ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 01, 2024

To determine Vitamin D andsuperoxide dismutase parameters play roles in pre- and post-menopausal women with type 2 diabetes.

Swarnima Singh [1], Savita Rathore[2], Salender Singh[3]

1. PhD Scholar, Department of Biochemistry, Malwanchal University, Indore, M.P & Assistant Professor, Glocal University, U.P.
2. Professor,Department of Biochemistry, Amaltas Institute of Medical Science, Devas, M.P
3. PhD Scholar, Department of Biochemistry, Malwanchal University, Indore, M.P

Corresponding Author:

Swarnima Singh, PhD Scholar, Department of Biochemistry, Malwanchal University, Indore, M.P & Assistant Professor, Glocal University, U.P.,swarnima.singh819@gmail.com

Abstract:

Maintaining optimal health requires a proper equilibrium between prooxidants and antioxidants, a parameter that can be affected by body composition and biochemical status. This is particularly crucial during periods of diminished antioxidant defense, such as menopause. The aim of the present study is to evaluate and compare the levels of Vitamin D and SOD in pre- and post-menopausal women with type 2 diabetes. The colorimetric method was utilized to ascertain the superoxide dismutase (SOD) activity, while the vitamin-D was determined. Utilizing the vitamin D and SOD concentrations were determined.Key body composition and biochemical profiles may ultimately impact the alterations in antioxidant status including SOD associated with menopause. To validate this assertion, additional research endeavors are required to assess the effects of biochemical interventions and alterations in body composition on antioxidant defense.

Key words: Pre-menopause; Post-menopause; Superoxide Dismutase; Correlation; Type 2 diabetes mellitus.

Introduction:

Menopause is a biological process that gradually takes place in women between the ages of 45 and 55. It is distinguished by the cessation of menstrual cycles permanently and a substantial reduction in estrogen and progesterone levels. These hormonal fluctuations have far-reaching effects on various organs, systems, and processes [1]. Estrogen levels are intricately linked to the redox status of the blood, thereby influencing the antioxidant levels of the blood [2]. Menopause diminishes estrogen's abilities to inhibit oxidative stress mechanisms and generate antioxidant molecules [3]. In addition, it has been observed that the mechanisms responsible for safeguarding against free radicals decline as age increases [4]. Sufficient prooxidant–antioxidant equilibrium is critical for sustaining optimal physiological conditions [5].Superoxide dismutase (SOD)is a metric that compiles the synergistic and redox interactions among the various antioxidant molecules found in biological fluids and nutrients [6].

It has been observed that the SOD is diminished in postmenopausal women relative towomen prior to menopause [7]. To evaluate and comprehend the antioxidant status, it is necessary to assess antioxidant enzymes, including SOD [8]. The SOD confronts oxidative stress through its

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 01, 2024

catalytic role in converting superoxide into oxygen and hydrogen peroxide [9]. Conversely, SOD mitigates oxidative stress by inhibiting the detrimental buildup of intracellular hydrogen peroxide [10]. SOD has been proposed as a highly consequential antioxidant within the human body, and its functionality might be compromised during the menopausal phase [11]. In addition, the absence of estrogens reduces the expression of the antioxidant gene, consequently leading to a decline in its levels in the bloodstream [1]. It has been observed that the combined activities of the SOD and GPx enzymes in the ovaries of postmenopausal women are considerably diminished compared to their levels during the premenopausal stage [13].It has been demonstrated that the aforementioned alterations in body composition, in conjunction with anthropometric irregularities, diminish the antioxidant defense of postmenopausal women [15]. With respect to this matter, despite the fact that various factors (e.g., aging, body mass index (BMI), and gender may impact TAC levels, SOD, and GPx activities, the available evidence has been contradictory thus far [16].

Thus, the comprehensive elucidation of the research pertaining to the correlation between antioxidant status and menopausal status has yet to occur [17]. Understanding the mechanisms by which antioxidant defense is influenced by biochemical and body composition parameters is crucial in this context. Such knowledge could aid in comprehending the antioxidant defense behavior of individuals who are susceptible to antioxidant disturbances, such as postmenopausal women [11].Consequently, the primary objective of the current investigation was to analyze the correlation between antioxidant status and body composition and biochemical parameters among a cohort of healthy postmenopausal women.The aim of the present study is to evaluate and compare the levels of Vitamin Dand SOD in pre- and post-menopausal women with type 2 diabetes.

Materials & method:

This study began after institutional ethics committee permission. The study was conducted at Index Medical College, Hospital & Research Centre, Malwanchal University, Indore, India, Department of Biochemistry. The comparative study included pre- and post-menopausal type 2 diabetes women. Hundreds with type 2 diabetes were enrolled in this study after institutional ethical committee permission. The study included 20-42yr pre-menopausal and 55+yr post-menopausal type 2 diabetic women. American Diabetes Association guidelines diagnosed T2DM. Medicine Department experts at Index Medical College, Hospital & Research Centre diagnosed T2DM patients. All subjects were examined by a skilled clinician using normal methods. Alcoholics, smokers, T2DM patients with less than two years of documented T2DM duration, and cancer and thyroid dysfunction patients were excluded.

After given written consent from all study group individuals, 5 mL of fasting venous blood was taken into fluoride and plane vials with a disposable syringe and needle under aseptic circumstances to estimate Vitamin D, lipid profile, and blood glucose. Plasma and serum were separated by centrifugation at 3000 rpm for 20 min after blood samples clot for 5-10 min. Once separated, serum was kept in aliquots at -20o C until analysis. All samples were run on a semi-

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 01, 2024

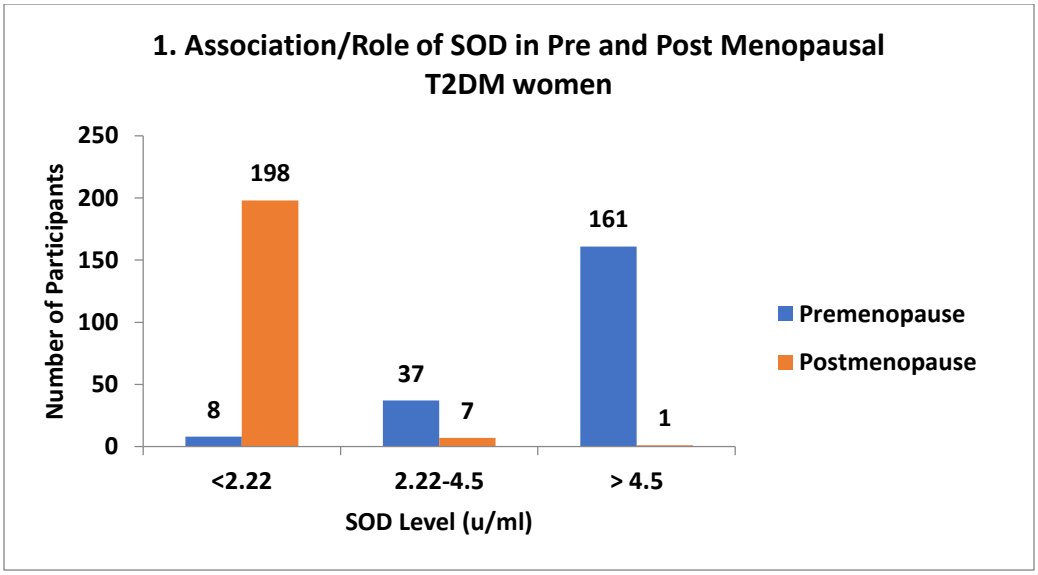
automated analyzer (Chem 7) within 2 h of serum separation for FBS estimate and stored for Vitamin D and lipid profile estimation.

SOD activity, and vitamin D evaluated for all research samples. Before testing, all reagents, calibrators, controls, and samples were room temperature. The serum parameters were determined using an automated chemistry analyzer using established procedures.

Statistical analysis:

The data was imported into Excel and processed using SPSS version 27. Quantitative data (mean ± SD) were analyzed using Student's t-test to compare two groups. Numbers and percentages represented qualitative data. The chi-square test determined the two variables' relationship. The correlation between two variables was calculated using Karl Pearson's coefficient. High statistical significance was defined as p-value <0.05/ (<0.01).

Results:



ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 01, 2024

Table 1: Correlation between SOD and vitamin D levels in the study population

Parameters	Mean	Std. Deviation	Karl Pearson Coefficient of Correlation (r)	P Value
SOD	5.65	1.48	0.33	<0.001*
Vitamin-D	34.06	9.91		

The correlation of SOD with parameters of Vitamin D and SOD in postmenopausal T2DM is shown in Table 1. SOD showed a negative correlation with different (r) values and P values, as mentioned in the table, and the positive correlation of SOD with vitamin D and SOD was not significant. SOD and vitamin D showed a positive correlation with a Karl Pearson coefficient (r) value of 0.326, and this correlation was significant at the 1% level of significance ($P < 0.001$).

Discussion:

The findings regarding SOD activity indicated that vitamin D2 and LDL had detrimental effects, while vitamin D3 had beneficial effects. It has been shown that vitamin D3 inhibits the production of free radicals by bolstering antioxidative defense mechanisms, such as SOD [11]. In contrast, animal models suggest that supplementing with vitamin D2 and an enriched diet can elevate SOD levels[12]. Supplementation with vitamin D did not result in statistically significant alterations in erythrocyte SOD in patients with hearing loss [13]. Consequently, the function of vitamin D remains unclear. In critical patients, there has been an observed correlation between decreased HDL levels and increased SOD levels, or vice versa. Abnormal activity of lipid parameters and diminished SOD levels may serve as an indicator of a more severe infection or a poorer prognosis [14]. A similar trend has been noted in the aftermath of bariatric surgeries, as evidenced by elevated levels of amylase and SOD and reduced levels of HDL[15]. In contrast, amylase activity was elevated in diabetic patients, while SOD activity was diminished [16]. Furthermore, there exists a positive correlation between elevated blood amylase levels and improved insulin sensitivity in pig models subsequent to bariatric surgery [17]. Everything indicates that any disruption in biochemical metabolism, particularly those parameters associated with glycemia, may increase oxidative stress. Significant antioxidant enzymes in humans, SOD converts superoxide anion radicals to oxygen and hydrogen peroxide, respectively. Glutathione peroxidase (GPx) converts this hydrogen peroxide to water and oxygen. The SOD/GPx ratio is more significant than the absolute activities of SOD and GPx.Implementing strategies to regulate these mechanisms before menopause could potentially enhance the cardiovascular risk profile of these females.

Conclusion:

SOD, an essential antioxidant enzyme, also revealed fascinating results in this study. The hormonal changes that occur during menopause may be the source of the reduced levels of SOD seen in type 2 diabetics who have gone through menopause. This could be related to oxidative

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 01, 2024

stress. Research has consistently shown that oxidative stress contributes to the onset of diabetes and its sequelae. Therefore, more research into the link between menopause, SOD activity, and oxidative stress is needed to better understand these connections and develop targeted treatments.

Conflict of interest:

There is no conflict of interest among the present study authors.

References:

1. Hemati K, Pourhanifeh MH, Fatemi I, Hosseinzadeh A, Mehrzadi S. Anti-degenerative effect of melatonin on intervertebral disc: Protective contribution against inflammation, oxidative stress, apoptosis, and autophagy. Current Drug Targets. 2022 May 1;23(7):711-8.
2. Aydemir D, Ulusu NN. The possible role of the endocrine disrupting chemicals on the premature and early menopause associated with the altered oxidative stress metabolism. Frontiers in Endocrinology. 2023 Feb 14;14:1081704.
3. Chandankhede M, Gupta M, Pakhmode S. Assessment of Psychological Status and Oxidative Stress in Postmenopausal Women: A Cross-Sectional Study. Journal of Menopausal Medicine. 2021 Dec;27(3):155.
4. Zujko ME, Waśkiewicz A, Witkowska AM, Cicha-Mikołajczyk A, Zujko K, Drygas W. Dietary Total Antioxidant Capacity—A New Indicator of Healthy Diet Quality in Cardiovascular Diseases: A Polish Cross-Sectional Study. Nutrients. 2022 Aug 6;14(15):3219.
5. Amaral AL, Mariano IM, Giolo JS, Dechichi JG, Souza AV, Batista JP, Souza TC, Caixeta DC, Peixoto LG, Teixeira RR, Espindola FS. Effects of combined exercise on salivary oxidative stress in hypertensive and normotensive postmenopausal women. Motriz: Revista de Educação Física. 2021 Dec 17;28:e10220012321.
6. Montoya-Estrada A, Veruete-Bedolla DB, Romo-Yañez J, Ortiz-Luna GF, Arellano-Eguiluz A, Najéra N, Ceballos G, Nieto-Velázquez NG, Ramos-Valencia MA, Cariño-Mancilla N, Valdez-Rodríguez NL. Markers of oxidative stress in postmenopausal women with metabolic syndrome. Journal of Obstetrics and Gynaecology. 2022 Aug 18;42(6):2387-92.
7. Malekian S, Mirghafourvand M, Najafipour F, Ostadrahimi A, Ghassab-Abdollahi N, Farshbaf-Khalili A. The Associations between Bone Mineral Density and Oxidative Stress Biomarkers in Postmenopausal Women. Korean Journal of Family Medicine. 2023 Mar;44(2):95.
8. Fateh HL, Mirzaei N, Gubari MI, Darbandi M, Najafi F, Pasdar Y. Association Between Dietary Total Antioxidant Capacity and Hypertension in Pre-and Postmenopausal Women; Finding From RaNCD Cohort Study.
9. Zhang R, Ni Z, Wei M, Cui Y, Zhou H, Di D, Wang Q. Composite dietary antioxidant intake and osteoporosis likelihood in premenopausal and postmenopausal women: a population-based study in the United States. Menopause. 2023 May 4;30(5):529-38.

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 01, 2024

10. Ha K, Liao LM, Sinha R, Chun OK. Dietary Total Antioxidant Capacity, a Diet Quality Index Predicting Mortality Risk in US Adults: Evidence from the NIH-AARP Diet and Health Study. Antioxidants. 2023 May 12;12(5):1086.
11. Abbaszadeh S, Yadegari P, Imani A, Taghdir M. Vitamin D3 protects against lead-induced testicular toxicity by modulating Nrf2 and NF-κB genes expression in rat. Reproductive Toxicology. 2021 Aug 1;103:36-45.
12. Mahmoudian-Sani MR, Boroujeni AS, Khodadadi A, Houshmandfar S, Gandomkari ST, Alghasi A. Resveratrol; an inflammasome inhibitor and a potential therapy for severe cases of COVID-19. Immunopathologia Persa. 2021 Jul 6;8(1):e9-.
13. Paprocki J, Sutkowy P, Piechocki J, Woźniak A. Association between vitamin D supplements, oxidative stress biomarkers, and hyperbaric therapy in patients with Sudden Sensorineural hearing loss. Oxidative Medicine and Cellular Longevity. 2021 Mar 10;2021:1-0.
14. Liao FL, Peng DH, Chen W, Hu HN, Tang P, Liu YY, Luo Y, Yao T. Evaluation of serum hepatic enzyme activities in different COVID□19 phenotypes. Journal of Medical Virology. 2021 Apr;93(4):2365-73.
15. Ciobârcă D, Cătoi AF, Copăescu C, Miere D, Crișan G. Bariatric surgery in obesity: effects on gut microbiota and micronutrient status. Nutrients. 2020 Jan 16;12(1):235.
16. Ahmad RS, Hussain MB, Sultan MT, Arshad MS, Waheed M, Shariati MA, Plygun S, Hashempur MH. Biochemistry, safety, pharmacological activities, and clinical applications of turmeric: a mechanistic review. Evidence-based complementary and alternative medicine. 2020 Oct;2020.
17. Pierzynowski SG, Stier C, Pierzynowska K. Hypothesis that alpha-amylase evokes regulatory mechanisms originating in the pancreas, gut and circulation, which govern glucose/insulin homeostasis. World Journal of Diabetes. 2023 Sep 9;14(9):1341.