



Periodontal condition and total antioxidant status in serum among patients with polycystic ovarian syndrome

Shamsoulmolouk Najafi ¹, Amir Abbas Zahedi ², Arghavan Tonkaboni ^{3*}, Mojgan Feli ⁴, Sima Amini ⁴

Atossa Mahdavi ⁵

1. Department of Oral Medicine, School of Dentistry, Tehran University of Medical Sciences, International Campus, Tehran, Iran.

2. Dentistry.

3. Department of Oral Medicine, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

4. International campus of Tehran university of medical science/ faculty of dentistry, Tehran, Iran.

5. MPH.MD, Assistant Professor, School of Medicine, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran.

ARTICLE INFO

Article Type:
Original Article

Received: 15 Jul 2017

Revised: 30 Aug 2017

Accepted: 28 Sep 2017

*Corresponding author:

Arghavan Tonkaboni

Department of Oral Medicine, School of Dentistry,
Tehran University of Medical Sciences, Tehran,
Iran.

Tel: +98-21-84902473

Fax: +98-21-84902473

Email: ArghavanTonkaboni@Gmail.com

ABSTRACT

Background and Aims: The most prevalent endocrine disease with unknown etiology among women in their fertility period is Polycystic Ovarian Syndrome (PCOS). The disease causes some changes in oxidative stress system, which in turn, is associated with such diseases as metabolic syndrome, diabetes, cardiovascular diseases, and periodontitis. The present study investigated periodontal status and total antioxidant status in serum of women with PCOS.

Materials and Methods: In this cross-sectional, analytic study eighty women, 40 with PCOS as cases and 40 infertile women without PCOS participated. Interview, oral examination and radiographs, and laboratory tests served as data collection tools. Body Mass Index (BMI), Community Periodontal Index (CPI), Periodontal Disease Index (PDI), bone loss, and total anti-oxidant status (TAS) in serum of the participants were measured. Chi-square test, Mann-Whitney test, and linear regression served for statistical analysis.

Results: While in case group 21 patients had bone loss, in control group bone loss was found in 11 patients ($P=0.022$). The distribution of maximum CPI score among cases was significantly different from that among controls in that more frequent higher scores existed among cases ($P=0.016$). The mean PDI in case and control group was 6.23 ± 3.3 and 4.48 ± 2.6 , respectively ($P=0.015$). In general linear model the level of serum TAS was significantly associated with CPI ($P=0.039$) and BMI ($P=0.019$).

Conclusion: Women with PCOS seem to be more susceptible to periodontal disease compared to other women. This calls for comprehensive periodontal care and regular dental visits for patient with PCOS.

Keywords: Polycystic Ovarian Syndrome, Total Antioxidant Status, Periodontal Status, Community Periodontal Index, Periodontal disease Index.

Introduction

The most prevalent endocrine disease with unknown etiology among women in their fertility period is Polycystic Ovarian Syndrome (PCOS), with a prevalence of 5%-10% [1,2]. The clinical manifesta-

tions of the disease vary among individuals but usually include ano-ovulation, oligo-ovulation, hyper-androgenism with such symptoms as acne and hirsutism, and presence of polycystic ovaries [1].

Women with PCOS are at risk of cardio-metabolic disorders including resistance to insulin, central obesity, dyslipidemia, and increased prevalence of cardio-vascular diseases risk factors. Thus, PCOS can be considered as a gender-related metabolic syndrome [3].

Periodontal disease affects 10% to 15% of world population and is the most prevalent cause of tooth loss [4]. Continuous battle between periodonto-pathogens and immune system of the host causes destructive processes in periodontal tissues. It has been noted that oxidative stress (OS) play an important role in pathogenesis of periodontal diseases; a concept that may justify the assumed relationship between periodontal diseases and such chronic inflammatory diseases as cardiovascular diseases, rheumatoid arthritis, and type 2 diabetes, as these diseases are also widely related to OS [5].

Free radicals are neutral atoms or molecules with one or more unpaired electrons in their external orbit making them very reactive [6]. Superoxide, hydroxyl, and proxyl are among the most important free radicals [7]. When the anti-oxidant capacity of the body decreases or the formation of free radicals increases a state called OS occurs, which has detrimental effects on biologic structures of the body and causes tissue damage [6]. Several studies have shown association of periodontitis with components of metabolic syndrome, diabetes and cardiovascular diseases [8,9]. Since systemic inflammation and resistance to insulin occur in both periodontitis and metabolic syndrome the two diseases might be related to each other through a pathophysiological pathway [8]. It has been suggested that OS might be the link between periodontitis, and the components of metabolic syndrome, diabetes and cardiovascular diseases [10]. The present study investigated periodontal status total antioxidant status in serum of women with PCOS.

Materials and Methods

The protocol of this cross-sectional, analytic study was approved by Research Ethics Committee, Deputy of Research, International Campus of Tehran University of Medical Sciences. Eighty women, 40 with PCOS as cases and 40 infertile women without PCOS or any biochemical or clinical sign of hyperandrogenism, all between 20-38 years old were selected consecutively from the patients referred to Obstetrics and Gynecology Department, Shariati Hospital, Tehran, Iran, in 2013. Exclusion criteria included presence of any of the following conditions: smoking, Cushing syndrome,

diabetes, cardiovascular diseases, non-classic congenital adrenal hyperplasia, hyperlactatemia, thyroid dysfunction, and androgen secreting tumors. A gynecologist made the diagnosis of PCOS based on Rotterdam criteria (Table 1). The study protocol was explained to the selected women, and written consent was obtained from them.

Interview, oral examination and radiographs, and laboratory tests served as data collection tools:

Interview: general and demographic information was obtained through interview with the patients. Patients' records were used to extract the results of paraclinical laboratory tests. BMI (Body Mass Index) of the patients was also recorded.

Oral examinations were done by use of dental mirror and explorer under sufficient light in order to record CPI (Community Periodontal Index) and PDI (Periodontal Disease Index). Panoramic radiographs were taken to investigate bone loss.

Laboratory tests: Five cc blood sample was obtained from each patient through venous puncture method in order to measure total anti-oxidant status (TAS) mmol/L in the serum. For this purpose, enzymatic calorimetry method using Biorex company kit(made in UK) was implemented.

Statistical Analysis

SPSS version 18 served for statistical analysis. Chi-square test, Mann-Whitney test, and linear regression were used. Significance level was set at $P < 0.05$.

Results

While in case group 21 patients had bone loss, in control group bone loss was found in 11 patients ($P=0.022$, chi-square test). The distribution of maximum CPI score (CPI max) among cases was significantly different from that among controls in that more frequent 3 and 4 scores existed among cases ($P=0.016$, Mann-Whitney test) (Table 2). The mean PDI in case and control group was 6.23 ± 3.3 and 4.48 ± 2.6 , respectively ($P=0.015$, Mann-Whitney test). However, the difference between the mean TAS in case and control group was insignificant (1.35 ± 0.60 and 1.33 ± 0.78 , respectively, $P=0.583$, Mann-Whitney test). In linear regression analysis, the higher levels of TAS in serum was significantly associated with lower frequency of CPI max ($P=0.039$), and higher BMI ($P=0.041$) (Table 3).

Rotterdam Criteria (2003)	
(i) oligo-and/or anovulation	
(ii) clinical and/or biochemical signs of hyperandrogenism	
(iii) polycystic ovarian on ultrasonography and exclusion of related disorders	
Two of three criteria must be satisfied	

Table 1. Rotterdam criteria for diagnosis of PCOS.

	CPI max				
	0	1	2	3	4
Women with PCOS (n=40)	0	6	13	19	2
Women without PCOS (n=40)	0	10	20	10	0

Table 2. Distribution of 40 patients with PCOS and 40 controls according to their maximum CPI score (CPI max).

	B	P value
Maximum CPI score	-0.206	0.039
BMI	0.041	0.019
PCOS	-0.009	0.956

Table 3. Factors associated with Total Antioxidant Status in serum of 80 women (40 with PCOS as cases, 40 without PCOS as controls) in linear regression analysis.

Discussion

The present study compared periodontal status as well as TAS in serum between women with and without PCOS. The results showed that more susceptibility to periodontal diseases exist among patients with PCOS compared to those without PCOS. Thus, patients with PCOS are in need of more comprehensive oral health care compared to healthy women. The difference in serum TAS between the two groups, however, was insignificant. Our study is the first to investigate periodontal status and serum TAS in patients with PCOS through a cross sectional analytic design in Iran. Relatively big sample size and focusing on both clinical and paraclinical parameters can be considered as the strengths of our study. With regard to the importance of the subject, however, further researches taking such factors as diabetes and OS separately into account are encouraged. Moreover, in addition to the level of serum TAS, the level of free radicals should also be investigated.

A study by Dursun et al. in 2011 in Turkey compared 25 non-obese patients with PCOS (mean age 22.7 years) with 27 healthy subjects (mean age 24.2

years) whose age was matched with the cases [13]. Clinical and radiographic parameters were used. The results showed that clinical periodontal parameters were worse in cases compared to those in controls. The volume of gingival crevicular fluid (GCF) was also higher in case group. Although the gingivitis was more prevalent among cases, no bone loss was observed in radiographs of cases, showing absence of periodontitis. They concluded that gingivitis in young women with PCOS may predispose them to periodontitis in higher ages [12]. In our study however, bone loss was more prevalent among patients with PCOS compared to that among controls. This difference between the results of the two studies might come from differences in accuracy of clinical examinations, in the age of the subjects, and in the sample size.

Clinical examinations and radiographic markers are among the usual methods for the diagnosis of periodontal diseases [13]. A more advanced method is evaluation of host response which includes studying specific and non-specific mediators through biochemical or immunologic procedures. These procedures use such potential resources as saliva, GCF and serum [14]. A study on mediators by Ozcaka et al. in 2012 found

that PCOS and gingivitis act synergistically in inducing production of TNF and IL-6 pre-inflammatory cytokines. Thus, they concluded that PCOS may induce periodontal diseases [15]. While we used clinical and radiographic parameters our results were in line with Ozcaka et al. findings as both CPI and PDI were worse among cases compared to those in controls showing more prevalence of periodontal diseases among patient with PCOS. A study by González et al. in US found that production of oxygen free radicals among women with PCOS increases in response to hyperglycemia regardless of their obesity status [16]. The TAS in serum, however, between the two groups was not different in our study. This might be because of the fact that we excluded diabetic patients from our sample. Moreover, it has been shown that control of glucose solely is insufficient to delay the adverse effects of diabetes. Instead, OS and consequently production of free radicals play an important role in pathophysiology of diabetes [17,18].

A Chinese study by Liu et al. in 2012 reported presence of OS in patients with PCOS, especially among obese patients [19]. Obesity is effective on expression of PCOS phenotype and it may play an important role in pathophysiology of hyperandrogenism and chronic ano-ovulation [20]. On the other hand, resistance to insulin is a common finding among obese people as well as women with PCOS. This phenomenon is more prevalent and more severe among individuals with classic NIK PCOS phenotype who suffer from hyperandrogenism and chronic ano-ovulation. Women with PCOS who still have regular cycles of menstruation based on Rotterdam criteria are less susceptible to metabolic disorders [2]. Findings of study by González et al. which was mentioned earlier also shows that the obesity seems to have an indirect effect on increase in the production of free radicals through increasing resistance to insulin as several studies have shown the effect of resistance to insulin on occurrence of OS [16,17,18]. In our study increase in BMI seemed not to induce OS since none of our sample was diabetic. BMI-associated increase in serum TAS in our study might be related to geographical and regional condition, diet, and other confounding factors.

Akalin et al. [21] and Borges et al. [4] studies in 2007 showed relationship between OS biomarkers and periodontal diseases. This finding is in line with our results as we found that serum TAS was lower among patients with higher scores as CPI max, which shows the relation between serum anti oxidant and periodon-

tal disease.

Bullon et al. in 2009 studied OS as the common factor between periodontal diseases and metabolic syndrome. According to their study in the both diseases the levels of oxidative stress products increase and a pre-inflammatory condition affecting both diseases occurs [10]. In the present study although periodontal status was in relation to TAS in serum, PCOS was not associated with TAS. Sample size, and such confounders as diet, geographical area, obesity (indirectly), diabetes, etc may be responsible for this difference. In diabetic patients hyperglycemia causes release of reactive oxygen species. Thus, diabetes adversely affects various cells and tissues in the body through production of free radicals leading to increase in OS [22]. On the other hand, one of the consequences of PCOS is diabetes. Thus, in patients with PCOS diabetes can be responsible for changes in the level of serum antioxidant. Anyway, as mentioned before, we excluded diabetic patients because diabetes exacerbates periodontal diseases.

Conclusion

Bone loss and susceptibility to periodontal disease is more common among women with PCOS compared to those in women without PCOS. This calls for comprehensive periodontal care and regular dental visits for patient with PCOS. In this way it is possible to prevent occurrence of advanced periodontal diseases among them.

Conflict of Interest

There is no conflict of interest to declare.

Acknowledgement

Our warmest thanks go to Research Deputy, International Campus of Tehran University of Medical Sciences (TUMS), who financially supported the present study. We also thank Endocrinology and Metabolism Research Institute of TUMS for their constructive support.

References

- [1] Eman M. Sayed Ahmed, Mohamed E. Salem, Mohamed Samir Eid Sweed. Effect of Lifestyle Modifications on Polycystic Ovarian Syndrome Symptoms. *Journal of American Science* 2012; 8(8).

- [2] Fauser BC, Tarlatzis BC, Rebar RW, Legro RS, et al. Consensus on womans health aspects of polycystic ovary syndrome (PCOS): the Amsterdam ESHRE/ASRM-Sponsored 3rd PCOS consensus workshop group. *Fertil Steril*. 2012 Jan; 97 (1): 28-38.
- [3] Sam S, Dunaif A. Polycystic ovary syndrome: Syndrome xx? *Trends Endocrinol Metab*. 2003 Oct; 14(8):365-70.
- [4] Borges I Jr, Moreira EA, Filho DW, de Oliveira TB, da Silva MB, Fröde TS. Proinflammatory and oxidative stress markers in patients with periodontal disease. *Mediators Inflamm*. 2007; 2007:45794.
- [5] Van der Velden U, Kuzmanova D, Chapple IL. Micronutritional approaches to periodontal therapy. *J Clin Periodontol*. 2011; 38(Suppl 11):142-58.
- [6] Halliwell B, Gutteridge JM. The antioxidants of human extracellular fluids. *Arch Biochem Biophys*. 1990 Jul; 280(1):1-8.
- [7] Murray RK, Granner DK, Mayes PA, Rodweil VW. *Harper's biochemistry*. 23 ed. USA: Appleton & Lange; 1993.
- [8] D'Aiuto F, Sabbah W, Netuveli G, Donos N, Hingorani AD, Deanfield J, et al. Association of the metabolic syndrome with severe periodontitis in a large U.S. population-based survey. *J Clin Endocrinol Metab*. 2008; 93:3989-94.
- [9] Kinane D, Bouchard P; Group E of European Workshop on Periodontology. Periodontal diseases and health: Consensus Report of the Sixth European Workshop on Periodontology. *J Clin Periodontol*. 2008 Sep; 35 (8Suppl):333-7.
- [10] Bullon P1, Morillo JM, Ramirez-Tortosa MC, Quiles JL, Newman HN, Battino M. Metabolic syndrome and periodontitis: is oxidative stress a common link? *J Dent Res*. 2009 Jun; 88(6):503-18.
- [11] Wolf HF, Hassell TM. *Color Atlas of Dental Hygiene Periodontology*. New York: Thieme; 2006.
- [12] Dursun E1, Akalin FA, Güncü GN, Çınar N, Aksoy DY, Tözüm TF, Kılınç K, Yıldız BO. Periodontal disease in polycystic ovary syndrome. *Fertil Steril*. 2011 Jan; 95(1):320-3.
- [13] Takane M, Sugano N, Ezawa T, Uchiyama T, Ito K. A marker of oxidative stress in saliva: association with periodontally-involved teeth of a hopeless prognosis. *J Oral Sci*. 2005 Mar; 47(1):53-7.
- [14] Newman MG, Takei HH, Carranza FA. *Carenza's Clinical Periodontology*. 11th ed. Philadelphia: WB Saunders Co; 2011. 104-6, 506-511.
- [15] Ozçaka O, Oztürk Ceyhan B, Akcalı A, Bıçakcı N, Lappin DF, Buduneli N. Is there an Interaction Between Polycystic Ovary Syndrome and Gingival Inflammation? *J Periodontol* 2012 Apr 17.
- [16] González F1, Rote NS, Minium J, Kirwan JP. Increased activation of nuclear factor kappaB triggers inflammation and insulin resistance in polycystic ovary syndrome. *J Clin Endocrinol Metab*. 2006 Apr; 91(4):1508-12. Epub 2006 Feb 7.
- [17] Ceriello A1, Motz E, Cavarape A, Lizzio S, Russo A, Quatraro A, Giugliano D. Hyperglycemia counterbalances the antihypertensive effect of glutathione in diabetic patients: evidence linking hypertension and glycemia through the oxidative stress in diabetes mellitus. *J Diabetes Complications*. 1997 Jul-Aug; 11(4):250-5.
- [18] Kaneto H1, Katakami N, Kawamori D, Miyatsuka T, Sakamoto K, Matsuoka TA, Matsuhisa M, Yamasaki Y. Involvement of oxidative stress in the pathogenesis of diabetes. *Antioxid Redox Signal*. 2007 Mar; 9 (3):355-66.
- [19] Liu J, Zhang D. The role of oxidative stress in the pathogenesis of polycystic ovary syndrome. *Sichuan Da Xue Xue Bao Yi Xue Ban*. 2012 Mar; 43(2):187-90.
- [20] Yildiz BO, Knochenhauer ES, Azziz R. Impact of obesity on the risk for polycystic ovary syndrome. *J Clin Endocrinol Metab*. 2008 Jan; 93(1):162-8. Epub 2007 Oct 9.
- [21] Akalin FA, Baltacıoğlu E, Alver A, Karabulut E. Lipid peroxidation levels and total oxidant status in serum, saliva and gingival crevicular fluid in patients with chronic periodontitis. *J Clin Periodontol*. 2007 Jul; 34(7):558-65.
- [22] Signorini AM, Fondelli C, Renzoni E, Puccetti C, Gagnoli G, Giorgi G. Antioxidant effect of gliclazide, glibenclamide and metformin in patients with type 2 diabetes mellitus. *Current Therapeutic Research*. 2002; 63:411-420.

Please cite this paper as:

Najafi Sh, Zahedi A, Tonkaboni A, Feli M, Amini S, Mahdavi A; Periodontal condition and total antioxidant status in serum among patients with polycystic ovarian syndrome. *J Craniomaxillofac Res* 2017; 4(4): 421-426