Several aspects of oral health are related to obesity including metabolic syndromes, implicating in the pathogenesis of oral diseases. Increased oxidative stress and low antioxidants generation through the imbalance between the production of free radicals and the ability of the body to neutralize their harmful effects is termed oxidative stress (4). The specific role of antioxidant is to neutralize rampaging free radical and thus reducing its capacity to damage tissues (7).

Increased oxidative stress and low-grade silent inflammation in accumulated fatty tissues due to high levels of reactive oxygen species in the body as a result of the unavailability of antioxidants is the underlying cause of obesity associated metabolic syndromes (8). In addition to that, oxidative stress implicated in the pathogenesis of oral diseases (9).

Several aspects of oral health are related to obesity including dental caries. Dental caries is a major public health problem and one of the most common infectious and communicable diseases which affect all age groups (10). Obesity and dental caries are both multifactorial diseases and are associated with poor dietary habits (11). There is a controversy in relation between obesity and dental caries. Several studies found that obese subjects are more likely to have dental caries than the normal weight ones (12, 13).

While other studies found that there is an inverse relation between dental caries and body weight (14, 15). Saliva is a biological fluid in oral cavity composed of mixture of secretory product from major and minor salivary glands which essential for oral health through various mechanisms such as salivary flow rate, buffer capacity and defense function through antibacterial factor and salivary antioxidant system (16). The specific role of antioxidant is to neutralize rampaging free radical and thus reducing its capacity to damage tissues (7). It was found that the susceptibility to dental caries can be reduced by the effect of salivary antioxidant (18). As far as it is known, there was no previous Iraqi study concerning the relation of salivary antioxidants (uric acid and total protein) with dental caries among obese females (19).

3. Materials and Methods

The total sample for this study consisted of eighty females aged 20-22 years at College of Islamic Sciences/Baghdad University. They were divided into two groups: the study group which included forty obese females and the control group which included forty normal weight females. A

Keywords: 

Obesity, dental caries, salivary antioxidants, salivary flow rate.
number of females were excluded from the study due to pregnancy, menstruation and presence of any systemic disease which may affect oral health condition (19). Anthropometric measurements included measurement of weight and height according to Trowbidge (20) using electronic scale and height measuring tape. Body Mass Index (BMI) is a number calculated from person's weight and height, according to this formula:

\[
\text{BMI (Kg/m}^2) = \frac{\text{Body weight (Kg)}}{\text{(height)}^2} \text{(m)}
\]

Females were chosen for BMI measurements according to World Health Organization (21) which identify the obesity at BMI≥30 Kg/m² while the normal weight at BMI between 18.5-24.9 Kg/m².

The collection of unstimulated salivary sample was performed under standardized condition following the instructions cited by Navazesh and Kumar (22). Salivary flow rate was expressed as milliter per minute (ml/min). Then salivary samples were taken to the laboratory for biochemical analysis at the Poisoning Consultation Center/Gazi Al-Hariry hospital. Salivary antioxidants (salivary total protein and uric acid) were determined calorimetrically by using the spectrophotometer (Cecil CE 1011, UK). Salivary total protein level was measured using a ready kit (Spinreact, Spain) while salivary uric acid level was measured using a ready kit (Biosystems, Spain) according to the manufactured instructions. The diagnosis and recording of dental caries was according to Manji et al (23). Data analysis was conducted by application of SPSS program (SPSS version 18). Independent sample T-test (Student T-test and Welch T-test) was applied.

3. Results

Result of the current study revealed that the mean value of salivary total protein was statistically highly significantly lower among the obese than that of the normal weight females (P<0.01), while the mean value of uric acid was statistically highly significantly higher among the obese than that of the normal weight females (P<0.01) as shown in Table 1. The mean value of salivary flow rate was higher among the obese than that of the normal weight females with statistically highly significant difference (P<0.01) as shown in Table 2.

Data of present study showed that the caries experience represented by DS, MS components and DMFS for the obese was lower than that of the normal weight females with statistically highly significant difference for DS and DMFS (P<0.01). On the other hand, FS mean value was higher among the obese in comparison with normal weight females with statistically not significant difference (P>0.05) as shown in Table 3. The mean values of \( \text{D}_1, \text{D}_2, \text{D}_3, \text{D}_4 \) gradesamong the obese were lower than those among the normal weight females with statistically highly significant difference for \( \text{D}_4 \) grade (P<0.01) and significant difference for \( \text{D}_1 \) and \( \text{D}_3 \) grades (P<0.05) as shown in Table 4.

### Table 1: The concentration of salivary antioxidants among the obese and normal weight females

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obese</th>
<th>Normal weight</th>
<th>Statistical test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
<td>t-test</td>
<td>P-value</td>
</tr>
<tr>
<td>Total protein (mg/dl)</td>
<td>503.14 ± 37.54</td>
<td>556.19 ± 32.14</td>
<td>-6.79**</td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>4.26 ± 0.90</td>
<td>3.66 ± 0.67</td>
<td><strong>3.34</strong></td>
</tr>
</tbody>
</table>

**= Highly significant at P<0.01

### Table 2: The salivary flow rate among the obese and normal weight females

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obese</th>
<th>Normal weight</th>
<th>Statistical test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
<td>t-test</td>
<td>P-value</td>
</tr>
<tr>
<td>SFR (ml/min)</td>
<td>0.38 ± 0.04</td>
<td>0.34 ± 0.05</td>
<td><strong>4.35</strong></td>
</tr>
</tbody>
</table>

***= Highly significant at P<0.01

### Table 3: Caries experience (DMFS) and its components among the obese and normal weight females

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obese</th>
<th>Normal weight</th>
<th>Statistical test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
<td>t-test</td>
<td>P-value</td>
</tr>
<tr>
<td>DS</td>
<td>5.08 ± 1.85</td>
<td>7.88 ± 3.09</td>
<td>-4.92**</td>
</tr>
<tr>
<td>MS</td>
<td>0.88 ± 1.92</td>
<td>1.50 ± 2.32</td>
<td>-1.31*</td>
</tr>
<tr>
<td>FS</td>
<td>2.05 ± 1.75</td>
<td>1.40 ± 1.60</td>
<td>1.73#</td>
</tr>
<tr>
<td>DMFS</td>
<td>8.03 ± 3.03</td>
<td>10.80 ± 3.93</td>
<td>-3.53#</td>
</tr>
</tbody>
</table>

** = Highly significant at P<0.01

### Table 4: Grades of DS (D1, D2, D3, D4) among the obese and normal weight females

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obese</th>
<th>Normal weight</th>
<th>Statistical test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
<td>t-test</td>
<td>P-value</td>
</tr>
<tr>
<td>D1</td>
<td>3.95 ± 1.06</td>
<td>4.60 ± 1.63</td>
<td>-2.11**</td>
</tr>
<tr>
<td>D2</td>
<td>0.55 ± 0.75</td>
<td>1.35 ± 1.21</td>
<td><strong>-3.55</strong></td>
</tr>
<tr>
<td>D3</td>
<td>0.20 ± 0.56</td>
<td>0.78 ± 1.39</td>
<td><strong>-2.43</strong></td>
</tr>
<tr>
<td>D4</td>
<td>0.38 ± 1.33</td>
<td>1.15 ± 2.35</td>
<td>-1.81**</td>
</tr>
</tbody>
</table>

*= Significant at P<0.05

**= Highly significant at P<0.01

#= Not significant at P>0.05

4. Discussion

In the current study, data analysis showed that the concentration of salivary total protein was lower among the obese group than that among the normal weight group. The same result was also reported by other studies (25) among overweight females but contradict with other studies among obese children and adults (26, 27). This could be attributed to the fact that the elevated free radical generation with obesity resulting in higher lipid peroxidation so salivary antioxidants would be exhausted in reaction with the elevated free radicals (28). The present study found that the level of uric acid was higher among the obese than that among the normal weight females. The same result was also reported by other studies (29, 30). On the other hand, this result was inconsistent with the result of other study (27). An elevated level of salivary uric acid among the obese female might be related to the fact that the body raises the level of its antioxidant systems to combat the oxidative damage (31), since uric acid is a powerful and dominant antioxidant in the body (32).

Another explanation for the elevated uric acid concentration in saliva among obese females is that the elevated uric acid is closely associated with fat accumulation (33). Obese adipose...
tissue is characterized by active fatty acids synthesis. It is presumed that fatty acids synthesis is closely associated with purine synthesis and uric acid is the final product of purine metabolism, thus, accelerating uric acid production (34). Salivary flow rate was higher among the obese group compared with the normal weight group with statistically highly significant difference between them. The same result was also reported by other studies (27, 29). But contradict with findings of other studies (15, 29). The obese subjects may have a larger salivary gland and this could be the reason for the increase in the salivary flow rate (40).

In the current study, dental caries experience for the study group was lower than that for the control group with statistically highly significant difference between them. This result was also reported by other studies among children and adolescents (37, 38). The decreased dental caries experience among obese females could be attributed to many findings that illustrated by the data of the present study, these include:
1) Higher antioxidant protection as indicated by statistically highly significantly higher level of salivary uric acid among obese females. It was reported that antioxidants might adversely affect the oxidative carbohydrate metabolism within dental plaque (30), since oral streptococci can adapt their sugar metabolism to act under both aerobic and anaerobic conditions, therefore, when antioxidants inhibit aerobic carbohydrate metabolism this will impact on oxidation-reduction balance within the cell thereby affecting bacteria metabolism and energy generation leading to cell death and consequently reducing dental caries (40).

2) Highly significantly decreased amount of salivary total protein among obese females. This could be attributed to the function of certain protein, as total salivary protein include several types of protein with different mechanisms and functions, these functions may depend on the molecule’s location or site of their action. Certain proteins such as agglutinins and adsains play a detrimental role by increasing the colonization of microorganisms (43). Moreover, when total protein level of saliva reduced, this leads to reduced saliva viscosity and elevated saliva quantities which in turn lead to increased salivary cleansing action of saliva (42). resulting in a decrease in dental caries.

3) Increased salivary flow rate among obese females in comparison with those in the control group. Salivary flow rate plays an important role in dental caries susceptibility through its cleansing activity that is very important in the clearance of food debris and bacteria (43).

4) Type of diet: The obese subjects were reported to consume more fast foods which contain unacceptable high levels of fats (44), which have an anticariogenic effect. Fats were found to reduce dental caries through a variety of mechanisms (45).

5) Tack care of the external appearance: From this study observation, most of obese females were looking in a well dressing and good general cleanliness. This could be due to that obese are often stigmatized by their peers, which can increase the likelihood of poor self-esteem, depression and risk of social discrimination (46). Consequently, obese females may be more interested about their general looking, as part of which the oral cavity (15). This fact is supported by the finding of the present study in which higher F5 and lower MS components were reported among obese females.

References

[34]De oliveira E, Burini R. High plasma uric acid concentration: causes and consequences. Bio Med Central 2012; 4:12.