Original Article

# Are there any differences in education levels and changes of cardiovascular risk factors among urban and rural population: Isfahan Healthy Heart Program

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## ABSTRACT

**Background:** This study aimed to find the influence of education level on the trends of changes of these risk factors among a great sample of Iranian population. **Materials and Methods:** This cross-sectional study is a secondary analysis of Isfahan Healthy Heart Program (IHHP). Blood samples were taken to determine the lipid levels including total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), low levels of high-density lipoprotein cholesterol (HDL-C), and triglycerides. Education categorized based on training system in Iran as 1-5, 6-12, and more than 12 years training. **Results:** The prevalence of diabetes was higher among illiterate participants in both areas. Hypertension was more prevalent in illiterate subjects (2001; 44.0% and 2007; 46.3%) in intervention area ($P < 0.001$). Dyslipidemia was more prevalent among illiterate people ($P < 0.001$). In the intervention, illiterates have higher BMI in both 2001 and 2007 ($P < 0.001$). The prevalence of current smoking was the highest in education level range 6 to 12 years and was steadily decreased in higher education levels ($P < 0.001$). Subjects with 6-12 years of education have more unhealthy nutritional habits in both areas. In 2001, subjects with 12 years of education or more had more physical activity than other groups ($P < 0.001$), whereas, in 2007, subjects with 6-12 years of education were more active ($P < 0.001$). **Conclusion:** Although the prevalence of diabetes, hypertension obesity, and dyslipidemia are more in illiterate subjects and prevalence of diabetes and hyperlipidemia was sharply decreased with education level, it seems that well educated participants have higher daily physically activity compared with those who have lower education without considering the place or residency.

**Key words:** Cardiovascular risk factors, education, Iran, rural, urban

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## INTRODUCTION

Cardiovascular disease (CVD) is now emerging as the leading cause of death and disability whole of the world. The burden of CVD, especially ischemic heart disease, varies remarkably between regions of the world, with declining rates in Europe, North America, and Australia/New Zealand, burgeoning epidemics in the former socialist economies and India, and relatively lower impact in developing regions.[1]

Some studies have indicated that education is inversely associated with the occurrence of CVD and the level of CVD risk factors,[2] whereas there are studies revealing an opposite



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trend. Iran as a developing country undergoes behavioral changes due to some improvement in level of education and is the largest developing country in the world; CVD has become the major cause of death, especially in urban areas. Two studies[3,4] indicated an inverse association of education and CVD risk factors in urban populations of Iran. To our knowledge, there has been no previous study reporting the trends of CVD risk factors in the Iranian population.

The prevalence of the major heart disease risk factors such as obesity, elevated cholesterol levels, and high blood pressure also differs significantly among men and women of different race and ethnic backgrounds.[4] On the other hand, it seems that educational level has a key role in the rise of cardiovascular disease.[5] Some studies have described overarching factors influencing variations in CVD by literacy and the influence of education in their specific population.[6] However, there is no population-based study assessing patterns and the presence of specific cardiovascular risk factors among Iranians in different age groups with different educational level, which widely varies. The purpose of this population-based study was to investigate the relationship of education level with the prevalence of coronary artery disease risk factors such as current smoking, diabetes, and high cholesterol level among a great sample of Iranian population.

## MATERIALS AND METHODS

This cross-sectional study is a part of Isfahan Healthy Heart Program (IHHP), which has been previously described elsewhere.[6,7] In this study, two intervention counties (Isfahan and Najaf-Abad) and a control area (Arak, 375 km north-west of Isfahan), all located in central Islamic Republic of Iran, were studied. Arak was selected as a control area because it resembled the intervention areas in its socio-economic, demographic, and health profile and offered good cooperation. Arak was monitored for evaluation purposes but did not receive any intervention. In each community, a random sample of adults was selected yearly by multi-stage cluster sampling in both 2001 and 2007.[6,7] Research Council of Isfahan Cardiovascular Research Center approved this study. Only participants who had lived in their respective areas for at least 10 years were included. Exclusion criteria included pregnancy, mental retardation, and physical disabilities. All participants underwent a 30-minute face-to-face interview to complete validated questionnaires containing questions on demographic, socio-economic status, smoking behavior, physical activity, nutritional habits, and other healthy behaviors regarding cardiovascular disease. In this program, blood pressure and body mass index (BMI) measurements were done, then fasting blood samples were taken for 2 hpp, serum (total, HDL, and LDL) cholesterol and triglyceride levels. After initial venous blood sample in the fasting status, participants drank glucose solution over five minutes. A second blood sample was taken two hours later. Serum total cholesterol and triglycerides were measured using enzymatic colorimetric methods. HDL cholesterol was determined after dextran sulfate-magnesium chloride precipitation of non-HDL cholesterol. LDL cholesterol level was derived from the friedewald equation in the presence of increased triacylglycerol levels. The coefficient of variation was <5% for all laboratory measurements.[8] All blood samples were collected from each center in the three cities then immediately frozen at -20°C until assayed within 72 hours in the central laboratory of Isfahan Cardiovascular Research Center, in which reference samples were created at the beginning of the study and included in each day's analysis to check laboratory variation. This assessment was made at the two time points (2001 as baseline and 2007 as the follow-up point). Education categorized based on training system in Iran as, illiterate, primary,[1-5] high school,[6-12] and university training (>12). Global dietary index (GDI) was calculated representing the general dietary behavior. In addition, two consumption indices were calculated for specific food groups, i.e. meat products and major sources of fat.[13] The usual dietary intake was assessed using a 49-item food frequency questionnaire (FFQ) listing foods commonly consumed by Iranians and administered by trained technicians. For each food item, participants were asked to report common portion sizes and consumption frequency during the previous year. The latter was recorded in terms of daily (e.g. bread), weekly (e.g. rice, meat), and monthly (e.g. fish) consumption, and the daily intake of each food was derived by dividing weekly consumption by 7 and monthly consumption by 30. Data on physical activity, expressed as metabolic equivalent task (METS) minutes per week, were obtained through an oral questionnaire. Several questions on smoking behaviors and the frequency of smoking in a day, week, or month were asked.[14]

The IHHP conducts integrated activities in health promotion, disease prevention, and health-care treatment and rehabilitation. The IHHP intervention promotes healthy nutrition and increased physical activity and conducts tobacco control and stress management activities via mass media, intersectional cooperation and collaboration, community participation, education, and involvement of health professionals. Interventions are targeted to individuals, populations, and the environment depending on the results of baseline surveys on diet, physical activity, and smoking and stress management and on an assessment of needs in these areas and of their coverage by existing health services.

Results were reported as mean ± standard deviation (SD) for quantitative variables and percentages for categorical variables. The groups were compared using the *t* test or one-way ANOVA test for continuous variables and the chi-square test for categorical variables. *P* values of 0.05 or less were considered statistically significant. All the statistical analyses were performed using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) for Windows.

## RESULTS

Totally, 8739 (55.4%) lived in the intervention area and 2,959 (44.6%) lived in the reference area [Table 1].

There were totally no significant differences in age and current cigarette smoking between the intervention and the control groups. But, intervention groups had higher prevalence of hyperlipidemia and were also more likely to be diabetics [Table 1]. The reference group had similar behavior between two genders regarding participants' age and prevalence of diabetes as well as hyperlipidemia.

**Table 1: Demographic characteristics and risk profile comparing intervention and reference area participants**

| Risk profile | Study area | 2001 | 2007 | *P* |
|---|---|---|---|---|
| Age | Intervention | 38.66±14.79 | 38.64±15.32 | 0.963 |
| | Reference | 39.03±15.11 | 37.59±14.57 | 0.000 |
| Smoking | Intervention | 716 (14.7%) | 490 (12.6%) | 0.004 |
| | Reference | 614 (14.5%) | 391 (14.0%) | 0.516 |
| Diabetes | Intervention | 315 (6.5%) | 288 (7.5%) | 0.065 |
| | Reference | 225 (5.4%) | 169 (6.1%) | 0.205 |
| Hyperlipidemia | Intervention | 3219 (66.4%) | 2539 (66.2%) | 0.832 |
| | Reference | 2749 (65.7%) | 1703 (61.3%) | 0.000 |

In the intervention area, the mean age based on illiteracy, 1-5 years, and 6-12 years study is significantly more than reference area. However, the mean age of higher education level is significantly higher in the reference area. Relationship between some lifestyle factors such as smoking, having physical activity, and having healthy diet have shown in Table 2. The mean of global dietary index in intervention area is lower than reference area in all educational levels before and after interventions. Similarly, the same trend has seen in smoking habit. Participants with 6-12 years education have higher daily physically activity compared with those who have lower education in both reference and intervention areas in 2001 and 2007. The overall prevalence of cigarette smoking was decreased among all participants with different educational levels after

**Table 2: Relationship between behavioral factors and education levels based on living area in 2001-2007**

| | Educational level | | | | |
|---|---|---|---|---|---|
| | Illiterate | 1-5 y | 6-12 y | >12 y | *P* |
| Age (years) | | | | | |
| 2001 | | | | | |
| Intervention | 56.92±13.07 | 41.73±12.91 | 31.96±10.64 | 33.64±11.03 | <0.001 |
| Reference | 53.68±13.59 | 38.08±11.68 | 29.92±9.65 | 33.38±10.82 | <0.001 |
| *P* value | <0.001 | <0.001 | <0.001 | 0.706 | |
| 2007 | | | | | |
| Intervention | 58.87±13.65 | 44.66±13.82 | 33.25±11.75 | 31.35±11.07 | <0.001 |
| Reference | 57.98±12.97 | 38.40±12.22 | 29.45±8.53 | 28.36±9.69 | <0.001 |
| *P* value | 0.194 | <0.001 | <0.001 | <0.001 | |
| Global dietary index | | | | | |
| 2001 | | | | | |
| Intervention | 0.99±0.28 | 1.05±0.27 | 1.06±0.28 | 1.07±0.28 | <0.001 |
| Reference | 1.06±0.23 | 1.11±0.23 | 1.14±0.25 | 1.12±0.26 | <0.001 |
| *P* value | <0.001 | <0.001 | <0.001 | 0.005 | |
| 2007 | | | | | |
| Intervention | 0.79±0.29 | 0.82±0.31 | 0.85±0.31 | 0.80±0.29 | <0.001 |
| Reference | 0.99±0.29 | 1.05±0.28 | 1.05±0.29 | 0.99±0.28 | <0.001 |
| *P* value | <0.001 | <0.001 | <0.001 | <0.001 | |
| Total daily physical activity | | | | | |
| 2001 | | | | | |
| Intervention | 665.11±520.19 | 891.21±542.16 | 950.26±558.46 | 945.27±498.86 | <0.001 |
| Reference | 769.03±515.92 | 952.64±538.55 | 940.90±509.11 | 1016.93±492.41 | <0.001 |
| *P* value | <0.001 | 0.001 | 0.549 | 0.020 | |
| 2007 | | | | | |
| Intervention | 577.36±512.62 | 768.51±592.98 | 890.76±658.98 | 787.39±574.15 | <0.001 |
| Reference | 590.18±492.29 | 812.45±552.86 | 891.79±567.42 | 751.84±499.58 | <0.001 |
| *P* value | 0.617 | 0.054 | 0.958 | 0.285 | |
| Smoking | | | | | |
| 2001 | | | | | |
| Intervention | 125 (13.4%) | 274 (15.2%) | 427 (15.8%) | 87 (13.9%) | 0.267 |
| Reference | 185 (10.3%) | 325 (17.4%) | 364 (17.2%) | 79 (17.5%) | <0.001 |
| *P* value | 0.018 | 0.070 | 0.180 | 0.105 | |
| 2007 | | | | | |
| Intervention | 48 (8.6%) | 132 (12.2%) | 326 (15.3%) | 97 (10.4%) | <0.001 |
| Reference | 89 (7.6%) | 241 (16.3%) | 314 (16.9%) | 39 (11.7%) | <0.001 |
| *P* value | 0.447 | 0.004 | 0.185 | 0.521 | |

intervention in intervention area ($P < 0.001$). Table 3 shows the relationship between cardiovascular risk factors and educational levels based on living area in 2001 and 2007. The prevalence of diabetes was higher among illiterate participants in both areas. Similarly, hypertension was more prevalent in illiterate (2001; 44.0% and 2007 46.3%) in intervention area than higher education level (>12 years) ($P < 0.001$). In addition, dyslipidemia was more prevalent among illiterate people. Prevalence of hyperlipidemia was increased in all educational levels, except in residents with higher level of education since 2001 to 2007 in the intervention group.

In the intervention group, illiterates have higher BMI level in both 2001 and 2007.

The mean age of study participants in both areas fell with education level and this trend was observed in both 2001 and 2007 years [Figure 1]. The prevalence of current smoking was the highest in education level range 6 to 12 years and was steadily decreased in higher education levels; however, this trend was not revealed in the intervention group in 2001 [Figure 2]. Meanwhile, prevalence of diabetes and hyperlipidemia was sharply decreased with education level [Figures 3 and 4] in both study time points.

## DISCUSSION

The result of this study demonstrated that the prevalence of diabetes, hypertension, obesity, and dyslipidemia is more in

**Table 3: Prevalence of cardiovascular risk factors and educational levels based on living area in 2001-2007**

| Risk factors | | | | Educational level | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Illiterate | 1-5 y | 6-12 y | >12 y | *P* |
| Diabetes | | 2001 | Intervention | 159 (17.1%) | 133 (7.4%) | 84 (3.1%) | 9 (1.4%) | <0.001 |
| | | | Reference | 164 (9.3%) | 82 (4.5%) | 49 (2.4%) | 10 (2.2%) | <0.001 |
| | | | *P* value | <0.001 | <0.001 | 0.111 | 0.330 | |
| | | | Intervention | 121 (21.9%) | 104 (9.7%) | 87 (4.1%) | 19 (2.1%) | <0.001 |
| | | | Reference | 164 (14.0%) | 88 (6.0%) | 51 (2.8%) | 9 (2.7%) | <0.001 |
| Dyslipidemia | | 2007 | *P* value | <0.001 | <0.001 | 0.018 | 0.510 | |
| | | | Intervention | 696 (74.6%) | 1260 (70.3%) | 1635 (60.7%) | 374 (60.1%) | <0.001 |
| | | | Reference | 1260 (71.1%) | 1195 (65.0%) | 1260 (60.7%) | 257 (57.8%) | <0.001 |
| | | | *P* value | 0.056 | 0.001 | 0.989 | 0.436 | |
| | | | Intervention | 425 (77.3%) | 773 (72.2%) | 1344 (63.9%) | 535 (59.0%) | <0.001 |
| | | | Reference | 869 (74.3%) | 962 (65.5%) | 1064 (57.6%) | 138 (41.8%) | <0.001 |
| HTN | | 2001 | *P* value | 0.188 | <0.001 | <0.001 | <0.001 | |
| | | | Intervention | 410 (44.0%) | 428 (23.8%) | 263 (9.7%) | 59 (9.5%) | <0.001 |
| | | | Reference | 565 (31.5%) | 239 (12.8%) | 142 (6.7%) | 43 (9.6%) | <0.001 |
| | | | *P* value | <0.001 | <0.001 | <0.001 | 0.956 | |
| | | | Intervention | 253 (46.3%) | 233 (22.3%) | 235 (11.5%) | 85 (9.6%) | <0.001 |
| | | | Reference | 501 (42.6%) | 227 (15.3%) | 116 (6.2%) | 24 (7.2%) | <0.001 |
| Abdominal obesity | | 2007 | *P* value | 0.151 | <0.001 | <0.001 | 0.195 | |
| | | | Intervention | 571 (61.7%) | 971 (54.4%) | 1012 (37.5%) | 157 (25.2%) | <0.001 |
| | | | Reference | 794 (44.6%) | 610 (32.8%) | 450 (21.5%) | 71 (15.7%) | <0.001 |
| | | | *P* value | <0.001 | <0.001 | <0.001 | <0.001 | |
| | | | Intervention | 348 (64.7%) | 470 (45.6%) | 507 (25.1%) | 142 (16.4%) | <0.001 |
| | | | Reference | 521 (56.9%) | 429 (39.8%) | 360 (25.8%) | 35 (13.2%) | <0.001 |
| | | | *P* value | 0.004 | 0.007 | 0.682 | 0.209 | |
| BMI group | <25 | 2001 | Intervention | 351 (38.3%) | 688 (38.6%) | 1330 (49.7%) | 339 (54.5%) | <0.001 |
| | 25-30 | | | 347 (37.8%) | 646 (36.3%) | 930 (34.7%) | 218 (35.0%) | |
| | >=30 | | | 219 (23.9%) | 447 (25.1%) | 417 (15.6%) | 65 (10.5%) | |
| | <25 | | Reference | 831 (46.7%) | 924 (49.6%) | 1244 (59.2%) | 262 (58.1%) | <0.001 |
| | 25-30 | | | 627 (35.2%) | 647 (34.7%) | 624 (29.7%) | 141 (31.3%) | |
| | >=30 | | | 321 (18.0%) | 292 (15.7%) | 234 (11.1%) | 48 (10.6%) | |
| | | | | <0.001 | <0.001 | <0.001 | 0.421 | |
| | <25 | 2007 | Intervention | 164 (30.5%) | 349 (33.9%) | 979 (48.6%) | 492 (56.9%) | <0.001 |
| | 25-30 | | | 210 (39.1%) | 411 (39.9%) | 739 (36.7%) | 281 (32.5%) | |
| | >=30 | | | 163 (30.4%) | 271 (26.3%) | 298 (14.8%) | 92 (10.6%) | |
| | <25 | | Reference | 494 (42.2%) | 630 (42.7%) | 1047 (56.3%) | 219 (66.0%) | <0.001 |
| | 25-30 | | | 446 (38.1%) | 564 (38.3%) | 593 (31.9%) | 86 (25.9%) | |
| | >=30 | | | 230 (19.7%) | 280 (19.0%) | 219 (11.8%) | 27 (8.1%) | |
| | | Reference | Reference | <0.001 | <0.001 | <0.001 | 0.016 | |

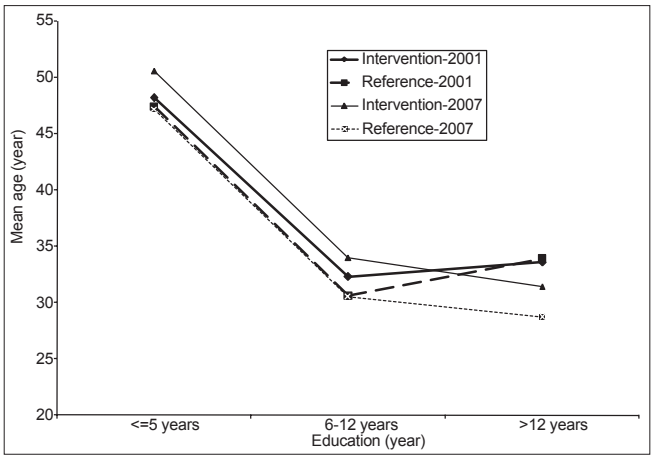


**Figure 1: Education level trends in mean age by study area and time point**

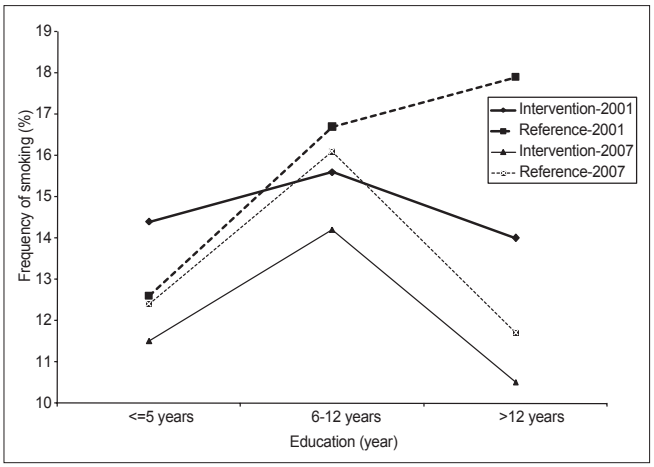


**Figure 2: Education level trends in smoking by study area and time point**

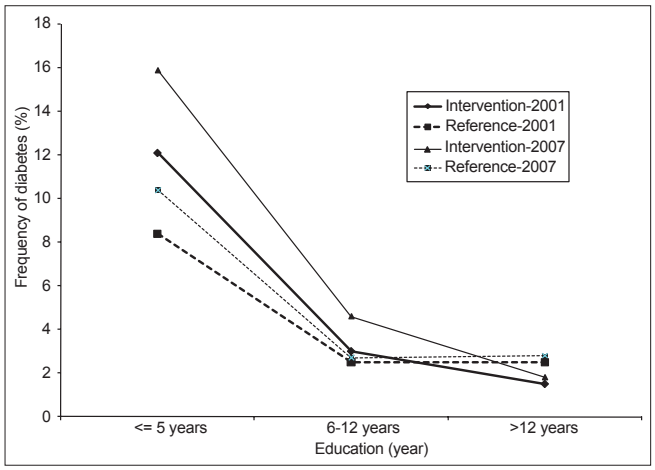


**Figure 3: Education level trends in diabetes by study area and time point**

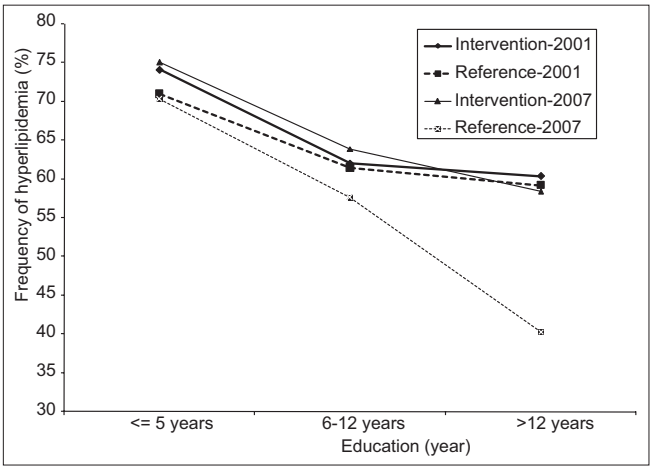


**Figure 4: Education level trends in hyperlipidemia by study area and time point**

illiterate subjects. Interestingly, education level has inverse relationship with prevalence of diabetes and hyperlipidemia. Apparently, subjects who have higher level of education have higher daily physical activity, lower smoking rate, and better nutritional habits compared with those who have lower education without considering the place or residency.

Results of North Karelia study indicated that this model is efficacious and cost-effective to prevent cardiovascular disease.[8] Many published studies revealed that cardiovascular risk factors such as smoking, high blood pressure, unhealthy diet, sedentary life style, and social factors play a major role in the incidence of myocardial infarction and stroke, and these diseases can, to some extent, be prevented if such risk factors are eliminated.[13-18]

This study revealed that social status, manifested by education level, was a more important mediator of the association between the individual CVD risk markers and urban status, even than health behavior or other CVD markers. In this study, prevalence of CVD risk factors was steadily decreased in higher education level. In a similar study in Spain, educational attainment was inversely associated with arterial hypertension in both genders and with overweight in women, and directly associated with cigarette smoking in women.[19] These findings support with another Iranian study, which stated those of developed countries that, along with other CVD risk factors, educational status has an converse relationship with CVD in elder population.[20] Also, in a Swedish survey, low socio-economic status exerted a stronger adverse influence on cardiovascular risk factors of women than it does on those of men.[21] But, some studies conversely showed that higher socio-economic status groups had greater prevalence of CAD risk factors than lower socio-economic status groups.[22] Of course, economic level of people has a crucial role in changing prevalence of CVD risk factor in each population. In this context, Christopher[22] showed that non-communicable diseases caused 34% of deaths among the poor and up to 85% of deaths among the richest sections of the population. The transition from poverty to affluence is likely to lead to a decline in communicable diseases compared to non-communicable diseases. In many countries, this transition tends to favor the adoption of atherogenic diets and physical inactivity, which are considered to be major

CHD risk factors.[23-26] However, more epidemiological studies are needed in each region of our country to provide baseline data against which future trends in risk factor levels can be assessed and preventive strategies planned.

This research also indicated that based on implementing and monitoring IHHP program, CVD risk factors had a decreasing trend with the study follow-up time. In the developed world, increased awareness and education about diet and lifestyle risk factors may have been partly responsible for the decline in CHD prevalence among the higher social classes. However, the situation in developing countries is different. Rapid industrialization and urbanization have brought about enormous changes in dietary patterns and lifestyles.[27] This is most obvious among higher socio-economic status groups, which tend to experience greater prevalence of CHD risk factors.[28]

## CONCLUSION

Overall, this research results showed that the prevalence of diabetes, hypertension obesity, and dyslipidemia are more in illiterate subjects and prevalence of diabetes and hyperlipidemia was sharply decreased with education level. But, it seems that well educated participants have higher daily physically activity compared with those who have lower education without considering the place or residency.

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## REFERENCES

1. Pradeepa R, Prabhakaran D, Mohan V. Emerging economies and diabetes and cardiovascular disease. Diabetes Technol Ther 2012;14(Suppl 1):S59-67.
2. Ramaraj R, Alpert JS. Indian poverty and cardiovascular disease. Am J Cardiol 2008;102:102-6.
3. Zeljko H, Skarić-Jurić T, Narancic NS, Salihović MP, Klarić IM, Barbalić M, *et al*. Traditional CVD risk factors and socio-economic deprivation in Roma minority population of Croatia. Coll Antropol 2008;32:667-76.
4. Dominguez LJ, Galioto A, Ferlisi A, Pineo A, Putignano E, Belvedere M, *et al*. Ageing, lifestyle modifications, and cardiovascular disease in developing countries. J Nutr Health Aging 2006;10:143-9.
5. Hajsheikholeslami F, Hatami M, Hadaegh F, Ghanbarian A, Azizi F. Association of educational status with cardiovascular disease: Teheran Lipid and Glucose Study. Int J Public Health 2011;56:281-7.
6. Sarraf-Zadegan N, Sadri G, MenkAfzali H, Baghaei M, MohammadiFard N, Shahrokhi S, *et al*. Isfahan Healthy Heart Programme: A comprehensive integrated community-based programme for cardiovascular disease prevention and control. Design, methods and initial experience. Acta Cardiologica 2003;58:309-20.
7. Sarrafzadegan N, Kelishadi R, Baghaei A, Hussein SG, Menkafzali H, Mohammadifard N, *et al*. Metabolic syndrome: An emerging public health problem in Iranian women: Isfahan Healthy Heart Program. Int J Cardiol 2008;131:90-6.
8. Shea S, Basch CE. A review of five major community-based cardiovascular disease prevention programs. Part II: Intervention strategies, evaluation methods, and results. Am J Health Promot 1990;4:279-87.
9. Yusuf S, Reddy S, Ounpuu S, Anand S. Global burden of cardiovascular diseases Part I: General considerations, the epidemiologic transition, risk factors, and impact of Urbanization. Circulation 2001;104:2746-53.
10. Bahonar A, Sarrafzadegan N, Kelishadi R, Shirani S, Ramezani MA, Taghdisi MH, *et al*. Association of socioeconomic profiles with cardiovascular risk factors in Iran: The Isfahan healthy heart program. Int J Public Health 2011;56:37-44.
11. Gharipour M, Khosravi A, Sadeghi M, Roohafza H, Hashemi M, Sarrafzadegan N. Socioeconomic characteristics and controlled hypertension: Evidence from Isfahan Healthy Heart Program. ARYA Atheroscler 2013;9:77-81.
12. Gharipour M, Kelishadi R, Toghianifar N, Tavassoli AA, Khosravi AR, Sajadi F, *et al*. Socioeconomic disparities and smoking habits in metabolic syndrome: Evidence from Isfahan healthy heart program. Iran Red Crescent Med J 2011;13:537-43.
13. Mittelmark MB, Hunt MK, Heath GW, Schmid TL. Realistic outcomes: Lessons from community-based research and demonstration programs for the prevention of cardiovascular diseases. J Public Health Policy 1993;14:437-62.
14. Shea S, Basch CE. A review of five major community-based cardiovascular disease prevention programs. Part I: Rationale, design, and theoretical framework. Am J Health Promot 1990;4:203-13.
15. Pirie PL, Stone EJ, Assaf AR, Flora JA, Maschewsky-Schneider U. Program evaluation strategies for community-based health promotion programs: Perspectives from the cardiovascular disease community research and demonstration studies. Health Educ Res 1994;9:23-36.
16. McLaren L, Ghali LM, Lorenzetti D, Rock M. Out of context? Translating evidence from the North Karelia project over place and time. Health Educ Res 2007;22:414-24.
17. Salonen JT, Kottke TE, Jacobs DR Jr, Hannan PJ. Analysis of community-based cardiovascular disease prevention studies--evaluation issues in the North Karelia Project and the Minnesota Heart Health Program. Int J Epidemiol 1986;15:176-82.
18. Cirera L, Tormo MJ, Chirlaque MD, Navarro C. Cardiovascular risk factors and educational attainment in Southern Spain: A study of a random sample of 3091 adults. Eur J Epidemiol 1998;14:755-63.
19. Hajsheikholeslami F, Hatami M, Hadaegh F, Ghanbarian A, Azizi F. Association of educational status with cardiovascular disease: Teheran Lipid and Glucose Study. Int J Public Health 2011;56:281-7.
20. Manhem K, Dotevall A, Wilhelmsen L, Rosengren A. Social gradients in cardiovascular risk factors and symptoms of Swedish men and women: The Göteborg MONICA Study 1995. J Cardiovasc Risk 2000;7:359-68.
21. Reddy KK, Rao AP, Reddy TP. Socioeconomic status and the prevalence of coronary heart disease risk factors. Asia Pac J Clin Nutr 2002;11:98-103.
22. Christopher JL, Murray CJL, Lopez AD. The global burden of disease: Comprehensive assessment of mortality and disability fromdiseases, injuries and risk factors in 1990 and projected to 2020. Cambridge, MA: Harvard School of Public Health; 1996.
23. Enas EA. High rates of CAD in Asian Indians in the United Statesdespite intense modification of life style: What next? Curr Sci 1998;74:1081-6.
24. Reddy KK, Ramamurthy R, Somasekaraiah BV, Kumara Reddy TP, Papa Rao A. Free radical and antioxidant status in urban and rural Tirupati men: Interaction with nutrient intake, substance abuse, obesity and body fat distribution. Asia Pacific J Clin Nutr 1997;6:296-311.

25. Hajian-Tilaki KO, Heidari B. Prevalence of obesity, central obesity and the associated factors in urban population aged 20-70 years, in the north of Iran: A population-based study and regression approach. Obes Rev 2007;8:3-10.
26. Ramsay SE, Whincup PH, Hardoon SL, Lennon LT, Morris RW, Wannamethee SG. Social class differences in secular trends in established coronary risk factors over 20 years: A cohort study of British men from 1978-80 to 1998-2000. PLoS One 2011;6:e19742.
27. Ramsay SE, Morris RW, Whincup PH, Papacosta AO, Thomas MC, Wannamethee SG. Prediction of coronary heart disease risk by Framingham and SCORE risk assessments varies by socioeconomic position: Results from a study in Britishmen. Eur J Cardiovasc Prev Rehabil 2011;18:186-93.
28. Jefferis BJ, Thomson AG, Lennon LT, Feyerabend C, Doig M, McMeekin L, *et al*. Changes in environmental tobacco smoke (ETS) exposure over a 20-year period: Cross-sectional and longitudinal analyses. Addiction 2009;104:496-503.

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