The effect of physical activity and body composition on inflammatory marker CRP in active and inactive older adults

Zahra Azarpira¹*, Hamid Agha-alinejad², Afkham Daneshfar³

1- M.A.in physiology, Department of Physical Education and Sport sciences, Islamic AzadUniversity, Central Branch of Tehran
2- Assistant professor, Department of Physical Education and Sport sciences, Tarbiat Modares University
3- Assistant professor in Motor Behavior, Department of Physical Education and Sport sciences, Alzahra University

*Corresponding author, E-mail: mitra.azarpira@yahoo.com

Abstract

Cardiovascular disease is one of the most common reasons of death in high ages that will be started by atherosclerosis. Today, the investigation of inflammatory markers as a predictor factor of atherosclerosis is increased. The principal purpose of this article is to investigate the effect of physical activity and body composition on inflammatory marker CRP in active and inactive older adults. Subjects were forty older adult with the average of the age 68.4±5.91 years, the height 1.67±0.08, body mass 69.28±11.96, body mass index 26.57±4.36 and body fat percent 7.32±2.66 %. The methods of present study were dividing All subjects based on levels of exercise in to 2 groups: active (n=20) and inactive (n=20) and then based on body mass index in to 2 subgroups: normal weight and overweight. To determine fasting value of CRP, blood samples were obtained at 8AM. To analyze data, SPSS software (version 18) and Kolmogorov – Smirnov Test were used. With due attention to the results of the Kolmogorov–Smirnov Test that indicated abnormal distribution for Hs-CRP, we use Mann- Whitney Test to investigate this variable and no meaningful difference was found between active and inactive subjects and between obese and normal weigh subjects at resting levels of inflammatory markers (P<0.05). It seems, obesity is a stronger factor than gender and physical immobility for development of inflammatory responses in older adults. Of course, the effect of these factors will be minimized in healthy older adults who does not have any disease history.

Keywords: Physical activity, Body composition, Inflammation, Aging

Introduction

Cardiovascular diseases and cerebra vascular diseases that mainly will be started by atherosclerosis, are the most common reasons of death especially in high ages in world wide that have been increased during past decades (Jameson, 2008; Valentine, 2009). Atherosclerosis is identified by sediments of cholesterol, calcium and cell residue products with setting of fibrosis fiber in the artery endothelium.

According to World Health Organization, cardiovascular diseases especially atherosclerosis gradually will be the head of diseases which will decrease patient's efficiency cause of disability and early death, also obesity and lack of physical activity will be the other reasons (Jameson, 2008; world health organization).
The pathogenesis role of inflammation in atherosclerosis and the role of inflammatory markers as accelerator and predictor of atherosclerosis are most extensively studied (Jameson, 2008; Bonow, 2011).

One of the most extensively studied systemic inflammation markers is high sensitivity serum C-reactive protein (Hs-CRP) (Michael, 2005; Hoth, 2008), that hepatocytes produce under the influence of cytokines such as interleukin-6 and tumor necrosis factor-alpha (Ridker, 2007; Sesso, 2007). Hs-CRP is an independent predictor of future myocardial infarction and stroke and even High serum Hs-CRP concentration is associated with atherosclerosis (Hoth, 2008; Ridker, 2007).

Ridker et al. (2007) investigated previous studies about the importance role of CRP in predicting cardiovascular events during past 10 years and the results demonstrated increased levels of CRP (more than 3 ml/gr) can predict vascular risk especially when blood lipids are low. The other advantage of CRP are high identifying ability (more than lipid factors and blood cholesterol) and stability during long term (Ridker, 2007).

Aging is associated with a cascade of morphologic and physiologic changes that naturally predispose older adults to progressive debility, functional decline, morbidity, disability and increased mortality. An active life style and regular physical activity provides many physiological benefits, reduces risk of disease outcomes (Niu, 2008; Hamer, 2009) and protect Cardio Vascular system by adjusting different factors such as obesity, diabetes, blood pressure, high blood lipids, disruption in endothelial function, and vessel inflammation (Akbartabartoori, 2007; Hamer, 2007), also, aging process is associated with progressive immune disruption and physical activity moderates such insidious aging patterns and is a vital preventive and therapeutic strategy to optimize health throughout the aging process (Edington, 2003). The results of the Aronson et al. (2004) study on healthy male and female adults and older adults demonstrated positive relationship between physical activity and CRP values (Aronson, 2004) Thus, older adults regular physical activity and exercise participation during many years will moderate immune system function in comparing with inactive older adults (Glueson, 2007).

Several researches have reported meaning inverse relation between the measures of body composition (body mass index and body fat percent) with levels of inflammatory factors such as Hs-CRP.

Rudy et al. (2009) studied the relation between gender differences with obesity, Hs-CRP, physical activity and depression in male and female older adults with the average of the BMI=28, the results demonstrated high levels of fatigue, obesity and inflammation in female older adults in comparison with males (Valentine, 2009).

Estrogen hormone protect females from Cardio Vascular Disease risks but estrogen levels significantly decrease in menopause, so low levels of estrogen is a comparable risk factor between male and female older adults (Bassuk, 2004).

Hamer et al. (2009) investigated the relation between physical fitness, obesity and Hs-CRP in male and female middle aged subjects in a prospective study and the results reported changes of inflammatory values have significant relation with obesity but not with physical fitness levels (Hamer, 2009).

Thus the relative influences of fitness, gender and inactive life style and generic differences on inflammatory pathway are unclear yet, so the aim of this study was moderating or omitting all stimulatory Factors such diseases as blood pressure, high blood lipids, diabetes, cardio vascular diseases, cancer and immunodeficiency diseases and selecting healthy subjects to identify which of gender, physical activity and body composition levels can alter or decrease inflammatory values of inflammatory marker Hs-CRP.

Materials and Method

All subjects completed a health and lifestyle questionnaire prior to entering the study. Volunteers were excluded if they were taking any prescribed medication; smoked cigarettes or drank alcohol. Subjects gave informed consent and were recruited to the study. Subjects (n=40) based on levels of exercise were classified as 2 group: active (n=20) and inactive (n=20), also based on body mass index were divided to 2 subgroups: normal weight (body mass index between 18.5 to 24.9 kg/m²) and overweight (body mass index>25 kg/m²). Thus subjects were classified in 6 subgroups: male (n=20), female (n=20), active (n=20), inactive (n=20), obese (n=25) and normal weight (n=15).

The subjects were forty older adult with the average of the age 68.4±5.91 years, the height 1.67±0.08, body mass 69.2±11.96, body mass index 26.57±4.36 and body fat percent 7.32±2.66 % were participated in this study. Blood samples (5cc) were collected into heparinized vacutainer tubes.
between 08:00 and 9:00 A.M after a fast of at least 10 h. Plasma was stored at -20 °C prior to analysis for 1 week.

Normal distribution pre hypothesis of data was investigated by Kolmogorov – Smirnov Test. With due attention to the results of the Kolmogorov – Smirnov test that indicated abnormal distribution for Hs-CRP, we use Mann-Whitney Test to investigate this variable and no meaningful difference was found between active and inactive subjects and between obese and normal weigh subjects at resting levels of inflammatory markers (P<0.05). All information was analyzed by computer and SPSS software (version 18). In descriptive part, mean and standard deviation had been used.

**Results**

Table 1: Characteristics of subjects (n=40)

<table>
<thead>
<tr>
<th>group variables</th>
<th>male(n=20)</th>
<th>female(n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>70.1±6.71</td>
<td>66.7±4.54</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.68±0.06</td>
<td>1.54±0.04</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>71.62±10.51</td>
<td>66.95±13.10</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.15±3.06</td>
<td>27.99±5.04</td>
</tr>
</tbody>
</table>

Participant characteristics at the time of study enrollment are described in Table 1. Also All data of variables (HS-CRP, BMI) in study groups are presented as Standard Deviation (S.D) ± mean in Table 2.

Table 2: Descriptive statistics of variables for study groups

<table>
<thead>
<tr>
<th>statistic variable - group</th>
<th>Hs-CRP (mgr/l)</th>
<th>BMI (mgr/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>3.96±3.67</td>
<td>27.15±3.06</td>
</tr>
<tr>
<td>female</td>
<td>2.91±1.69</td>
<td>27.99±5.04</td>
</tr>
<tr>
<td>Physical activity levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>active</td>
<td>3.41±2.06</td>
<td>26.62±3.58</td>
</tr>
<tr>
<td>inactive</td>
<td>3.43±3.55</td>
<td>26.52±5.12</td>
</tr>
<tr>
<td>Body composition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>normal</td>
<td>3.65±3.97</td>
<td>23.03±1.74</td>
</tr>
<tr>
<td>obese</td>
<td>3.28±1.97</td>
<td>28.69±4.08</td>
</tr>
</tbody>
</table>

As it has shown in tables 1 and 2, levels of Hs-CRP in males are more than females and in obese subjects are less than normal samples but there is no significant difference between active and inactive subjects.
Also BMI levels in females are more but there is no significant difference between active and inactive subjects.

The results of Kolmogorov – Smirnov Test (k-s) indicated abnormal distribution for Hs-CRP in study groups, thus we use Mann-Whitney Test to investigate this variable and the results demonstrated no significant difference for Hs-CRP in different levels of gender (U=136.5 P=0.133), physical activity (U=162 P=0.431) and body composition (U=166.5 P=0.697).

**Discussion and Conclusion**

As described Hs-CRP levels in males are more than females but there is no significant difference between obese and normal samples and active and inactive subjects too. In total, the findings from the present study demonstrate no significant difference to Hs-CRP in study groups (P>0.05). Similar to our findings, some previous researches have reported physical activity levels can not alter inflammatory values as (Michos, 2009; Hamer, 2009) but inversely several studies have reported reduction in Hs-CRP levels by exercise in healthy middle aged individuals and older adults (Michos, 2009; Sesso, 2007; Hamer, 2009; Aronson, 2004; Miller, 2008; Cesari, 2009; Valentine, 2009; Kohut, 2006).

The main reasons of difference between the results of previous researches with present literature are: age, gender, levels of physical fitness, and the kind of exercise, obesity and smoking. For example, in present study to identify the long term effects of active life style and overweight, the levels of inflammatory marker Hs-CRP were measured in active and inactive old subjects but Miller et al. (2008)
In addition of energy-restricted diet, obliged subjects to participate in exercise training and active life style. That seems the type of fat and weight-loss intervention (rateol weight loss, nutrient composition) employed may be a factor affecting inflammation (Hs-CRP) changes. Furthermore, Kohut et al. (2006) randomly assigned participants to either an aerobic exercise treatment (CARDIO) or a flexibility/strength exercise treatment (FLEX) 3 days/week, 45 min/day at 65–80% of maximal cardiac effort for 10 month period that the CARDIO treatment resulted in significant reductions in serum CRP compared to the FLEX treatment. Therefore, it is clear that kind, intensity and time of exercise training can influence inflammatory levels and training intervention to raise aerobic fitness can alter inflammatory levels too (gleeson, 2007).

Also, estrogen levels significantly decrease in menopause so the protective aspect of estrogen hormone in cardio vascular diseases will decrease too (Mathews, 1976). Among contrary studies to present study, Verdaet et al (2004) exclusively investigated the effect of active life style and exercise training on Hs-CRP levels in male subjects and Mora et al. (2007) exclusively studied the effect of exercise training on Hs-CRP levels in female subjects (Verdaet, 2004; Cesari, 2009) but to identify the effect of gender in present study, we investigated inflammatory levels in male and female older adults that seems gender intervention is one of the contrary reasons to present study (Jameson, 2008).

Additionally, depression, stress and emotional pressure are significant risk factors for C.V.D by raising inflammatory levels (Jameson, 2008) also, smoking by increasing blood pressure makes thromboarteritis, thrombocytosis and accelerate thrombogenesis and thus increase inflammatory levels and accelerate Atherosclerosis (Gleeson, 2007). Among contrary researches just Hamer et al. (2008 and 2009) and just Mora et al (2007) has modified smoking and Rudy has controlled and modified the both but healthy subjects with no medicine or smoking history were selected in present study to omit all disruptive factors. Also our results demonstrated body composition have no influence on inflammatory levels in older adults (P>0.05) but several researches have reported the effects of body composition levels on inflammatory levels in older adults (Michos, 2009; Akbartabartoori, 2007; Cesari, 2009; Valentine, 2009).

Because of debility, disability and over weight in older ages (Wilmore, 2004) it sounds that the effect of age differences in subjects are the main contrary reason of present study to others. Furthermore, the effects of gender and not controlled nutritional status on the relation between body composition levels and inflammatory values can be the other reasons of difference in the results of previous studies thus, in present study to omit all disruptive factors healthy subjects selected and their diet and mental status controlled.

It sounds that in Kohut et al. (2006) research, exercise intervention to weight-loss and increase aerobic capacity had affected inflammatory values such as Hs-CRP but in present study, long term effects of active or inactive lifestyle on normal or obese-healthy older adults were measured. Also, in Miller et al. (2008) study, subjects had an energy-restricted diet and participated in exercise training and active life style during 6 months period that the results demonstrated weight-loss in subjects can make Hs-CRP values modification and decrease and it sounds that fat and weight-loss may affecting inflammatory values Decrease and make contrary results to present study (Wilmore, 2004; Gleeson, 2007).

Furthermore, nutritional status in samples can be effective on the relation between the levels of BMI and Hs-CRP (Michos, 2009; Bonow, 2011) that among contrary studies, just Miller et al. (2008) had modified and Erin et al. (2009) had controlled subjects ‘s diet that not controlled nutritional status in other contrary studies to present study is one of the reasons of difference. Also because of the influence of depression on obesity and raising Hs-CRP values and intervention in the relation between BMI and Hs-CRP, older adult subjects with depressive symptoms among the others is one of the contrary reasons of present study to Hamer et al. (2008, 2009).

In summary, we conclude that there is no significant difference on modulating or raising effects of gender, physical activity levels and body composition on Hs-CRP levels in all ages in both males and females, but the obesity and the gender are stronger factors for inflammatory responses in older adults that these effects reduce in healthy older adults with no morbidity history.

References


The World Health Organization Web Page, Who. int/whosis/ International Cardiovascular disease statistic,(up to date), Health topics, Cardiovascular diseases.
