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## PERIODONTAL POCKET DEPTH AND SALIVARY CALCIUM AND PHOSPHOROUS LEVELS AMONG OBESE YEMENIS PATIENTS

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### ABSTRACT

**Background:** Our study was designed to evaluate the relationship between periodontal pocket depth and salivary calcium and phosphorous among overweight and obese Yemenis living in Abha city.

**Methods:** This study will focus on the analysis of 450 Yemeni patients living in Abha city; 160 patients have a body mass index  $>30\text{kg/m}^2$ ; 120 patients had  $\text{BMI} \geq 25$ - $<30\text{ kg/ m}^2$  and 170 patients had  $\text{BMI} < 25\text{ Kg/ m}^2$ . All entrants' patients in our study were subjected to periodontal examinations including as assessment of plaque index (PLI), gingival index (GI) and periodontal pocket depth (PPD). Data regarding salivary calcium (Ca) and phosphorus (P) levels were also collected and analyzed by ANOVA test

**Results:** About (75%) of patients had a  $\text{BMI} \geq 25$ , and All patients had PPD more than 5mm and salivary Ca and P levels more than salivary Ca and P levels in patients with  $\text{BMI} \leq 25$ . There was relationship between increased BMI and increased PPD. In addition, salivary Ca and P levels were significantly and positively associated with periodontal pocket depth formation ( $P < 0.05$ ).

**Conclusion:** Among Yemenis obesity patients in Abha city, there were relationships between PPD, BMI and salivary Ca and P levels. There is dire need to additional studies to detect this correlation and social environmental factors should be evaluated.

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### INTRODUCTION

Obesity is an increasing of body fat formation and it is considered as a systemic condition that is according to World Health Organization (WHO) definition and it may be lead to low patients age and systemic diseases which occur due to increased consumption of food without bodily activity. There are some factors that contribute to increased body fat accumulation like endocrine disorders, genes psychiatric illness and medications<sup>1</sup>.

On the other hand, there are some systemic diseases that may be increased especially type 2 diabetes, cardiac disease, some kinds of malignant diseases and sleep apnoea. Moreover, the obesity is considered as a risk factor of oral diseases especially periodontal disease according to contemporary research<sup>2,3</sup>. This could persist as pre-existing gingivitis without progression to the deep periodontal structures if it does not exacerbated by one of the risk factors<sup>4</sup> like obesity<sup>5</sup>. This agrees with other studies which detected a positive correlation between increased body weight and periodontal disease,<sup>6</sup> whereas in the other studies there were moderate or no relation between the body mass index and severity of periodontitis<sup>7</sup>.

There are possible mechanisms to explain the correlation between increased body weight and periodontal disease. The obesity individuals may depend on bad dietary habits as increased fat and sugar in the food that contains increased susceptibility of periodontal disease<sup>8</sup>.

The modification in life style, excess stress and immune response may play important role in excess fat accumulation<sup>9</sup>. There are several recent studies discussed the clinically existed periodontal disease as secondarily to metabolic syndrome diseases or by impairment the immune system<sup>10</sup> like the study that was carried out by Saito *et al* where they were found that the obese patients more affected by periodontal disease compared to non-obese patients 3:1 ratio<sup>11</sup>.

So Gencoand *et al* (2005) proposed that the nature of inflammation, elevated tumor necrosis factor- $\alpha$  (TNF $\alpha$ ) and its receptors in the obese patients could clarify the correlation between overweight and periodontal disease<sup>12</sup>. Other lately studies were found that there were relation between body mass index and waist-to-thigh ratio and several periodontal parameters such as gingival bleeding, calculus index, periodontal pocket depth and clinical attachment loss<sup>13</sup>.

Saliva is a protective complicated fluid due to secretion different mucosal host defense agents from salivary glands and gingival crevicular fluid<sup>14</sup>. In advanced periodontal disease, the saliva is the main sources of dental plaque formation<sup>15</sup> and there is positive relationship between severity of periodontal disease and salivary calcium<sup>15</sup>.

In the results of Sah N *et al* study there were significance differences where the value of salivary calcium was more in periodontal disease group compared to non periodontal disease group also in the same study on gingival disease samples where the value of salivary calcium was more in gingival disease group compared to non gingival disease group<sup>16</sup>. So the salivary calcium is important factor in formation of dental plaque and severity of periodontal disease<sup>17</sup>.

Calcium, phosphorus and some minerals form the inorganic are components of dental plaque. When these components increase the dental plaque to be hard mass and calculus formation<sup>18</sup> and there are tight relation between increased amount of calcium in saliva, calcification of plaque and increased tendency to periodontal disease may be due to integration between the minerals with salivary protein during dental plaque formation and increased severity of periodontitis and amount of phosphorus in saliva<sup>19</sup>.

In the study that was carried out by Pannunzio E *et al* (2010) there were no significant differences in salivary calcium and fluoride between overweight and obese group and control group, whereas the salivary phosphorus in overweight and obese group is lower than control group (P<0.001)<sup>20</sup>.

However, no study was found the impact of obesity on salivary calcium and phosphorous and severity of chronic periodontitis, the aim of this study was to determine the relationship between Severity of chronic periodontitis and salivary calcium and phosphorous among overweight and obese Yemenis lining in Abha city.

**MATERIAL AND METHODS**

**Patients samples**

Four hundred and fifty Yemeni patients were selected out of patients of clinics of college of dentistry king Khalid university, aged 20-50 years, systemically they were healthy.

**Body Mass index (BMI) evaluation:** BMI is evaluated by assessment the patient weight in kilograms divided by the square of the Height in meters, measured as non-obese (< 25 Kg/ m2), over weight (≥25- < 30 kg/ m2) and obese ≥ 30 Kg / m2). The patients were divided into three groups according of Body Mass Index (BMI), group I: 170 patients were non-obese (NO) (< 25 Kg/ m2), group II: 120 patients were overweight (OW) ( ≥25- < 30 kg/ m2) and group III: 160 patients were obese (OB) (≥30 Kg / m2).

**Clinical examination**

Periodontal clinical parameters; plaque index (PI),<sup>21</sup> gingival index (GI),<sup>22</sup> and periodontal pocket depth (PPD) were recorded for all patients groups of the present study.

**Sample collection**

The samples of resting saliva were collected about 5-10 ml and were transferred in Eppendorf tubes for biochemical analysis of calcium and phosphorus<sup>23,24</sup>.

**Statistical analysis**

All data of the present study were collected and analyzed by ANOVA test.

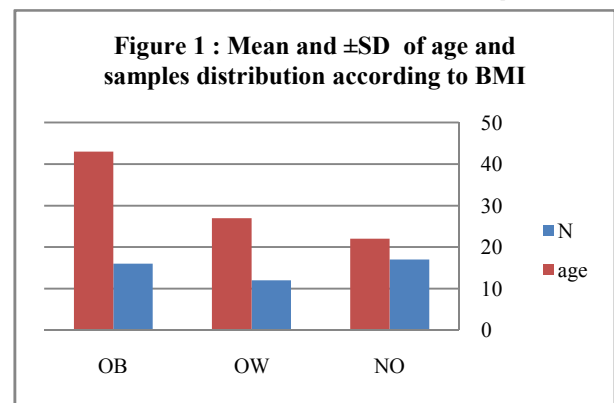
**RESULTS**

In our study the samples distribution and the mean of patients' age and standard deviation (± SD) were showed in table (1) and figure (1). There were 170 patients (37.7%), 120 patients (26.7%) and 160 patients (35.6%) in the patients groups I, II and III respectively. The mean and ± SD of age in group I was recorded to be 22.4±3.6 and 27.2±3.3 in group II and (43.3±4.7) in group III.

**Table 1** Mean and ± SD of age and sample distribution according to BMI \*

BMI groups	N**	%	Mean of age ±SD
Non-obese (<25 Kg/ m <sup>2</sup> ) (NO)	17	37.7	22.4±3.6
Over weight (≥25-<30 kg/ m2) (OW)	12	26.7	27.2±3.3
Obese ≥30 Kg / m <sup>2</sup> (O)	16	35.6	43.3±4.7
Total	45	100	

SD: Standard deviation. BMI: Body Mass index. N: Number of patients.



**Figure 1** Mean and ±SD of age and samples distribution according to BMI.

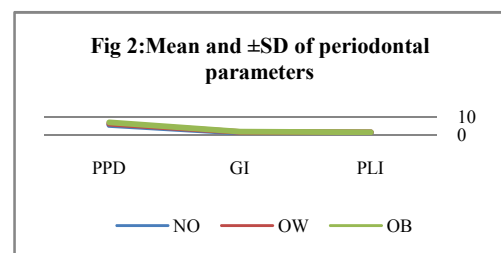
SD: Standard deviation. BMI: Body mass index N: Number of patients. No: non-obese. OW: Overweight. OB: Obese.

Table (2) and figure (2) demonstrate the mean and standard deviation (± SD) of clinical parameters of the present study. In general there were significant differences in PLI and GI and PPD (P<0.05) in group I and II compared to group I.

**Table 2** Mean and ± SD of periodontal clinical parameters

PGs	PLI	GI	PPD
NO	1.4± 0.3	1.4± 0.4	5.7± 2.3
OW	1.5 ± 0.1	1.6±0.3	6.3± 2.8
OB	1.5± 0.5	1.8 ±0.3	7.1±2.9

PGs: patients groups No: non-obese. OW: Overweight. OB: Obese. PLI : plaque index. GI: Gingival index. PPD: Periodontal pocket depth.



**Figure 2** Mean and ±SD of periodontal parameters

SD: Standard deviation. No: non-obese. OW: Overweight. OB: Obese. PLI: plaque index. GI: Gingival index. PPD: Periodontal pocket depth.

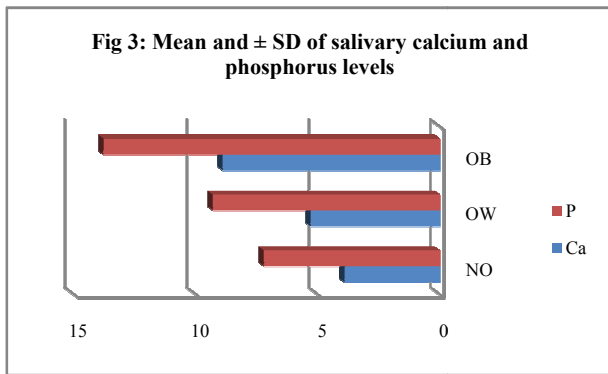
The mean and  $\pm$  SD of PLI, GI and PPD in group II were more than the mean and  $\pm$  SD of PLI, GI and PPD of group I whereas the mean and  $\pm$  SD GI and PPD in group III were more than the mean and  $\pm$  SD of GI and PPD of group II and group I. On the other hand there were no significance differences in GI between group II and group III in the present study.

The salivary calcium and phosphorus contains of the present study are summarized in table (3) figure (3). There were highly statistically significant differences salivary calcium and phosphorus values in all patients groups ( $P < 0.005$ ).

**Table 3** Mean and  $\pm$  SD of salivary calcium and Phosphorus.

PGs	Salivary Constituents mg/ 100 ml	
	Calcium	Phosphorus
NO	3.9 $\pm$ 0.6	7.2 $\pm$ 1.32
OW	5.3 $\pm$ 1.08	9.3 $\pm$ 2.3
OB	8.9 $\pm$ 2.6	13.79 $\pm$ 4.2

PGs: patients groups No: non-obese. OW: Overweight. OB: Obese.



**Figure 3** Mean and  $\pm$  SD of Salivary calcium and phosphorus levels  
Ca: calcium P: Phosphorus No: non-obese. OW: Overweight. OB: Obese.

In our study there a positive significant correlation have been found between PPD, BMI and values of salivary calcium and phosphorus, the tables and figures of the results showed a significant increase in PPD with increase of BMI and a significant increase in salivary calcium and phosphorus values with increase both BMI and PPD.

## DISCUSSION

Periodontal disease is chronic inflammation caused by microbial dental plaque and disorders of the host defense in the gingival structure<sup>25</sup>. Spreading of this inflammation still rise worldwide, the almost recent study in America indicating that 47% of adults affected by this disease<sup>26</sup>.

Actually Saliva and crevicular fluid are more important in protection and conversely creation of periodontal disease. The collecting and stagnated saliva creates the oral cavity environment so the saliva was obtained from these areas.

On the other hand, the connection between calcium and phosphorus components of saliva and periodontal status is not clear yet but Ashley and Wilson assumed that there was a potential link between calcium and phosphorus in saliva and periodontal disease but the obtained sample should be mixed where some interactions may be occur<sup>27</sup>.

The level of calcium and phosphorus in saliva may affect clinically on periodontal tissue according to the Chaterjee and Kleinberg opinion<sup>28</sup>.

In study of Becks<sup>29</sup> and Weinwright, and Kamat N.V<sup>30</sup> calcium amount in saliva was decreased with increasing the severity of periodontal diseases<sup>29,30</sup> but in Sewon study there was significance in the increased calcium in saliva among periodontitis patients that is not agreement to previous study<sup>31</sup> when the severity of periodontal diseases increased the amount of calcium in saliva increased<sup>32</sup> but Ramakrishna found the salivary calcium decreased when the gingivitis progresses to periodontitis due to the effect of other factors like nutrition, intake, age and secretion of calcium<sup>33</sup>.

Regarding to salivary phosphorus and in the study of Ericson there was significance increased in salivary phosphorus with increased severity of periodontal diseases<sup>34</sup> this agrees with the present study findings where it was detected that the salivary calcium and phosphorus amounts increase with increase PPD. Obesity is a systemic disturbances and considered as risk factor for some systemic diseases like heart disease, hypertension and periodontal diseases<sup>35</sup>. In recent days it was from that the etiologic factor in progression of periodontal disease<sup>36</sup>.

Biologically, there is relation between obesity and periodontal disease due to the effect of some inflammatory mediators (cytokines) like adipokines and hormones on periodontal tissues that is released by fat tissue<sup>37</sup>.

The obesity leads to increasing the affect to the individuals by inflammatory periodontal tissue destruction due to the change in the immune and inflammatory systems<sup>38</sup> and to increasing the quantities of adipokines from deep fat may be cause blood agglutination in blood microvasculature, reducing gingival blood flow and increased progression of periodontitis among obese patients. For example, increased bleeding on probing, deep periodontal pocket formation and increased bone loss in obese patients<sup>39</sup>.

Actually, periodontal disease is aggravated by metabolic syndrome in the obese patients and also it is increased in patients with high density lipoprotein cholesterol concentration  $< 60$ mg/dl in serum<sup>40</sup> these findings agree with Alzahrani *et al* study that found relation between BMI, waist circumference and periodontal disease especially periodontal pocket depth ( $\geq 4$ mm) and clinical attachment loss ( $\geq 3$ mm) among young adults patients<sup>41</sup>. These findings agree the results of our study that was showed a significant increase in PPD with increase of BMI and a significant increase in salivary calcium and phosphorus values with increase both BMI and PPD.

In other study that was carried out on 298 children and adolescents aged 6-12 years old included 190 obese and 108 non-obese, there were decreased phosphorus in the obese patients serum compared to non-obese patients<sup>42</sup>. In the present study, salivary calcium and phosphorus values appeared significant difference among all patients groups, there were increased significantly among the patients of obese and overweight patients compared to non-obese patients. Since the findings of present study are not enough for detect the effect of body mass index values on severity of periodontitis for this displays the need for additional study in more subjects to clear the effect obesity on salivary calcium and phosphorus and progression of periodontitis to help and develop adequate prevention and treatment strategies for this medical condition.

## CONCLUSION

The results of this study let to the conclusion that the overweight and obesity in relation to PPD have increasing in the salivary calcium and phosphorus values with increased PPD in OW and OB patients groups compared to the NO patients group.

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