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Physical Activity and Biochemical Parameters in Patients with Acute Coronary Syndrome: A Cross-Sectional Study

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Abstract

Background: Physical activity reduces the risk of Coronary Heart Disease (CHD). The precise mechanism for reducing CHD risk after physical activity has not been determined. The aim of this study was to determine the relationship between physical activity and some biochemical parameters in patients with Acute Coronary Syndrome (ACS).
Methods: This cross-sectional study was conducted on patients with ACS referring to Heshmat Medical Center in 2016. Convenient sampling method was used and 280 eligible patients with ACS were included in the study. For data gathering the checklist was used for demographic characteristics of patients and biochemical parameters and the Baecke Questionnaire was used to assess the patients' physical activity. The data were analyzed in PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc. using Spearman correlation and multiple regression analyses. The significance level was set at P>0.05.
Results: The results showed that 67% of the patients were male and the mean age of the patients was 62.38±12.01 years. The BUN blood urea nitrogen (r=-.121 and -.177) and blood creatinine level (r=-.259 and -.185) had a significant correlation with physical activity in general and at the work hours, (P<.05). However, these correlations were poor, and only the correlation between the creatinine level and physical activity at work was moderate.
Conclusion: The correlation between physical activity level and biochemical parameters was not observed in our study. However, because the protective effect of physical activity on the cardiovascular system is clearly observed, it is suggested that appropriate physical activity and regular fitness be incorporated in the care plan for patients with cardiovascular diseases. Further clinical studies are recommended.

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Introduction

Cardiovascular diseases, including the coronary artery disease, are viewed as one of the main causes of death in the world (1, 2); and the leading cause of premature deaths and disability in developed countries (3). Cardiovascular diseases have also turned into a social problem in Iran (4). Normally, acute coronary syndrome occurs in individuals over 45; however, the prevalence of such factors as obesity, hypertension, diabetes and metabolic syndromes have increased the risk of premature cardiovascular disease in the young (5). Acute coronary syndrome refers to a group of clinical symptoms including acute myocardial ischemia and a spectrum of clinical conditions like unstable angina, Non-ST Segment Elevation Myocardial Infarction (NSTEMI) and ST Segment Elevation Myocardial Infarction (STEMI) (6).

Research has shown that physical activity reduces the risk of coronary diseases and inactive people are more susceptible to developing cardiovascular diseases (7). Therefore, doing physical activities are regarded as one of the non-drug treatments and beneficial mechanisms to prevent and fix the level of risk factors of cardiovascular diseases (7, 8). Regular physical activity reduces the probability of the occurrence of health threatening situations including mortality risk and the complications of chronic diseases like cardiovascular diseases (9, 10).

The results of a study by Held et al (2011) showed that the risk of cardiac diseases was low in a group of employees who had a marginal to average physical activity and had lighter workload, whereas drivers and those who used to watch TV a lot had a higher risk of developing myocardial infarction (11). In addition, the results of a study by Etemad and Esmail Nasab on a group of students showed that there was a significant correlation between physical activity and the percentage of body fat, body fat mass and the level of cholesterol of male and female students (7). According to the results of a study conducted in 2002, regular physical activity is a practical strategy to prevent cardiovascular disease particularly myocardial infarction and to rehabilitate individuals afflicted by such disease. It has also been reported that the incidence of cardiovascular disease in a period of two years was less than one percent in individuals with average physical activity and was 3.2 percent in people with low physical activity. It was actually shown that there was an indirect correlation between the amount of weekly physical activity and the mortality rate resulting from cardiovascular diseases (12) .

The results of a study by Florind et al showed that there was a significant correlation between the level of physical activity and age, gender and body mass index (13).Therefore, one of the major challenges of heart rehabilitation program is changing lifestyle and incorporating physical activities in individuals' daily routines (14) .

Several lines of evidence suggest that there is a reverse relationship between the level of physical activity and complications of cardiovascular disease. A study by Takashima et al (2004) on physical activity has shown contradictory results (8, 15). Despite sample evidence confirming that physical activity reduces the risk of developing Coronary Heart Disease (CHD), the exact mechanism for the reduction of CHD risk following physical activity has not been identified yet. It is, however, speculated that such a reduction occurs because of curbing risk factors like reduced LDL-C and triglyceride level as well as higher HDL-C level (11) . In a study on hemodialysis patients, Matsuzawa et al showed that physical activity is related to HDL-C and that low level of physical activity has a strong correlation with the reduction of HDL-C in patients (16). Skretteberg et al (2012) showed that there is a significant correlation between higher HDL level and lower risk of cardiovascular disease, whereas there is no significant correlation between HDL and physical activity (17). Aadahl et al (2007) conducted a study in Denmark showing that there is an indirect significant correlation between an average level of less than 45 minutes of physical activity in 24 hours and waist circumference size, body mass index and triglyceride. There was also a positive correlation with HDL. Moreover, there was no significant correlation in people with the physical activity over 45 minutes in 24 hours (18). The results of a study by Stewart et al (2013) indicated that 46 percent of the patients with coronary heart disease had a lower physical activity compared with the time before being diagnosed with heart disease (19). Such findings necessitate a lifestyle change to eliminate contributory factors in coronary heart disease. Given the fact that inadequate physical activity increases risk factors of coronary heart diseases (20), the present study was designed to investigate the association between physical activity and the results of some biochemical parameters in blood of the patients with acute coronary syndrome.

Methods

This descriptive cross-sectional study was conducted at four nursing and This cross sectional study was done on patients with acute coronary syndrome referring to a heart center in Rasht in the north of Iran in 2015. The sample size was calculated using the correlation sample size formula $n = \left(\frac{(Z_\alpha + Z_\beta)}{.5 \times Ln\left(\frac{1+r}{1-r}\right)}\right)^2 + 3$ with a significance level of 0.05, a statistical power of 0.80 and a correlation of 0.18 based on a study by Matsuzawa et al (16). After considering 15% of the total sample size for the probable missing data, the required sample size was determined as at least 278 patients. The convenience sampling method was used

and 282 eligible patients with acute coronary syndrome were recruited in the study (20). The inclusion criteria for the patients were having acute coronary syndrome and being willing to participate in the research. The patients who had elevated high sensitivity C-reactive protein (CRP) levels and took anti-inflammatory drugs were excluded from the study. Data were collected using the checklist for demographic characteristics of patients, biochemical parameters and the Baecke Questionnaire.

The demographic characteristics of patients were included age, gender, marital status, education level, life status, occupation, residence area, family history of heart disease and diabetes or hypertension and body mass index. The biochemical parameters were included of the patients' laboratory tests in the first 24 to 48 hours of being admitted to the hospital (including Feritin-HbA1c-FBS-BUN-Cr-LDL-HDL–TG-CHOL) which was available in the medical record of patients.

To collect the data, first, the personal characteristics of the participants were recorded and then their weight and height were measured. Calibration of the weighing scales was performed and to ensure accurate measurements, the patients' weight was measured with Seca (made in Iran). The patients were asked to remove excess clothes and shoes before measuring their weight. A meter was used for measuring the patients' height with a precision of half a centimeter and the patients' height was measured with the participants standing against a wall and their heels and buttocks in contact with the wall. Next, blood specimens were taken from the participants anonymously in the same environment and at the same time. The body mass index was calculated on the basis of dividing weight (kilogram) by the square of height (meter) and the values less than 18.5 were considered as thin, over 18.5 and less than 25 were listed as normal, equal to or over 25 were labeled as overweight and over or equal to 30 were named as obese (22). The patients' physical activity was assessed using the Backed questionnaire which is a reliable and valid instrument (13, 21). The questionnaire comprises three dimensions; physical activity at work, physical activity at exercise time and exercise at the leisure time, and the participants' performance over the past month. The questionnaire consisted of 16 items, eight items were on physical activity at work time and four items were on physical activity at sport time and the last four items were on physical activity at the leisure time. The scores were calculated using a predefined algorithm (20). The scores ranged from 1 to 5 for each of the three dimensions and 3 to 15 in total. A higher score shows a higher level of activity. In addition, an acceptable level of intra-class correlation coefficient was reported for the Persian version of the questionnaire (with ICC of work score=0.95, sport score=0.93, and leisure score=0.77) (23).

Informed consent was obtained from all patients before they take part in the study. The study was approved by Guilan University of Medical Sciences and received an ethical approval code of IR.GUMS.REC.1394.243 from the university's Ethics Committee.

The descriptive statistics (mean, standard deviation, and frequency) were used to present the results. Spearman corrwas used to test the correlation between the quantitative variables and physical activity. Multivariable regression analysis was used to confirm the relation between BUN and Cr levels and physical activity after adjusting for the confounders. The data were analyzed in PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc. The significant level was considered less than 0.05.

Results

The finding showed that 67% of the participants were male and the average age of the patients was 62.38±12.01 years old, which ranged from 33 to 91 (Table 1). Physical activity scores in total and in each of the investigated areas are given in Table 2 and a description of the biochemical parameters investigated in the study is given in Table 3. Except for the work hours, the patients' physical activity was low in all dimensions (Table 2).

The findings indicated that only the BUN (r=-.121 and -.177) and blood creatinine level (r=-.259 and -.185) had a significant negative correlation with the level of physical activity in total and at the work hours, respectively. However, the severity of these correlations was poor, and there was only a negative correlation with moderate severity between the creatinine level and physical activity at work (Table 4). The results of the correlation between biochemical parameters and demographic characteristics also showed that the level of BUN and Cr was significantly higher in elder patients (r=.294, P<0.001 and r=.336, P<0.001 for BUN and Cr respectively) and that there was no significant correlation between other variables (gender, education, place of residence and BMI category) and the level biochemical parameters (p>0.05 for all).

Moreover, as the findings showed that the BUN had a significant correlation with age, a multiple regression was used to control the effect of age.

In the regression analysis, the results showed that controlling for the effect of age, there was no significant relationship between the BUN parameter and the level of physical activity in general and during the work, sport and free time. There was also no significant relationship between the Cr parameter and the physical activity in general (P=0.181), during sport activities and in the free time. There was, however, a negative significant correlation between the physical activity at work and the level of Cr (b=-.277, 95% CI: -.477 to -.081, p=0.006).

Table 1. The frequency of patients' demographic characteristics

		N	%
Gender	Male	188	67
	Female	92	33
Educational Statuse	Illiterate	135	48
	Low literate	99	35
	Diploma	32	12
	College education	14	5
Living Condition	Alone	38	14
	With spouse	57	20
	With spouse and children	132	47
	With children	53	19
Occupation	Retired	40	14
	Worker	14	5
	Employee	7	3
	Self-employed	99	35
	Housewife	83	30
	Other	37	13
Place of Residency	City	218	78
	Rural area	62	22
BMI	Thin	4	2
	Normal	112	40
	Over weight	128	46
	Obese	36	13

Table 2. The scores of physical activity and its domains
* Inter-Qu

Physical Activity Domain	Mean± SD	Median (IQR)*	Min- Max
Work	2.67 ±.59	2.63 (2.25-3.00)	1.25-4.38
Sport	1.74 ±.54	1.50 (1.25-2.00)	1.00-4.00
Free Time	2.06 ±.52	2.00 (1.75-2.25)	1.00-4.25
Total	6.48 ±1.24	6.25 (5.50-7.38)	3.75-10.13

*artile Range

Table 3. Description of biochemical parameters of patients

Biochemical Parameters	Median (IQR)	Mean±SD	Min-Max
Chol (mg/dl)	167 (139.25-196)	168.80±46.14	25-387
HbA1C (%)	6.4 (5.34-9.4)	7.91±6.52	4.2-63.0
Feritin (g/dl)	98 (64-184)	147.82±132.80	5-854
BUN (mmol/l)	19 (14-23)	20.72±9.82	9-72
CR (mol/l)	1.10 (0.94-1.25)	1.17±0.43	0.18-4.36
FBS (mmol/l)	128 (101-178)	148.09±67.67	12.3-547
TG (mg/dl)	120 (87.7-161)	134.27±66.62	5.7-441
LDL (mg/dl)	98.9 (74.3-125.7)	102.00±38.74	1.7-268.4
HDL (mg/dl)	39 (32-45)	41.82±20.77	18-282

Chol, cholesterol; HbA1C, hemoglobin glycosylated; BUN, blood urea nitrogen; CR, creatinine; FBS, fasting blood sugar; TG, triglyceride; LDL, low-density lipoprotein; HDL, high-density lipoprotein.

Table 4. Correlation between biochemical parameters and physical activity domains

Physical Activity Domains		Biochemical Parameters								
		CHOL	HB1AC*	FERITIN**	BUN	CR	LDL	HDL	FBS	TG
Work	r***	-.109	-.190	-.032	-.177	-.259	-.075	-.042	.026	-.103
	P	.069	.081	.745	.003	.000	.216	.485	.671	.095
Sport	r	-.016	.050	.162	-.094	-.105	-.034	-.035	-.025	.091
	P	.795	.646	.096	.119	.083	.575	.563	.680	.138
Free Time	r	-.068	.069	.047	.027	-.046	-.058	-.056	.080	-.051
	P	.257	.529	.631	.653	.444	.339	.355	.187	.406
Total	r	-.094	-.041	.073	-.121	-.185	-.078	-.070	.035	-.025
	P	.116	.709	.453	.043	.002	.199	.247	.564	.687

*Data was available for 85 patients; **Data was available for 107 patients; ***Correlation coefficients

Discussion

Cardiovascular disease in the recent decade has been the main cause of mortality in industrial countries. It seems that physical activity can perform a significant role in decreasing the incidence and progression of cardiovascular diseases through having an effect on total cholesterol, HDL, LDL and TG (7). The present study was conducted to determine the relationship between the level of physical activity and biochemical parameters of the blood in patients with acute coronary syndrome. The findings of the study demonstrated that except for the creatinine level of blood, no other measured biochemical parameter (HDL, LDL, TG, Feritin, FBS, HBA1C and BUN) had a significant correlation with the level of physical activity. Unlike the findings of the present study, a study by Matsuzawa demonstrated a significant correlation between HDL and level of physical activity (16). Rahmani et al also reported that there exists a significant correlation between the level of physical activity and cholesterol, TG, LDL and HDL (20). Aadahl et al also investigated the correlation between the level of physical activity and cardiovascular risk factors in an adult population, reporting that there is a significant correlation between physical activity and TG and HDL (18) . The findings of a study by Hosseini et al also indicated that there exists a significant correlation between physical activity and LDL and total cholesterol; the results of their study , however, did not show a relationship between physical activity and HDL (20). Additionally, a study by Etemad et al showed that there is a significant correlation between students' physical activity and cholesterol and LDL, but there is no correlation between physical activity and TG and HDL (7). In the same vein, Bijeh et al studied the effect of a six-month training course on lung function markers of middle-aged women, reporting no remarkable correlation between the levels of BUN, Creatinine and GFR (21).

The researchers believe that the existing differences and disagreements in the findings of the studies could be due to the differences in the population of the studies and differences in the age and gender groups studied. Additionally, as each of the studies in this area have been carried out in different parts of the country and the world, it can be claimed that part of the differences in the findings of the studies could be owing to cultural and climatic differences. If other variables such as lifestyle, nutrition, were investigated as intervening variables in the statistical analyses, other results could be obtained.

Although the present study demonstrated no significant correlation between physical activity and biochemical parameters of blood, given the advice of ACSM, CDC, and surgeons (22), daily exercise is highly recommended because of its protective effect on the heart as well as people's general health. The results also indicated no significant relationship between physical activity and HDL and it had been reported that this might be due to the lack of intense and regular physical activity by subjects (23).

With regard to the findings of the present study, it is suggested that a more comprehensive study with a larger sample size be conducted.

One of the limitations of the present study could be the sample size under investigation; the results could be much better if the study were conducted on a larger sample size. As a correlation existed between level of physical activity and patients' lung function markers (BUN and Cr), it is suggested that a similar study be conducted on patients with lung dysfunction. It is also advised that appropriate levels of suitable physical activities, with regard to their dehydration effects, be included in the treatment and protective programs. In addition, with regard to the results of this study and because of the lack of a relationship between physical activity and biochemical parameters, physical activity should be considered in the treatment of patients with acute coronary syndrome.

Conclusion

Although the findings of the study indicated no significant correlation between physical activity and parameters such as HDL, LDL, and TG, as the protective effect of physical activity on cardiovascular system has been proved, it is recommended that regular and proper physical activity be incorporated in the treatment and care program of the patients with chronic diseases particularly cardiovascular ones. Moreover, with regard to the role of education in the reduction of dire consequences of chronic diseases in the society and treatment systems, it is suggested that training courses and workshops on the positive effects of physical activities and the right ways of doing them be organized

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