Comparison of Hs-CRP, WHR, LDL/HDL and TC/HDL in Active and Inactive Middle-aged Women

Mohammad Reza Ramezanpour[a], Masoumeh Hosseinnezhad[a], Vahid Moghaddam[b], Tohid Mabhout Moghaddam [a]

a: Departement of Physical Education, Mashhad Branch, Islamic Azad University, Mashhad, Iran.
b: Departement of Physical Education, GHazvin Branch, Islamic Azad University, GHazvin, Iran.
Corresponding author Email address: ramezanpour@mshdiau.ac.ir

Abstract: Purposes - Cardiovascular diseases have nowadays become the most common diseases in developing countries, particularly in urban regions. The purpose of this study is to investigate and compare cardiovascular risk factors such as hs-CRP, WHR and TCL, LDL to HDL ratios in active and inactive middle-aged women. **Materials and Methods -** Subjects in this study were middle-aged women (avg. age: 41.34±3.51 years, height: 158.89±5.136cm, weight: 76.69±4.749 kg, BMI: 27.61±1.96 kg/m^2) who were selected randomly among volunteers and classified into two active (15) and inactive (14) groups. Active group was consisted of women who had one year regular sport activity history and inactive group was including women who had no sport activities in last year. In this comparative, causal study, Kolmogorov-Smirnov test was used to demonstrate assumption of normal data and independent t test to compare averages. **Results -** Findings showed that hs-CRP in serum, WHR level and LDL, TC to HDL ratios are less in active than inactivemiddle-aged women. **Conclusions -** Considering the findings in this study, it can be cautiously concluded that regular physical activities because of anti-inflammatory effects and lipid profile improvement cause to decrease the risk of cardiovascular diseases in overweight middle-aged women.
[Ramezanpour MR, Hosseinnezhad M, Moghaddam V, Mabhout Moghaddam T. **Comparison of Hs-CRP, WHR, LDL/HDL and TC/HDL in Active and Inactive Middle-aged Women**. *Life Sci J* 2013;10(3s):527-533] (ISSN: 1097-8135). http://www.lifesciencesite.com. 83

Keywords: High-sensitivity C-reactive protein (hs-CRP), WHR, LDL/HDL ratio, TC/HDL ratio

1. Introduction

Sedentary and obesity outbreak and their negative effects on public health are rapidly increasing in developing and developed countries [1]. Overweight and obesity raise the risk of cardiovascular disease, type 2 diabetes, hypertension, hyperglycemia, hyperlipidemia, arthritis, asthma and some certain types of cancers [2]. Among these, cardiovascular diseases are important, on top of which are CAD problems. Atherosclerosis is the most important cause of CAD-related diseases. It has been demonstrated that total serum cholesterol (TC) accompanied by LDL will cause to CAD and low HDL is considered as the main cause [3]. Yet, in recent studies it has been reported that variations of TC and LDL to HDL ratios are more important prognostic factors than that of cholesterol level for cardiovascular diseases. These ratios are very appropriate to estimate atherosclerosis risk, the higher ratios, is the higher risk [4]. Cbek (2001) studies showed that TC/HDL ratio is a simple and useful factor to determine the risk of ischemic heart diseases. He expressed that this ratio indicates a set of disturbances followed by obesity and is applicable to predict risk possibility [5].

On the other hand, many researchers believe that inflammatory process (even in generic type) is included in main predisposing factors and is a premier for atherosclerosis and cardiovascular diseases. Therefore, in last decade researchers have paid attention to inflammatory factors which predict cardiovascular disease risks with more sensitivity and accuracy [6, 7, 8, and 9].

There are some inflammatory factors effective in cardiovascular disease prognosis. Among these, hs-CRP is one of the most sensitive inflammatory factors, most powerful [9]. The results of hs-CRP researches are aligned no longer, there are paradoxes,and guidelines resulted in CRP decrease and eventually decreasing cardiovascular disease risks has yet been remained ambiguous [10].

WHR assessment, another risk factor for cardiovascular disease, in middle-aged overweight women besides determining a WHR point in which the chance of being suffered by cardiovascular disease risk factors increases, is very important. Many researchers have recommended WHR assessment as a simple anthropometric index to evaluate abdominal obesity. The results have shown that having high fat around the abdomen is related to cardiovascular risk factors. Obesity and body fat distribution, especially in middle part of the body (abdomen and waist) are appropriate prognoses for disease in future. The most important disturbances related to increase body lipid level, especially around waist and abdomen, are hyperlipidemia, hypertension and CAD [11]. Considering obesity prevalence and related diseases increase in middle-aged women in Iran [12], preventing obesity, especially abdominal obesity, should be one of important priorities in

public health. Knowing these health factors in the society can play an effective role to determine possibility of cardiovascular disease in middle-aged women. It is important to answer the question whether this anthropometric factor is affected by physical activities and having a regular schedule for the activities, WHR factor can be maintained in natural range.

Considering the importance of factors in this study, unfortunately there is much little information and little quantitative researches has been undertaken regarding the effect of physical activities on hs-CRP, WHR and lipoprotein ratios in middle-aged (35-45 years old) women. Also, these researches have some limitations such as generalizability because most researches have been undertaken in obese old women or men communities. Therefore, researchers in this study are to find answer of this question: having determined and compared hs-CRP, WHR, LDL/HDL and TC/HDL ratios in active and inactive middle-aged women, could be obtained a factor to undertake required actions to prevent cardiovascular diseases in women communities?

2. Methods

Having distributed calls for participation among active women in Sarabi aerobics hall in Mashhad, total 100 middle-aged volunteers completed physical activities and medical data paper, among which 15 volunteers confirmed by requirements for the study were selected and classified in active group. Also, among total 100 middle-aged housewives confirmed by study requirements, 14 women were selected and classified in inactive group. Confirmation requirements in the study were including enjoyment of public health, 35-45 years old range, BMI 25-30kg/m^2 (overweight threshold), no special diets or supplements, no medicines or tobacco use, no menopause, no apparent and clinical signs of cardiovascular, diabetes and hypertension diseases, no physical practices and activities for inactive group, three times a week regular physical practices and in-hall aerobics practices for a minimum a year for active group. Having selected the study sample, the subjects were provided with required data about the plan and pints that they should regard during the study. Then, the subjects were asked to complete consent form and personal information questionnaire. Anthropometric characteristics and physical components such as height, weight and BMI were measured by tape meter, analog stadiometer and digital balance. By the way, 29 qualified and confirmed volunteers were classified in active (15) and inactive group (14).

Active group blood samples were obtained by laboratory specialist in Sarabi aerobics hall and simultaneous with active group, inactive group fasting blood samples wereobtained in Kian Laboratory at 8-9am. Firstly, a 5ml blood sample was taken from right brachial veins of the subjects in sitting and relaxing positions and the samples were transported to the laboratory with special considerations. A 2.5ml blood sample of each subject was maintained in room temperature for 15min to coagulate. Then, the clots were centrifuged for 10min at 2500rpm. Obtained serum was held in -20°C and its CRP level was quantitatively measured by high-sensitivity immunoturbidimetry. Biochemical parameters including TC, HDL and LDL were calculated using laboratory kit of Pars Azmoon Co. and auto biochemistry analyzer RA1000 made in U.S.A.

3. Statistics

In this study, descriptive and inferential statistics methods have been used to analyze data. Descriptive statistics was applied to investigate average and standard deviation of variables, Kolmogorov-Smirnov test to demonstrate normalized data and independent t test to analyze the data. Additionally, Spss/pc++ (version 16) software package was implemented to undertake the computations and Excel software to draw diagrams.

4. Practices

As a practice program followed by active group, they practiced in aerobics hall three days a week in the morning. Duration of each session was approximately 60min and the practices were including warming up with exercises (10min), harmonious aerobics movements (30min), running with moderate to high speed (10min) and cooling with slow movements, breathtaking and stretching.

5. Results

In Table 1, there has been presented measurements related to physical and biochemical subjects. Considering significance level (<0.05) for hs-CRP, WHR, LDL/HDL and TC/HDL variables, the difference between respective factors in active and inactive groups were significant. Therefore, it can be concluded that regular physical activity can cause to decrease risk factors for cardiovascular diseases in overweight middle-aged women.

Table 1: Average and significance level for study variables in active and inactive groups (df=27)

Variables	Group	Mean ± S.D	F	Variance Congruity	Mean Difference	t	P
Hs-CRP	active	1.76±0.315	0.162	0.691	-2.176	-15.933	0.001
	inactive	3.95±0.416					
WHR	active	0.78±0.066	0.222	0.641	-0.068	-3.268	0.003
	inactive	0.85±0.042					
LDL/HDL	active	2.71±0.337	0.427	0.519	-0.593	-3.398	0.002
	inactive	3.303±0.579					
TC/HDL	active	3.799±0.865	0.166	0.687	-1.022	-3.373	0.002
	inactive	4.822±0.759					

6. Discussions

This study is aimed to investigate and compare the risk factors of cardiovascular diseases including hs-CRP, WHR, LDL/HDL and TC/HDL ratios in active and inactive middle-aged women. The results have shown that there is a significant difference in hs-CRP level between active and inactive women, means that hs-CRP level in active women is lower than inactive women (P=0.001). Investigating experimental and interventional studies about the effect of physical activities on inflammatory factors, especially hs-CRP, has shown different contrary and compliant results respect to the results of this study. This study results are compliant with results of many studies [14, 15, 16, 17, 18 and 19]. Investigating hs-CRP levels in the compliant studies has shown a significant and inverse relationship between regular physical activities and inflammatory factors. These studies have reported that people who are physically more active and have better physical fitness have inflammatory factors in lower levels [15 and 19], which is consistent with this study findings. Hs-CRP level increase in inactive group in comparison with active group may be because of their less previous activities and lower fitness. Although this study was no longer aimed to investigate mechanisms responsible to probable variations in inflammatory factors, based on suggestions of previous studies, cardiovascular system supplement is probably caused by aerobics exercises, metabolism variations and lipolysis process reinforcement (which is appeared as weight and fat loss resulted in adipose tissue reduction while adipose tissue is one of inflammatory cytokines produces) and the final result is direct or indirect reduction in hs-CRP production in the liver [20]. Various investigations in adolescents have reported negative relationship between hs-CRP levels and aerobics fitness.

On the other hand, there are studies contrary with recent study results regard to hs-CRP [22, 23, 24, 25 and 26]. In these studies it has been reported that physical activities have no effect on CRP levels. With this regard, Hoffman (2006) and Christian (2008) indicated that no reduction in CRP is caused by no variation in adipose tissue and insufficient time for exercises to vary CRP levels while Nassis et al. (2005) expressed that no variation in weight and percentages of fat in the body is a cause to no variations in CRP. Garry et al. (2004) reported insufficient time to exercise or lack of appropriate speed and duration experienced by subjects and Nicholas et al. (2004) also reported negligence of sexual and racial differences as causes to CRP invariants [2].

In this study was also recognized that there is a significant difference in WHR ratio between active and inactive women, means that WHR ratio in active women is less than in inactive women (P=0.003). Average WHR ratios in active and inactive women were respectively 0.78±0.066 and 0.85±0.042 and middle-aged women WHR was finally estimated as 0.81. WHR norm of women in Tehran, Iran was obtained by Azizi (2004) as 0.78<WHR<0.92 with which the average in this study (WHR= 0.81) is consistent. The results of this study are consistent with many studies [11, 27, 28, 29, 30 and 31]. Gaeini (2006) expressed that if the resulted number is more than 80% for women, then it indicates very much fat around central part of body which is harmful for health. According with the results, inactive women in this study have more abdominal obese and are in dangerous threshold which is consistent with previous results [11, 30 and 31].

Obese resulted from hyperlipidemia and increased inflammation could cause to increase rupture of atheroma plaques and also to increase platelet and plasminogen activator inhibitor activity which is resulted in intensifying and accelerating initiation and spread of intravascular clot caused by plaque rupture. Obese accompanied by cardiac hypertrophy increase the risk of cardiac ischemia [34]. Inverse significant relationship between this anthropometric factor and physical activities [11, 35 and 36] indicates that the causes of higher norms in inactive women are probably related to low mobility, lower activities and obese. Therefore, emphasize on physical fitness and sport activities, knowing risks

resulted from obese and low mobility are required for middle-aged women.

According to the study findings, there is a significant difference between LDL/HDL ratio in active and inactive women, means that LDL/HDL ratio in active women is lower than inactive women (P=0.002). Average LDL/HDL ratio in active and inactive women was calculated respectively 2.71±0.337mg/dl and 3.303±0.579mg/dl and finally this ratio factor was estimated 3.00 in middle-aged women.

According to the International Standards, 3<LDL/HDL<5 is considered as the factor range. A value lower than 3.00 is ideal with very low risk, between 3.00 to 5.00 with moderate risk and higher than 5.00 has been reported dangerous and natural value for LDL/HDL ratio is about 2.50 in women [37]. The average value obtained in this study for active and inactive middle-aged women has been estimated 2.70 and 3.30, respectively. By the way, active women are in appropriate condition but inactive women are in intermediate risk exposure and their risk for cardiovascular disease vulnerability is more than active women. This result is consistent with some studies [27, 38, 39, 40, 41 and 42].

This study results have also shown that TC/HDL ratio has a significant difference in active and inactive women, means that TC/HDL ratio in active women is less than inactive women (P=0.001). Average TC/HDL ratio in active and inactive women was respectively 3.799±0.865mg/dl and 4.822±0.759mg/dl and finally this ratio factor was estimated 4.30 in middle-aged women. According to International Standards, 3.5<TC/HDL<5.5 is considered as factor range for women. A value lower than 4.00 is ideal with very low risk, a 4.50 to 5.50 value with moderate risk and higher than 5.50 with high risk and dangerous. Natural value for TC/HDL ratio is about 3.50 for women [37]. Average value obtained in this study was estimated 3.70 and 4.80 for active and inactive middle-aged women, respectively. Therefore, active women are in appropriate condition but inactive women are in intermediate risk range and higher vulnerability exposure with cardiovascular diseases than active women. This result is consistent with some previous study results [27, 38, 39, 41, 43 and 44].

A natural value for LDL/HDL and TC/HDL ratios is about 2.50 and 3.50, respectively. These ratios are very important to estimate atherosclerosis risk. The higher this ratio, is higher the risk for cardiovascular disease exposure [37]. In recent studies it has been reported that variations of TC/HDL and LDL/HDL ratios respect to variation of cholesterol levels are important prognosis factors for cardiovascular events. In cases with lowest ratios, the percentage of these events is 5.8%, in fact half of events in which TC/HDL and LDL/HDL ratios are in maximum. In cases with maximum ratios, the subject is threatened by the highest risk for cardiovascular disease events [45]. In this study, however, there was no longer observed any difference in TC and LDL levels in the blood serums of two groups but there were tangible differences in TC/HDL and LDL/HDL ratios. Therefore, changes created in the pattern of lipoproteins ratios should be more considered in cardiovascular diseases prevention and treatment, especially in middle-aged women who are unfortunately women with low mobility and vulnerable with cardiovascular injuries.

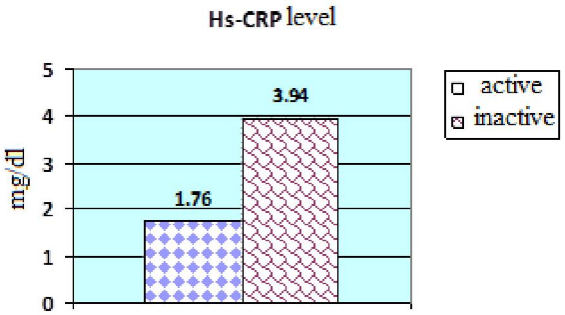

Figure 1: Hs-CRP level of the subjects in each group

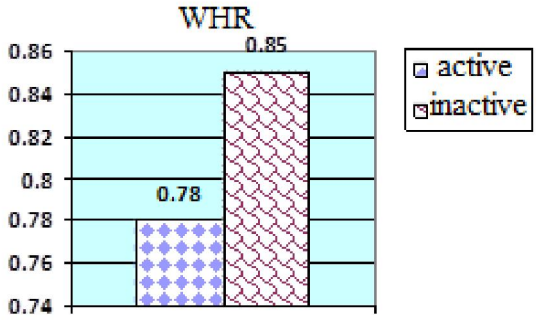

Figure 2: WHR ratio (waist to heap in cm) in the subjects in active and inactive groups

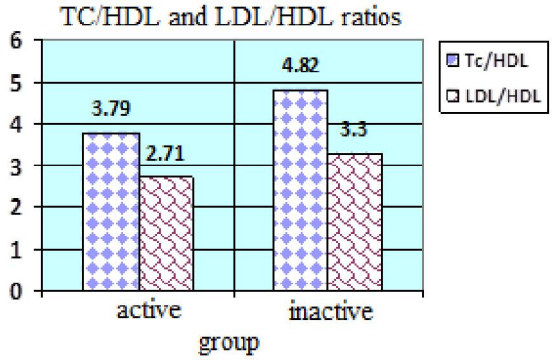

Figure 3: TC/HDL and LDL/HDL ratios in active and inactive subjects

7. Conclusions

With regard to research findings in this study based on serum hs-CRP, WHR, LDL/HDL ratio and TC/HDL ratio reduction in active middle-aged women as prognosis factors for cardiovascular disturbances, it can be prudently concluded that regular physical activities, because of anti-inflammatory effects and lipid profile improvement, probably cause to decrease the risk for cardiovascular diseases exposure in overweight middle-aged women. Also, it is appeared that active women with higher physical activities have usually more concentrated HDL and lower LDL/HDL and TC/HDL ratios than inactive group. Therefore, it can be said that inactive lifestyle is accompanied by higher risks to exposure with cardiovascular diseases. Also, anthropometric factor WHR may be affected by physical activities and women, with regular physical activity program, can maintain this factor in natural ranges.

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1/5/2013