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The prevalence of low physical activity in an urban population and its relationship with other cardiovascular risk factors: Findings of a community-based study (KERCADRS) in southeast of Iran

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Original Article

Abstract

BACKGROUND: The low physical activity (LPA) more or less affects every community. Because of high prevalence of cardiovascular diseases in Iran and their relationship with LPA, this study aimed to measure precisely the epidemic size of LPA and determine its relationship with six other coronary artery disease (CAD) risk factors among an urban population aged 15 to 75 years in Kerman, Iran.

METHODS: Using household survey, 5895 adults were randomly recruited through single-stage cluster sampling from 250 postal codes. Demographic characteristics, blood pressure, blood glucose, cholesterol, triglyceride, smoking, opium use, mental status and physical activities at work, rest and recreation were assessed and ranked as low, moderate and intense. Adjusted odds ratio (AOR) was reported as a measure of the relationship between LPA and other CAD risk factors.

RESULTS: The prevalence of low, moderate, and intense physical activity were 42.1% (40.3-43.9), 45.0% (43.6-47.4) and 12.4% (11.1-13.9), respectively. LPA showed a sudden rise from 36.8% to 45.4% after the age of 25 years. On average, women had less physical activity than men (45.1% vs. 39.2%, P = 0.01). Participants with low physical activity compared to those without physical activity had significantly higher chance of anxiety [odds ratio 1.39; confidence interval (95% CI) 1.08-1.79; P = 0.01], hypertension (1.59; 1.08-2.35; P = 0.02), hyper-cholesterolemia (1.37; 1.06-1.76; P = 0.02), cigarette smoking (1.52; 1.07-2.11; P = 0.01), opium addiction (1.47; 1.07-2.02; P = 0.02) and overweight/obesity (1.34; 1.05-1.71; P = 0.02).

CONCLUSION: LPA was very common in the studied population and almost half of the adults were at risk for CAD because of insufficient level of physical activity. Such risky life-style pattern makes the emerging of CAD epidemic unavoidable, if effective interventions not being in place timely to this community.

Keywords: Physical Activity, Coronary Artery Disease, Urban Population, Kerman, Iran

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Introduction

According to the report from World Health Organization (WHO), cardiovascular diseases account for almost 30% of overall deaths all around the world.[1] In developing countries, 80% of deaths are because of cardiovascular diseases mostly due to change in life style, increase in urbanism and lack of intervention plans in these countries.[2] Although Iran is not among countries with highest cardiovascular mortality rates, the change in life style and aging might lead to a huge increase in cardiovascular diseases in the near future. In a national project that measured the burden of diseases in 2003, ischemic heart diseases accounted for the most burden of diseases in Iranian population.[3]

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Based on the definition of WHO, physical activity is any type of body movement produced by skeletal muscles that requires energy expenditure. Physical activity does not inclusively mean doing a sport. In fact, all kind of activities including a body movement such as working, playing, training, housekeeping and recreational activities should be accounted.[4] Low physical activity is accounted as the fourth cause of mortality and morbidity in the world. It also accounts for 27% of diabetes and 30% of ischemic heart diseases. Regular physical activity in adults decreases hypertension, coronary artery diseases (CAD), strokes, diabetes, and colon and breast cancers.[4]

Unlike some cardiovascular risk factors which have mostly genetic basis and are not modifiable (e.g. hypertension and hyperlipidemia), low physical activity could be decreased and removed by a proper planning, change in attitude and behavior. In a research carried out to measure the lipid and glucose of Tehran's population, Iran, only 30% of the participants had enough physical activity.[5] Based on the findings of the third round of CAD surveillance of risk factors conducted in 2006, 40% of Iranian adults had low physical activities.[6]

With a population of 2,990,000 (based on a census carried out in 2011), Kerman province constitutes 3.9% of Iran's population.[7] According to the data given by the third national surveillance of risk factors of non-communicable diseases (NCDs), obesity and overweight increased from 39% in 2003 to 42% in 2006 in this province.[6] Only a few studies have examined the relationship between CAD risk factors and physical activity in Iran.[5] In a study carried out on cardiovascular risk factors in Semnan, Iran, physical activity was not taken into consideration.[8] Few researches focused on the physical activity of their participants, and they were only limited to specific hours instead of the whole day. For example, in a large study performed on the glucose and lipid of Tehran's population, only physical activity in leisure time was addressed.[5]

Here, we included all types of physical activities at work, daily commute, recreational and sport-related activities. We also addressed less routine CAD risk factors including anxiety, depression and opium use along with ordinary risk factors of obesity, hypertension, hyperlipidemia, high blood glucose and smoking status in the study. None of the previous cross sectional studies at local or national level assessed psychological status or opium addiction as CAD risk factor.

The objective of this paper was to comprehensively describe the prevalence and pattern of low physical activity by age, sex, education and occupation subgroups, and also to estimate the association of other CAD risk factors with individual level of physical activity.

Materials and Methods

The present paper is a sub-analysis of data collected in a study which focused on the risk factors of CADs (i.e. Kerman Coronary Artery Disease Risk Factor Study; KERCADRS). It was carried out on 5895 individuals ranging between 15 to 75 years of age in 2010-2011 on an urban population in southeast of Iran. The ethics committee of the Kerman University of Medical Sciences approved the study protocol (ethic code 88/110KA). A written informed consent was obtained from all participants in the study. Kerman is the biggest city in the southeast of Iran that, according to the 2012 census, has a population of about 750,000. More details about the city conditions and sampling and data collection methods are previously published at IJPH.[9]

One stage cluster sampling method was applied for sample selection. The primary units of sampling were households who have been living in Kerman for at least one year prior to the interview. Using the zip code in the mail office, we marked 250 areas and approached households in the area to recruit 5895 individuals in twelve strata of age and sex. The eligible people (6200 subjects) were invited to complete the informed consent and participate in the research, from which close to 95% responded to the invitation. They were referred to the clinical study site located in city downtown where they went through several steps of in-person interview to disclose their demographic characteristics, CAD risk behaviors and past medical history, mental status (anxiety and depression), and to provide fasting blood sample (after 12-14 hours fasting) for serum lipid and glucose level measurement. They were also asked to report their smoking status, opium use and physical activity level. The sample size was calculated as of 5910 based on prevalence of 50% to be efficient for all NCD risk factors considering the precision at the level of 5%, and response rate 78%, which was corrected according to eight age-sex strata.

Daily physical activities at home and work place were recorded using WHO Global Physical Activity Questionnaire (GPAQ).[10] To evaluate the intensity of physical activity, metabolic equivalent (MET) was used. MET is the use of energy in an adult individual while he/she is sitting (equivalent to 3.5 ml oxygen consumption per kg body weight in a

minute). Moderate physical activity is considered as consuming energy four times, and intense physical activity equal to or more than eight times in proportion to sitting. In other words, a combination of walking and other physical activities with at least 3000 METs per week was assigned to intense physical activity. Subjects with less than 1500 METs were regarded as low physical activity.

Anthropometric measurements were height (a tape stadiometer with a minimum measurement of 0.1 cm in a standing position, without shoes) and weight [light clothing without shoes measured by a calibrated standard weighing balance (Seca, model 707, Germany) with an accuracy of 100 g]. Laboratory measurements were blood pressure (measured in sitting position after at least 10 minutes at rest, if abnormal, was measured once again about one hour after the first measurement),[11] with standard manometer (RISHTER mercury manometer, Germany), fasting blood glucose (KIMIA Kit, code 890410, Iran), triglyceride (TG) (KIMIA Kit, code 890201, Iran), and total cholesterol (KIMIA Kit, code 890303, Iran). Cholesterol and TG values more than 200 mg/dl were considered as over normal values.[12] Depression was measured by a valid-translation of the 21-question BECK-BDI questionnaire,[13] and anxiety score was measured by a valid-translation of the 21-question BECK Anxiety questionnaire,[13] both conducted by a face to face interview. Both questionnaires had a score range of 0-63. For depression, score of more than 30 and for anxiety, score of more than 26 were identified as disease state. Opium addiction was defined according to DSM-IV criteria. A physician asked the participants to disclose whether they have ever used any type of drug. "Occasional users" were not dependent but irregularly used opium (mostly for entertainment) and "dependents" were regular opium consumers.[14,15]

All interviewers were trained before data collection and the validity of their collected data was checked by gold standards (chief researcher). Because the most of required information were objective and we used trained interviewers, we did not measure the agreement indices. However, strict quality control was performed during the study conduction to minimize any error. We tried to track all non-response households twice and replace participants who were not found at the end by their neighborhoods.

Continuous variables were reported as mean ± standard deviation (SD) and non-continuous variables as n (%). We did a survey analysis keeping household as primary sampling unit (clusters). People were assigned into three subgroups; having low, moderate and intense physical activity and the prevalence of different CAD risk factors was reported for every subgroup. Because of non-proportionate to size sampling method, the total estimates were standardized based on the real age distribution of the target population (national consensus of Kerman population size for 2006). We weighted the estimates by non-responses. We also assessed the correlations by applying chi-square test. A logistic regression model was applied to evaluate the relationship between the different levels of physical activity and other CAD risk factors. To control any potential confounders, we adjusted the estimates controlling for age, sex, smoking status, education, occupation and body mass. Using likelihood ratio test, we observed a statistically significant dominancy of the effect of categorical age variable ($P = 0.013$) and no trend effect of age as a continuous variable was found. All the statistical procedures were performed in Stata Statistical Software, Release 11.0 (Stata Corporation, College Station, TX, USA) under survey data analysis. $P < 0.05$ was considered as significant.

Results

This analysis was carried out on 5895 individuals including 2659 (45.1%) males and 3236 (54.9%) females with age of 45.4 ± 16.4 years.

About 42.1% (n = 2476) of the participants [confidence interval (95% CI) 40.3%-43.9%] had low physical activity. The most frequent (47.7%) and the least frequent low physical activity (36.8%) was observed among elderly people and those with 15-24 years of age respectively (Table 1). Physical activity decreased as age increased from 15 to 75 years ($P < 0.001$). Overall, the prevalence of intense physical activity was less than 20%.

Surprisingly, the level of physical activity was almost constant among people with different education status (36.2%-41.6%). In terms of occupation, the lowest physical activity was observed in unemployed people and housewives (49.7%). Women were less physically active compared to men (45.1% vs. 39.2%) ($P < 0.001$) (Table 2).

Individuals with low physical activity, had significantly higher rates of hypertension (11.4% vs. 10.1%, $P = 0.009$), obesity (15% vs. 11.5%, $P = 0.001$), occasional opium consumption (5.6% vs. 4.6%, $P = 0.001$), anxiety (79.1% vs. 76.1%, $P = 0.03$), depression (37% vs. 33.4%, $P = 0.01$) and hypertriglyceridemia (16% vs. 12.6%,

Table 1. The standardized prevalence of different levels of physical activities by age groups (total participants = 5895)

Age range (year)	The level of physical activity					
	Low (n = 2496)		Moderate (n = 2700)		Intense (n = 504)	
	Raw [n (%)]	Standardized % (95% CI)	Raw [n (%)]	Standardized % (95% CI)	Raw [n (%)]	Standardized % (95% CI)
15-24	309 (37.2)	36.8 (35.4-38.2)	374 (45.9)	45.7 (44.2-47.3)	129 (16.9)	17.5 (16.3-18.7)
25-34	493 (45.5)	45.4 (44.6-46.3)	476 (43.8)	43.3 (42.4-44.1)	104 (10.8)	11.3 (10.8-11.9)
35-44	478 (45.9)	46.4 (45.8-47.0)	473 (44.9)	43.3 (42.7-43.8)	100 (9.2)	10.3 (10.0-10.7)
45-54	522 (43.2)	43.7 (43.2-44.1)	593 (50.1)	48.7 (48.3-49.1)	83 (6.7)	7.6 (7.4-7.9)
55-64	441 (42.9)	42.7 (42.5-42.9)	516 (51.2)	51.2 (51.0-51.4)	60 (6.0)	6.1 (6.0-6.2)
65-75	253 (47.2)	47.7 (47.5-47.9)	268 (47.3)	47.1 (46.9-47.3)	28 (5.4)	5.2 (5.1-5.3)
Total	2496 (43.6)	42.1 (40.3-43.9)	2700 (47.5)	45.5 (43.6-47.4)	504 (8.9)	12.4 (11.1-13.9)

P < 0.001 for effect of age; 95% CI: Confidence interval
To reduce the number of rows in the table, age ranges were reported by divisions of 10-year

P = 0.004) compared to those with moderate and intense physical activities. Conversely, prevalence of dependent opium use (4.6% vs. 6.9%, P = 0.001) and hypercholesterolemia (27.2% vs. 31.4%, P < 0.001) among low physically active subjects were significantly lower than hyperactive individuals (Table 3).

After adjusting for sex, age, education, occupation, smoking status and body mass, low physical activity compared to intensive activity, increased the odds ratio (OR) of anxiety, hypertension, hypercholesterolemia, cigarette smoking, opium addiction and overweight/obesity to 1.39 (P = 0.01), 1.59 (P = 0.02), 1.37 (P = 0.02), 1.52 (P = 0.01), 1.47 (P = 0.02) and 1.34 (P = 0.02) respectively. In addition, we did not observe any significant adjusted odds ratios for diabetes/high FBG (OR 1.21; P = 0.3), depression (OR 1; P > 0.999) and hypertriglyceridemia (OR 1.35; P = 0.07) (Table 4).

Table 2. The prevalence of low physical activity in the participants by sex, education and occupation groups (total participants = 5895)

Variable	Number and prevalence of low physical activity [n (%)] 95% CI	P
Education		
Illiterate	420 (36.2) (28.9-44.3)	0.200
Less than Diploma	1715 (41.6) (39.5-43.8)	
More than Diploma	472 (41.4) (37.7-45.2)	
Occupation		
Unemployed, housewife	1638 (49.7) (42.9-56.5)	< 0.001
Employee	781 (35.4) (27.8-43.7)	
Soldier, student	176 (36.1) (31.6-40.9)	
Other jobs	12 (18.0) (12.7-24.7)	
Gender		
Male	1091 (39.2) (37.9-40.6)	< 0.001
Female	1518 (45.1) (43.8-46.4)	

95% CI: Confidence interval

Table 3. The prevalence confidence interval (95% CI) of coronary artery disease (CAD) risk factors among people with different physical activity levels (total participants = 5895)

Risk factor	Physical activity status (95% CI)		P
	Low [n (%)] 95% CI	Moderate and intense [n (%)] 95% CI	
Hypertension (n = 1333)	638 (11.4) (10.2-12.6)	695 (10.1) (9.3-11.1)	0.009
Obesity (n = 1048)	522 (15.0) (13.2-17.0)	526 (11.5) (10.3-12.9)	0.001
Occasional opium use* (n=366)	187 (5.6) (4.6-6.9)	179 (4.6) (3.8-5.6)	0.001
Dependent† (n = 484)	256 (6.9) (5.9-8.1)	228 (4.6) (3.9-5.4)	0.001
Smoking (n = 657)	322 (11.8) (10.2-13.6)	335 (8.6) (7.6-9.8)	0.002
Anxiety (n = 4531)	2051 (79.1) (76.6-81.5)	2480 (76.1) (74.0-78.1)	0.030
Depression (n = 2304)	1127 (37.0) (34.1-39.9)	1177 (33.4) (31.1-35.7)	0.010
Triglyceride > 200 mg/dl (n = 1119)	545 (16.0) (14.1-18.1)	574 (12.6) (11.4-14.0)	0.004
Cholesterol > 200 mg/dl (n = 2352)	1112 (31.4) (29.0-34.0)	1240 (27.2) (25.4-29.0)	< 0.001

*Occasional use: Irregularly used opium mostly for entertainment; †Dependent: Regularly consumed opium; 95% CI: Confidence interval

Discussion

The findings of this study showed that low physical activity was a widespread phenomenon, and almost half of the community did not have enough physical activity efficient to prevent coronary artery diseases and the corresponding risk factors. Physical activity decreased after the age of 15 years. Higher education had no positive association with physical activity.

Table 4. The association of physical activity with other coronary artery disease (CAD) risk factors (total participants = 5895)

Risk factor	The level of physical activity	Crude odds ratios		Adjusted odds ratios	
		Amount (P)	95% CI	Amount	95% CI
Blood glucose > 126 mg/dl or old diabetes	Intense	1	---	1.00	---
	Moderate	1.95 (< 0.001)	1.35-2.82	1.30	0.86-1.96
	Low	1.97 (< 0.001)	1.36-2.86	1.21	0.80-1.83
Depression	Intense	1	---	1.00	---
	Moderate	1.24 (0.070)	0.98-1.56	0.82	0.63-1.06
	Low	1.59 (< 0.001)	1.26-2.01	1.00	0.77-1.29
Anxiety	Intense	1	---	1.00	---
	Moderate	1.69 (< 0.001)	1.34-2.15	1.25	0.98-1.61
	Low	1.94 (< 0.001)	1.53-2.47	1.39	1.08-1.79
Hypertension	Intense	1	---	1.00	---
	Moderate	2.32 (< 0.001)	1.68-3.20	1.41	0.96-2.07
	Low	2.59 (< 0.001)	1.87-3.57	1.59	1.08-2.35
Triglyceride > 200 mg/dl	Intense	1	----	1.00	---
	Moderate	1.39 (0.030)	1.02-1.89	1.16	0.84-1.60
	Low	1.63 (0.002)	1.20-2.21	1.35	0.98-1.88
Cholesterol > 200 mg/dl	Intense	1	---	1.00	---
	Moderate	1.73 (< 0.001)	1.37-2.20	1.19	0.92-1.54
	Low	1.99 (< 0.001)	1.57-2.52	1.37	1.06-1.76
Smoking	Intense	1		1.00	
	Moderate	0.60 (< 0.001)	0.41-0.78	1.00	0.72(1.40)
	Low	0.81 (0.200)	0.60-1.11	1.52	1.09(2.11)
Addiction	Intense	1		1.00	
	Moderate	0.70 (0.020)	0.52-0.94	0.92	0.66-1.27
	Low	1.08 (0.600)	0.81-1.45	1.47	1.07-2.02
Overweight/obesity	Intense	1		1.00	
	Moderate	1.80 (< 0.001)	1.42-2.21	1.12	0.88-1.42
	Low	1.97 (< 0.001)	1.58-2.46	1.34	1.05-1.71

The odds ratios are adjusted based on sex, age, education, occupation, smoking status and body mass; 95% CI: Confidence interval

Housewives and unemployed individuals were significantly less physically active than the rest of the participants. Compared with moderate/intense physically active participants, the prevalence of hypertension, obesity, opium use, smoking, anxiety and depression were significantly higher in individuals with less physical activity. The level of TG and cholesterol were also higher in people with low physical activity. Low physical activity had a significant positive association with anxiety, high blood pressure, high level of cholesterol, cigarette smoking, opium use and overweight/obesity status.

Overall, we found 42.1% of adult population had low physical activity. In a study carried out by Bergman et al. on 1470 Swedish males and females, the prevalence of low physical activity was reported to be 37.1%.[16] In another study by Hallal et al. on 3128 individuals over 20 years in Brazil, the prevalence of low physical activity was 41.1%.[17] In another study in Tehran, the prevalence of low physical activity was estimated as 69.8%.[5] However they only measured exercise during non-working time. In a similar study in Yazd, Iran, on the population over 20 years of age, the prevalence of low physical activity was found to be 65.8%.[18] The existing difference in results could be ascribed to the different age range of the studied population, different questionnaire, and the different definitions of physical activity levels.[5,18,19] The results of the prevalence of low physical activity in this study are in line with the findings of the third national surveillance of risk factors of NCDs.[6]

We found the prevalence of low physical activity was higher in females than in males. In other studies such as the third national surveillance of risk factors of NCDs, the same result was attained.[2] This is mainly because the majority of women in our population were housewives, which led to reduced physical activity in comparison with men.

Among the age ranges, the highest and lowest rate of low physical activity belonged to the oldest and youngest groups respectively. In the age group of 15 to 24 years old which was expected to be the most active group, only 17.5% had intense physical activity. This is an important issue to be taken into account. This figure decreased by 6.5% among the next age group (25 to 34 years). Unfortunately, this measure was added to the low physical activity group (Table 1). The prevalence of low physical activity related to age has been shown in Yazd and other cities and countries as well.[16,18,20]

Many people mention busy life and long working hours as excuses for not being physically active. However, our results showed that unemployed people had a 49.7% low physical activity rate, which proved the busy life is not a reason for having low physical activity. Basically this attitude needs to change in a way that people do not consider physical activity as leisure, but more to improve their health and incorporate it in their daily life.

It is believed that there would be a decrease in the level of physical activity among people after their marriage. Considering the average marriage age (25-30 years) in Iran, one of the reasons for sudden rise in low physical activity after the age of 25 could be marriage.

It appears that the current national education system does not have much influence on people's attitude and performance on daily activities. People with high education level who have higher level of socio-economic status do not have more physical activity. This is a challenge and needs specific attention and intervention strategies.

In the present study, the depression and anxiety among the low physical activity group has been more than the moderate or intense ones. In the multivariate analysis, after adjusting the confounding variables, it was shown that low physical activity increased the odds of anxiety to 39%. This finding is in agreement with the positive effect of physical activity on reducing depression and anxiety found in other studies.[21-23] This can be due to the fact that exercising increases endorphin release in the brain. Endorphins have been proven to cause feelings of happiness.[24] On the other hand, anxiety increases sympathetic activity that may cause reduction of synovial blood flow because of sympathetic innervation and the presence of adrenergic receptors in the joint blood vessels.[25,26] Joint blood flow reduction may worsen the negative impact of low physical activity on the joints' health.

We observed a positive association between smoking and low physical activity. Mensink et al.[27] and Salimzadeh et al.[28] report have also verified such results. Low physical activity was also reported to be associated with hypertension, high cholesterol and high triglyceride.[29,30] We also observed such clustering among the other CAD risk factors and physical activity in our study.[14,31] It has been shown that opium in long term increases the risk of hypertension and causes reduction of plasma high density lipoprotein (HDL) cholesterol.[32]

Although univariate analyses showed significant associations between low physical activity and diabetes mellitus, depression and hypertriglyceridemia, controlling for potential

confounders did not show any relationship. It indicates that the observed effects of low physical activity are due to other factors such as sex, age, education, occupation, smoking status and body mass.

We acknowledge the limitation of our study as a cross-sectional survey. Beside, our study benefited from a relative large sample size, random sampling from a general population, high response rate (close to 95%) and including all aspects of physical activity and numerous risk factors including psychological status and opium addiction. For further studies, we recommend monitoring physical activity both at individual and community level by a longitudinal prospective cohort study. It is required to assess the efficacy of local and national intervention programs in managing and control of the epidemic of low physical activity.

Conclusion

The findings of this study showed that almost half of the population lack sufficient physical activity to effectively prevent coronary artery diseases and their risk factors. Low physical activity was associated with higher prevalence of unemployment, anxiety, smoking, opium use, and hyperlipidemia. Without effective and timely interventions, current risk profile would significantly increase the burden of cardiovascular diseases in this community in near future.

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Conflict of Interests

Authors have no conflict of interests.

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