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Original Article

Internal Medicine Section

Oxidative Stress in Obese Postmenopausal Women: An Additive Burden for Atherosclerosis

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ABSTRACT

Introduction: Coronary Artery Disease are on the rise in the general population and is the leading cause of death in both men and women. The impact of CAD is underappreciated in younger women when compared to men. Women have unique risk factors for CAD and postmenopausal women are at higher risk of developing CAD when compared to normal menstruating women.

Aim: The aim of our study was to find out the difference in oxidative stress levels between obese postmenopausal women and normal menstruating women, also to compare the same in normal weight postmenopausal women.

Materials and Methods: Thirty one normal and 29 obese postmenopausal women with age more than 45 years who visited obstetrics and gynaecology outpatient department for general clinical evaluation at a tertiary care centre were recruited in this cross-sectional study. Thirty normal menstruating women were compared. Anthropometric measurements were recorded and the body mass index was calculated. Serum Malondialdehyde and superoxide dismutase was measured using a spectrophotometer.

Results: There was a significant difference in mean MDA levels in postmenopausal women (1.477 ± 0.359) when compared to normal menstruating women (0.666 ± 0.302) ($p < 0.01$). There was no significant difference in mean SOD levels in postmenopausal women (2.836 ± 0.899) when compared to normal menstruating women (2.986 ± 0.686) ($p > 0.05$). Also, there was a significant increase between mean MDA levels in obese postmenopausal women (2.48 ± 0.52) when compared to normal weight postmenopausal women (1.65 ± 0.36) ($p < 0.01$). There was a significant difference between mean SOD levels in obese postmenopausal women (1.36 ± 0.96) and normal weight postmenopausal women (2.56 ± 1.03) ($p < 0.01$).

Conclusion: The oxidative stress was higher in obese postmenopausal women when compared to normal weight postmenopausal women and normal menstruating women.

Keywords: Coronary artery disease, Cardiac risk factor

INTRODUCTION

Coronary Artery Disease are on the rise in the general population and is the leading cause of death in both men and women [1]. The rise of CAD risk in the population is attributed to lifestyle diseases such as diabetes and hypertension. In women the incidence of CAD is low during their reproductive stages; however the presence of diabetes negates this protection [2]. The impact of CAD is underappreciated in younger women when compared to men [2]. Women have unique risk factors for CAD [3,4] and postmenopausal women are at higher risk of developing CAD when compared to normal menstruating women [2,5-7]. In general postmenopausal women are subjected to oxidative stress which is attributed to aging and other related factors [8]. Oxidative stress has known to play crucial role in many human diseases and atherosclerosis is one of them. The reactive oxygen species (ROS) and free radicals produced due to oxidative stress are known to mediate the atherogenesis [9,10].

Studies have shown that age, smoking, diabetes, and body mass index are highly associated with systemic oxidative stress [11]. Studies have also reported that, obesity is known to cause oxidative stress which further contributes for endothelial dysfunction in obese individuals [12]. The presence of oxidative stress in postmenopausal women has been studied earlier [13,14]. However with respect to body weight in postmenopausal women has not been studied so far. If a significant association is established between body weight and oxidative stress in obese postmenopausal women, it will help us to identify high risk individuals who can be further subjected to intense lifestyle modification and diet control, where in future cardiovascular complications can be averted in such individuals.

Thus the present study was designed to find out the difference in oxidative stress levels as measured by serum Malondialdehyde (MDA) between obese postmenopausal women and normal menstruating women, also to compare the same in normal weight postmenopausal women.

MATERIALS AND METHODS

Sixty postmenopausal women with age more than 45 years who visited obstetrics and gynecology outpatient department for general clinical evaluation at a tertiary care center with no serious gynecological illness were recruited in this cross-sectional study after obtaining the informed consent. Thirty normal menstruating women were compared. Based on body mass index the postmenopausal women were further divided into two groups. The BMI less than or equal to 23 kg/m^2 were considered as normal weight and BMI greater than 25 kg/m^2 were defined as obese as per Indian standards [15]. Among the 60 postmenopausal women selected for the study 31 had normal weight and 29 were obese. Subjects with hypertension, diabetes, surgically induced menopause, renal diseases, and on exogenous antioxidant supplement were excluded from the study. The study was approved by institutional human ethic committee.

Age and anthropometric measurements were recorded as per WHO norms [16]. The body mass index was calculated. Venous blood samples were collected in a vacutainer. The blood was allowed to clot for 30 min and then centrifuged at 2000 × g for 15 min for separation of serum. The serum then assayed for MDA by thiobarbituric acid method [17] and SOD by nitro-blue tetrazolium method [18] and was measured using a spectrophotometer.

STATISTICAL ANALYSIS

Student t-test was performed to find out whether there is a significant difference between mean MDA and SOD between the groups. $p< 0.05$ was considered statistically significant. Data were analyzed using SPSS Version 16 (SPSS, Chicago, IL, USA).

RESULTS

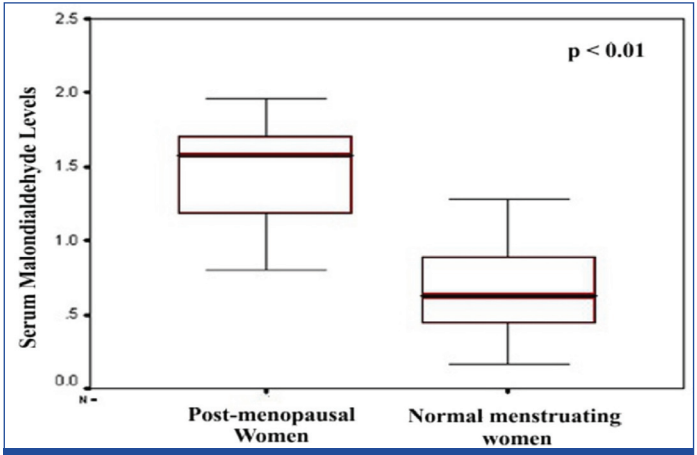
The mean SOD level was 2.836 ± 0.899 in postmenopausal women; the mean SOD level was 2.986 ± 0.686 in normal menstruating women [Table/Fig-1]. The mean MDA level was 1.477 ± 0.359 in postmenopausal women; the mean MDA level was 0.666 ± 0.302 in normal menstruating women [Table/Fig-2]. There was a significant difference in mean MDA levels in postmenopausal women when compared to normal menstruating women ($p < 0.01$) [Table/Fig-3]. There was no significant difference in mean SOD levels in postmenopausal women when compared to normal menstruating women ($p > 0.05$) [Table/Fig-4].

Variable	Postmenopausal Women (n =60)	Normal menstruating Women (n =30)	p-value
SOD			
Mean ± S.D.	2.836 ± 0.899	2.986 ± 0.686	p>0.05
MDA			
Mean ± S.D.	1.477 ± 0.359	0.666 ± 0.302	p<0.001

[Table/Fig-1]: Mean levels of SOD and MDA in postmenopausal women and normal menstruating women.

Variable	Obese Postmenopausal Women (n =29)	Normal weight Postmenopausal Women (n =31)	p-value
MDA			
Mean ± S.D.	2.48 ± 0.52	1.65 ± 0.36	p<0.01
SOD			
Mean ± S.D.	1.36 ± 0.96	2.56 ± 1.03	p<0.001

[Table/Fig-2]: Mean levels of SOD and MDA in Obese postmenopausal women and normal weight postmenopausal women.



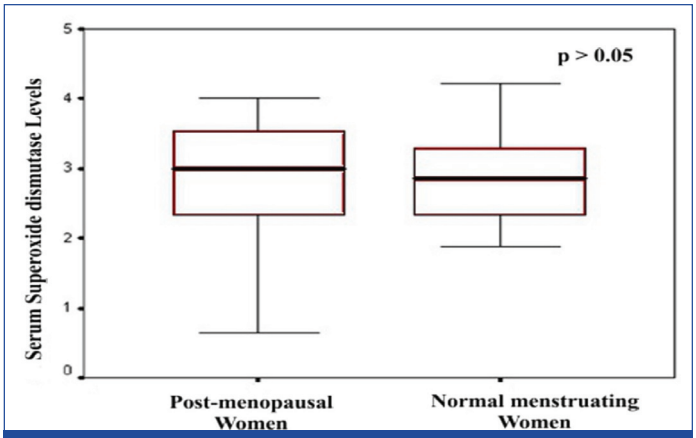
[Table/Fig-3]: Comparison of serum Malondialdehyde (MDA) level between post menstrual women and normal menstruating women

Also, there was a significant increase between mean MDA levels in obese postmenopausal women (2.48 ± 0.52) when compared to normal weight postmenopausal women (1.65 ± 0.36) ($p < 0.01$). There was a significant difference between mean SOD levels in obese postmenopausal women (1.36 ± 0.96) and normal weight postmenopausal women (2.56 ± 1.03) ($p < 0.01$).

DISCUSSION

In the present study we found that the obese postmenopausal women are associated with increase oxidative stress when compared to normal menstruating women and normal weight post-menopausal women. This finding is corroborated by the study done at southern part of India; where it has been observed that postmenopausal women had higher proportion of atherogenic markers when compared to premenopausal women [5].

In general postmenopausal women are subjected to oxidative stress which might be attributed to low level estrogen, has estrogen is shown to have antioxidant property [19]. Previous studies have



[Table/Fig-4]: Comparison of serum Superoxide dismutase (SOD) level between post menstrual women and normal menstruating women

shown that 17-β-estradiol, a nonestrogenic stereoisomer, 17-α-estradiol, and some estradiol derivatives can prevent intracellular peroxide accumulation [20].

Obesity can be the reason for production of atherosclerotic lesions by causing oxidative stress and LDL oxidation. High concentration of ox-LDL can be produced in individuals with greater Waist Circumference which is independent of BMI [21].

As the concentration of MDA, 4-HNE and ox LDL were higher among the postmenopausal women when compared to fertile women; oxidative stress is more among postmenopausal women as depicted in the earlier study ($p< 0.001$), while GSH-PX concentrations were significantly higher in fertile women than in postmenopausal subjects ($p<0.001$) [22].

Studies have shown that the decrease in SOD levels and increase in MDA levels is function of age [23]. Similarly in our study we found that there was reduction in mean SOD levels between postmenopausal women and normal menstruating women, which was statistically not significant, but there was a significant decrease in SOD levels between obese postmenopausal women and normal weight postmenopausal women. The mean MDA levels were also comparatively higher in obese postmenopausal women. Thus we hypothesize that significant increase MDA levels in obese postmenopausal women might have caused down regulation of SOD highlighting that obesity playing crucial role in increase oxidative stress in obese postmenopausal women.

It was evident from our study that increase in oxidative stress was observed not only in postmenopausal women but its levels were significantly higher in obese postmenopausal women when compared to normal weight postmenopausal women. This can be explained by the fact that increasing BMI can also play an important role in maximizing the oxidative stress along with increasing age and depleting estrogen level.

With a thorough study on many other oxidative stress markers and antioxidants among postmenopausal women, the oxidative stress can be monitored in the following generation of postmenopausal women which may be helpful in preventing them from developing atherosclerosis complications.

Our study highlighted that obese postmenopausal women are at higher risk of developing atherosclerosis complications when compared to normal weight postmenopausal women. Also, oxidative stress levels can be used as early markers among the premenopausal women and thus and intense life style modifications and diet control should be advised in order to prevent future cardiovascular complications.

LIMITATIONS

Limitations of the study were its cross-sectional study design and small sample size. Further estimations of other relevant oxidative

stress markers and antioxidant levels might be helpful for monitoring oxidative stress in these high risk individuals.

CONCLUSION

Our study showed that the oxidative stress was higher in obese postmenopausal women when compared to normal weight postmenopausal women and normal menstruating women. Thus highlighting that obese postmenopausal are higher risk of developing cardiovascular complications and should managed with aggressive lifestyle modification and diet control.

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