic status. A same study with present study that was conducted in Tehran with a smaller sample size, showed the same results with developed countries ^[22]. CAD is the most common cause of death, thus attempts to control and prevent it can reduce mortality. On the other hand, SEF are one of the most important items in CAD etiology and prevention. Therefore, we assessed the impact of SEF on CAD in Yazd province.

Materials and Methods

This retrospective case-control study based on hospital was performed from January 2011 to October 2012 in Yazd province. The case group included both men and women >25 years of age, residing in Yazd province, admitted in the cardiology or CCU ward of Hospital, with angiographically proven CAD (the disease was recorded in the medical record as CAD) or (myocardial infarction) MI or CABG (Coronary Artery Bypass Graft). Patients admitted in other wards of the hospital and with normal angiography were used as the control group. They were randomly assigned and matched for age and sex. Inclusion criteria for controls were those without a previous history of CAD, MI, CABG or other similar diseases such as arrhythmia.

Exclusion criteria for both groups were non-native individuals, pregnant women and patients with chronic debilitating systemic diseases (like cancers). Considering the significance level of 5% and a study power of 80% and according to previous studies that have reported an odds ratio (OR) of at least 2.1, overall, the total sample size achieved from statistical software was 500 patients (n=250 in case and n=250 in control group). The members of both groups were selected by convenience sampling from Afshar, Shahid Sadoughi and Seyedoshohada hospitals. The data were collected using a questionnaire (face to face interviews), laboratory and anthropometric measurements and physical examination. The validity of the questionnaire was confirmed by 3 cardiologists. To assess reliability, 30 participants completed the questionnaire as pilots and the data were collected. Next Cronbach's alpha was measured for the intended questions which was equal to 76%. The questionnaire included questions about demographic characteristics such as age, sex, marital status, SEF including education, occupation, income, insurance type, family size, accommodation, physical examination; anthropometric measurements such as height, weight, body mass index (BMI), blood pressure and clinical findings like total cholesterol, fasting blood sugar (FBS), low-density lipoprotein (LDL), High-density lipoprotein (HDL), Triglycerides (TG). After collecting the data, statistical tests such as chi-square and student T-test were applied by

SPSS v.16. To determine the SEF predicted CAD, Conditional Multiple Logistic Regression and related OR with corresponding 95% confidence level were used.

Results

There were 159 (63.6%) men and 91 (36.4%) women in each group. In terms of CAD, no significant difference was found between the sexes ($p > 0.05$). Subjects in case and control groups were mostly married (89.2% and 92.8%, respectively) and a few were single, divorced or widow. In both groups, the most frequent age group was 60-51 years (40.4% in case and 44% in the control

group) and the least frequent age group was 30-40 years (3.2% in case and 4.8% in the control group). Tests results of the association between SEF and CAD with Unadjusted OR are shown in Table 1. According to the Table, variables including family size, insurance type, education and total family monthly income are significantly associated with CAD; but no other variables ($p < 0.05$). In terms of family size, most individuals in the case group lived in large families (>6 members) but in the control group, the highest frequency was for families with 4-6 members and large families were in the second priority.

Table 1. Socio-economic data in cases & control

Variable	case	control	OR(95% CI)	P-value
	Frequency (%)	Frequency(%)		
Family size				
1-3	7 (3)	8 (3.2)	1*	0.01
4-6	85 (35.9)	121 (48.8)	0.8 (0.28-2.29)	
>6	145 (61.2)	119 (48)	1.39 (0.49-3.95)	
Living areas				
Rural	41 (16.4)	28 (11.3)	1*	NS**
Urban	209 (83.6)	220 (88.7)	0.65 (.38 – 1.08)	
building owner				
Yes	244 (97.6)	240 (96)	1*	NS**
No	6 (2.4)	10 (4)	0.59 (0.211-1.65)	
No. of cars in household				
None	90 (37)	77 (31.2)	0.668 (.188-2.36)	NS**
1	146 (60.1)	166 (67.2)	0.503 (.144-1.75)	
2	7 (2.9)	4 (1.6)	1*	
Insurance coverage				
Medical services	38 (15.6)	43 (17.4)	1*	0.004
Social security	141 (57.8)	140 (56.7)	1.14 (0.69-1.87)	
Military services	8 (3.3)	8 (3.2)	1.13 (0.39-3.31)	
Rural	21 (8.6)	4 (1.6)	5.94 (1.87-18.85)	
Other	28 (11.5)	47 (19)	0.67 (0.35-1.28)	
No insurance	8 (3.3)	5 (2)	1.81 (0.55-6.008)	
Education				
Illiterate	74 (28.9)	64 (25.6)	1.66 (0.91-3.06)	0.04
Primary	98 (39.5)	80 (32)	1.76 (0.98-3.18)	
High school	27 (10.9)	27 (10.8)	1.44 (0.69-3.01)	
Diploma	24 (9.7)	43 (17.2)	0.804 (0.394-1.64)	
Above Diploma	25 (10.1)	36 (14.4)	1*	
Dominant Occupation				
Unemployed	5 (2)	4 (1.6)	1.42 (0.37-5.49)	

Housekeeper	83 (33.3)	78 (31.2)	1.21 (0.77-1.89)	NS**
Simple worker	29 (11.6)	31 (12.4)	1.06 (0.58-1.94)	
Technician	65 (26.1)	61 (24.4)	1.21 (0.748-1.49)	
Employee	67 (26.9)	76 (30.4)	1*	
Time work				
Unemployed and Retired	89 (44.9)	87 (39.7)	1*	
≤8	56 (28.3)	74 (33.8)	0.74 (0.47-1.16)	NS**
9-12	42 (21.2)	46 (21)	0.89 (0.53-1.49)	
>12	11 (5.6)	12 (5.5)	0.89 (0.37-2.139)	
Total family income				
<500000	80 (32)	58 (23.2)	1.52 (0.88-2.62)	
500000-700000	77 (30.8)	70 (28)	1.21 (0.71-2.07)	0.03
700000-1000000	53 (21.2)	78 (31.2)	0.747 (0.43-1.29)	
>1000000	40 (16)	44 (17.6)	1*	

*Reference category

**None significant

In both groups, most patients had elementary education. But in the control group, the percentage of Diploma and above was higher than that of the case group. As can be seen the difference in education levels between the groups was statistically significant. The results showed that total family income for most subjects in the case and control groups was respectively less than 500,000 and 700,000 - 1000,000 Tomans in month. According to the Unadjusted OR with increasing income levels the risk of getting CAD will be lower. Frequency percentage of various insurances, except the rural insurance,

in the two groups was almost the same. Frequency percentage of rural insurance in cases was more than that of the controls so that the risk of disease in subjects with rural insurance was 5.94 times more than that in subjects with health insurance. To evaluate the simultaneous effect of socio-economic variables, a logistic regression model (step-wise regression analysis) was used whose results with adjusted OR are shown in Table 2. According to Table 2, after adjustment of confounding factors, education and total family monthly income remained significant.

Table 2. Impact of multiple risk factors using logistic regression models adjusted

Variable	Coefficient	Adjusted OR	95% CI	P-value
Education				
Illiterate	$\beta_1 = 1.726$	5.621	.586- 53.948	NS**
Primary	$\beta_1 = 2.348$	10.462	1.675- 65.344	.012
High school	$\beta_1 = 1.003$	2.727	.416- 17.898	NS**
Diploma	$\beta_1 = .056$	1.057	.199- 5.609	NS**
Above Diploma	-	1*	-	-
Residence				
Rural	-	1*	-	-
Urban	$\beta_1 = 2.231$	9.311	1.220-71.041	.031
Income				
<500000	$\beta_1 = -.280$.756	.152- 3.768	NS**
500000-700000	$\beta_1 = -.351$.704	.153- 3.232	NS**
700000-1000000	$\beta_1 = -1.292$.275	.078- .967	.044
>1000000	-	1*	-	-

*Reference category

**None significant

In the present study, we observed a significant inverse association between education levels and CAD so that the odds of getting CAD in subjects with elementary education were 10.462 times higher than those who had higher than Diploma degrees. The findings indicate that city residents toward rural's were in a higher of CAD (9.3 times more). Families with 700,000-1000, 000 Tomans of monthly income were in lower risk of getting CAD (OR =0 .275).

Discussion

The aim of this study was to investigate the association between socio-economic factors and CAD, a hospital-based case-control method conducted in Yazd province. In order to evaluate the major factors contributing to the disease, case and control groups were matched for age and sex.

In most studies, the factors considered for the evaluation of SES were educational level, occupation and income. In the present study, in addition to the mentioned variables, insurance type, family size, working hours, housing status (owned, leased) and place of residence (rural and urban) were also investigated. Since several studies have shown that variables such as BMI, blood pressure and clinical findings like total cholesterol, FBS, LDL, HDL and TG are independent risk factors for CAD, to evaluate the effect of socio-economic factors, we considered these variables on the model and adjusted their effect.

After adjustment of confounding variables by logistic regression models, education level and total family monthly income remained significant. Furthermore, residence also showed a significant association with CAD.

In the present study, we observed a significant inverse association between education levels and CAD. Therefore, those with elementary education had greater odds of getting CAD than those who had higher than Diploma degrees (OR = 10.462). This finding is in agreement with that of several studies [1, 14-17]. As well, Hardarson found an inverse association between education level and mortality from CAD. Thus, the 14% reduction in CAD mortality has been reported for men who have high school education versus those with primary education level [18]. However, contradictory results were found in some studies. Lotfi, Chadha and Singh found a significantly direct relation and showed that subjects with graduate and post graduate education have higher odds for getting CAD [19-21], while Sezavar in a case-control study, did not observe a significant association between MI in subjects <45 years old and education level [22]. As a reason for the inverse relation between education level and CAD, it can be noted that knowledge and education level regarding risk factors, and consequently the selection of a healthy lifestyle in subjects with higher education may be partially responsible for lower incidence of CAD in these classes.

Several studies reported conflicting results, so that in some studies it was observed that the risk of getting CAD was higher in individuals who had professional jobs [19-21]. Some studies have also shown that the risk of death due to cardiovascular disease in farmers was 9.1 times more than that of managers and lawyers [3, 23, 24]. In this study, no significant association was observed between occupation and getting CAD which is likely due to factors attributable to occupation such as exertional activity and disease concomitant and also the psychological condition.

In this study, the odds of getting CAD in city residents were 9.3 times higher than those of rural residents; so urbanization is a risk factor for CAD. This finding is consistent with several studies in developing countries [25, 26]. In addition, other studies showed that the prevalence of the disease in rural areas is lower compared with urban areas, but an increasing trend can be seen [27]. Similar results have been reported from developed countries [26]. Due to rapid industrialization and urbanization, these patterns may exist because of diet and lifestyle changes.

The results of this study showed that the risk of getting CAD in individuals with higher incomes is lower so that high income is considered as a protective factor. Kivimaki and Yarnell found similar results [14, 28]. However, in some studies the results suggest the risk of getting CAD in individuals with higher income [19-21]. Lammintausta et al. in their study also showed that the ratio of

coronary heart disease mortality among men and women 35-64 years of age was higher in those with higher incomes [29]. In order to explain the inverse relation between income and risk of getting CAD one can say that a higher education level can improve the income and subsequently the economic situation of an individual.

The limitation of this study was that some questions such as income level may have been answered incorrectly due to social and cultural reasons. In addition, some patients did not cooperate in answering.

Conclusions

Overall, it seems that poor education, low income and urbanization can play important roles in causation of CAD in Yazd province. In fact, the relation between socio-economic factors and CAD in Yazd province is similar to that of developed countries which means that individuals with lower education and income are in higher risk. But, this pattern is different in developing countries where the prevalence of CAD among high and moderate socio-economic levels is higher than lower ones. This paradox is because of different stages of epidemiological and economic transition in different countries. In this context it could be possible that our country tends to developed countries. So for prevention of CAD, promoting healthy lifestyles, alleviating poverty, increasing knowledge about CAD risk factors and national policy changes seem to be necessary. To achieve more complete

and comprehensive results regarding SEF associated with CAD in our country, we suggest performing similar studies in other cities thereby designing a meta-analysis.

We are grateful to the staff of angiography, cardiology, CCU and archived wards in Afshar and Shahid Sadughi hospital and to all the patients involved.

Acknowledgements

References

1. Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *American journal of public health*. 1992; 82(6):816-20.
2. Janati A, Matlabi H, Allahverdipour H, Gholizadeh M, Abdollahi L. Socioeconomic Status and Coronary Heart Disease. *Health Promotion*. 2011;1(2):105-10.
3. Marmot MG, Shipley MJ, Rose G. Inequalities in death—specific explanations of a general pattern? *The Lancet*. 1984; 323(8384):1003-6.
4. Steptoe A, Marmot M. The role of psychobiological pathways in socio-economic inequalities in cardiovascular disease risk. *European Heart Journal*. 2002; 23(1):13-25.
5. Vardan S, Mookherjee S, Sinha A. Special features of coronary heart disease in people of the Indian sub-continent. *Indian heart journal*. 1995; 47(4):399.
6. Nouhi A, Abdolkarimi M, Rezayian M. Quality of life and its relation to stress and coping strategies in patients with coronary artery disease. *Journal of Rafsanjan University of Medical Sciences*. 2012; 2(10):127-37.
7. Vorster H, Kruger A, Venter C, Margetts B, Macintyre U. Cardiovascular disease risk factors and socio-economic position of Africans in transition: the THUSA study. *Cardiovascular journal of Africa*. 2007;18(5):282.
8. Rosamond W, Flegal K, Furie K, et al. American heart association statistics committee and stroke statistics subcommittee. Heart disease and stroke statistics—2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee *Circulation*. 2008; 117(4):e25-e146.
9. WHO. Cardiovascular diseases: Health topics. 2012. Available from: <http://apps.who.int/gho/data/?vid=2490>.
10. Hosseini SA, Salehi A. The relationship between coronary risk factors and coronary artery involvement based on angiography findings. *Koomesh*. 2012;14(1):7-12.
11. Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. *Circulation*. 1993;88(4):1973-98.
12. Gupta R, Gupta V, Ahluwalia N. Educational status, coronary heart disease, and coronary risk factor prevalence in a rural population of India. *BMJ: British Medical Journal*. 1994;309(6965): 1332–6.

13. Lotfi M, Kannan A, Sundaram SDK. The role of adverse lifestyle changes in the causation of coronary artery disease. *Acta Medica Iranica*. 2008; 46(2):763-9.
14. Yarnell J, Yu S, McCrum E, et al. Education, socioeconomic and lifestyle factors, and risk of coronary heart disease: the PRIME Study. *International Journal of Epidemiology*. 2005;34(2):268-75.
15. Pourreza A, Barat A, Hosseini M, et al. Related to socio - economic factors in patients with coronary artery less than 45 years, the heart hospital: case - control study. *School of Hygiene and Public Health*. 2009; 4(7):25-32.
16. Rosvall M, Engström G, Hedblad B, Janzon L. The role of preclinical atherosclerosis in the explanation of educational differences in incidence of coronary events. *Atherosclerosis*. 2006;187(2):251-6.
17. Smith GD, Hart C, Hole D, et al. Education and occupational social class: which is the more important indicator of mortality risk? *Journal of epidemiology and community health*. 1998;52(3):153-60.
18. Hardarson T, Gardarsdottir M, Gudmundsson K, et al. The relationship between educational level and mortality. The Reykjavik Study. *Journal of internal medicine*. 2001;249(6):495-502.
19. Lotfi MH, KannanAnjur T, Dwivedi S, et al. The Role of Socio-economic Indicators in the Causation of Coronary Artery Disease. *Acta Medica Iranica*. 2009; 47(4):301-7.
20. Singh RB, Niaz MA, Thakur AS, et al. Social class and coronary artery disease in a urban population of North India in the Indian Lifestyle and Heart Study. *International journal of cardiology*. 1998;64(2):195-203.
21. Chadha S, Radhakrishnan S, Ramachandran K, et al. Epidemiological study of coronary heart disease in urban population of Delhi. *The Indian journal of medical research*. 1990;92:424-30.
22. Sezavar H, Amini Sani N, Alavizadeh S. Cardiac risk factor in young adult: A case control study. *Research & Scientific Journal of Ardabil University of Medical Sciences & Health Services*. 2004; 4(13):51-5.
23. Asefzadeh S, Alikhani S, Javadi H. Socio-economic status and mortality from cardiovascular diseases in Qazvin (2009).
24. Rosengren A, Wedel H, Wilhelmsen L. Coronary heart disease and mortality in middle aged men from different occupational classes in Sweden. *BMJ: British Medical Journal*. 1988; 297(6662):1497-500.
25. Singh R, Sharma J, Rastogi V, et al. Social class and coronary disease in a rural population of north India The Indian Social Class and Heart Survey. *European heart journal*. 1997;18(4):588-95.
26. Gwatkin DR, Heuveline P. Improving the health of the world's poor. *BMJ: British Medical Journal*. 1997; 315(7107):497-503.
27. Reddy KK, Ramachandraiah T, Reddanna P, et al. Serum lipid peroxides and lipids in urban and rural Indian men. *Archives of Environmental Health: An International Journal*. 1994; 49(2):123-7.
28. Kivimäki M, Lawlor DA, Smith GD, et al. Socioeconomic position, co-occurrence of behavior-related risk factors, and coronary heart disease: the Finnish Public Sector study. *American journal of public health*. 2007; 97(5):874-9.
29. Lammintausta A, Immonen-Räihä P, Airaksinen JK, et al. Socioeconomic inequalities in the morbidity and mortality of acute coronary events in Finland: 1988 to 2002. *Annals of epidemiology*. 2012; 22(2):87-93.