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# Comparison of the Dental Caries Experience and Some Salivary Physicochemical Variables among Iraqi Boxers

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## ABSTRACT

**Background and Objective:** Due to the importance of oral hygiene to athletes in the evaluation of oral health status, efforts continue to raise their performance. This study aims to determine a correlation between some salivary physicochemical variables to dental caries in Iraqi boxers.

**Methods:** This cross-sectional study was conducted on 80 people in two groups of 40, including 40 boxers in different boxing clubs in Baghdad and 40 male students aged 15-16 from different schools in Baghdad. The two groups were compared in terms of some variables including age, sex, education status, general health status. The clinical assessment of dental caries was done by dental mirror and dental probes. The unstimulated salivary analysis included samples collected to determine pH (measured by pH meter), flow rate (By dividing the measured amount of saliva by ml/min) and minerals like calcium (measured by calcium kit), and salivary immunoglobulin A (measured by ELISA kit).

**Findings:** There were no significant differences between the two groups in terms of demographic variables. Dental caries was seen in the study group in 100% of 40 subjects compared to control group (2.5%). The mean value of decay surfaces, missing surfaces, decay missing filling teeth, and decay missing filling surfaces show high levels with a significant difference in the study group 20.275±6.880, 4.050±5.514, 11.775±3.779 and 24.450±9.375 respectively ($p<0.05$). The mean values to the pH and flow rate were 5.903±0.568, 0.939±0.445 respectively ($p<0.05$). For the salivary immunoglobulin A (IgA) and calcium, they were about 0.375±0.123, 0.887±0.260 respectively ($p<0.05$) and were lower in the study groups, indicating statistically significant differences.

**Conclusion:** According to the result of this study, dental caries had a negative correlation with pH and flow rate. Also, salivary calcium and salivary IgA show a negative correlation with dental caries.

**Keywords:** *Iraqi Boxer, Dental Caries, Salivary Physicochemical Variables.*

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## Introduction

The most common kind of chronic oral disease that mostly harms the health of humans is dental caries (1). Despite the progress in oral health in recent years, there stays oral health problems globally due to it being widely infectious and widespread (2, 3). Oral diseases are highly significant and the WHO analysis reported that they affect 621 million teenagers globally. In teenagers, the general standard decayed-missing-filled teeth (DMFT) is about 1.86.3. The communication of a mass of cariogenic oral microorganisms can lead to caries (4, 5). A high risk of dental caries is reported in athletes in different studies; about 78.72 % (6) and 49.1% (7). According to the findings, good nutritional health leads to good oral health (8). Sports dentistry seeks to reply to these athletes' particular requirements (9). Saliva can determine oral health status by salivary components (10). Many researchers used salivary diagnostics as a precious tool for systemic conditions in diagnosis (11). Saliva flow rate is the volume of Saliva which changes during lifespan (12). Stress may be connected with several pathologies of the oral cavity (13). Oral and dental health including caries may result from the negative impact of stressful life (14). A significant positive association is seen between salivary pH and flow rate (15). Many of the electrolytes in the body diminish. As a result, sports performance is negatively influenced by insufficient electrolytes. Sports scientists were interested in it due to its impact on athletic performance (16). The large appropriate immune constituent produced by mature B lymphocytes is Secretory IgA (17).

Therefore, the objective of this research is to detect the exercise-related factors like stress, dry mouth, and fatigue that may lead to changes in oral diseases, including dental caries and salivary variables among boxers and to evaluate the correlation between Iraqi boxers' dental caries and some physicochemical salivary variables. More studies are required to give them the care specialty in oral health they meet and to dissolve all their problems.

## Methods

After approval by the ethics committee of the University of Baghdad's College of Dentistry on 2/6/2022, Ref. number: 579, this cross-sectional comparative was conducted among 80 males, including 40 male boxers with weights ranging from (46-60 kg) and 40 male school students, in the age range of (15-16) as case and control groups, respectively. The study was conducted in different boxing clubs in Baghdad and different schools in Baghdad. The sample size of this study was measured by utilizing G power 3.1.9.7 (Program by Franz- Faul, Kiel University, Germany), alpha error of probability=0.05, study power=85%, Independent T-test and assuming the effect size of 0.6 in the two groups. So, the sample size was 40 for both groups. Cohen's d was as follows: small=0.3, medium=0.5, large≥0.8. This number includes only Baghdad in Iraq. Clinical and demographic data were also collected. These include sex, age, education status and practicing in boxing clubs. We exclude people with systemic disease, uncooperative people, smokers, hormonal stimulations, and if they did other sports.

The procedure was done by oral examination and was carried out according to the basic method of an oral health survey by the WHO 2013. The four surfaces of each tooth were examined. All teeth were included except the third molars (18). Clinical examinations were done using dental mirrors and dental probes. To collect unstimulated salivary samples, the people were ordered to avoid food, smoke, and beverages 1 hour before saliva collection. The subject then washed his mouth with distilled and rested for five minutes. A subject had to fix the forehead over the test tube and keep steady. To collect Saliva in the tube for five minutes, subjects were required to keep their mouth open. In the last stage, the subject was told to keep any remaining saliva in the mouth and immediately spit it in the exam tube. The actual timespan

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must be almost 5 minutes. Then, when saliva collection was completed and the foam disappeared, the flow rate of saliva was detected by dividing all collections of saliva in milliliters by the minutes consumed until the sample was fixed (10 min), expressed by ml/min (11). Flow rate= Volume (ml)/Time (min). Saliva pH was measured by merging the pH meter's sensor into the tube containing saliva and the tube was tilted so that the saliva could cover the entire surface of the sensor. Saliva was sent to the lab in a cooling box. Then, samples were centrifuged at 3000 rpm for 10 minutes. Then a micropipette was used to separate the supernatant and underwent deep freezing (-20°C). The Salivary calcium concentration released in the demineralizing solution was measured by spectrophotometry in a lab. Then the standards, samples, and quality control specimens were diluted according to instructions 50-fold with lanthanum diluents, mix, and calcium measured by using AAS. A hollow cathode lamp at a wavelength of 422.7 nm specific was used for calcium. ELISA kit was used for determent concentration of immunoglobulin IgA level (enzyme-linked immunosorbent assay). The required streaks dictated by the samples were as follows:

1-Put in only Chromogen solutions A with B, and break off fluid.

2-Put in 50 µl standard and streptavidin-HRP 50µl.

3-Put in 40 µl of sample and then 10µl IgA antibodies, 50 µl streptavidin-HRP to sample well to be tested.

Then with a seal plate membrane, they were strongly shaken to mix them up. Incubation was done at 37°C for 60 minutes. Fluid prepared to wash: it was debilitated with distilled water to washing concentration (30X) for later use. After washing, seal paten membrane was used, the solution was drawn off, and the remaining liquid was vibrated, and all wells were cleaned with a wiping solution. The liquid drawn off after 30 seconds of staying still. This process was repeated 5 times. Evaluation color: Put in 50µl chromogen solution A to all well and then put in 50µl liquid of chromogen B to all. Vibrate firmly to mix them up. Incubate at 37℃ for 10 minutes away from light for color Evaluation. Then put in 50µl liquid over both well to be over that short time the reaction changed from color blue to yellow.

Data analysis, presentation, and description were conducted by Statistic Package to Social Sciences SPSS version 22, Chicago, Illinois USA, Statistic analyses categorized into descriptive analysis consist of frequency, and percentage for qualitative variables while mean, standard error (SE) and standard deviation (SD) for quantitative variable. Graphs included cluster chart bars and the analysis inferential as independent sample T-test parametric test the difference between two groups, human correlation: parametric test for correlation between two quantitative variables and Levene test for homogeneity of variance in groups.

## Results

The study shows that dental caries was high in study group (100% of the 40 people). The mean value of decay surfaces, missing surfaces, decay missing filling teeth, and decay missing filling surfaces was higher in study group with a significant difference of 20.275±6.880, 4.050±5.514, 11.775±3.779 and 24.450±9.375, respectively ($p<0.05$). Except for FS; it was significantly different between the two groups, and lower in the study group as seen in Table 1.

The study group showed increase in salivary flow rate and pH with significant differences ($p<0.05$), and the mean values were 0.939±0.445, 5.903±0.568, respectively (Table 2). The mean values of salivary immunoglobulin IgA and calcium in the study group were 0.375±0.123, 0.887±0.260, respectively ($p<0.05$), and found to be low with significant difference (Table 3).

The result of this relation includes that there was significant negative correlation between PH and salivary flow rate and dental caries in the study group (-0.540, -0.134, -0.500, -0.170), respectively ($p<0.05$). At the same time, other results are weak, with no significant correlations, as seen in Table 4.

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There was a weak significant negative correlation between salivary IgA and calcium with the missing surface in the control group (-0.245, -0.407) respectively ($p<0.05$), while other results are not significant (Table 5).

**Table 1. Descriptive of caries experience**

| Vars. | Groups | | | | T-test | p-value |
|---|---|---|---|---|---|---|
| | Study | | Control | | | |
| | Mean±SD | ±SE | Mean±SD | ±SE | | |
| DS | 20.275±6.880 | 1.088 | 15.675±10.247 | 1.620 | 2.357 | 0.021 |
| MS | 4.050±5.514 | 0.872 | 1.000±2.025 | 0.320 | 3.284 | 0.002 |
| FS | 0.125±0.463 | 0.073 | 0.975±1.423 | 0.225 | 3.592 | 0.001 |
| DMFT | 11.775±3.779 | 0.598 | 9.550±5.602 | 0.886 | 2.082 | 0.041 |
| DMFS | 24.450±9.375 | 1.482 | 17.650±10.888 | 1.721 | 2.993 | 0.004 |

**Table 2. Physicals constituent salivary pH with a flow rate**

| Vars. and groups | Mean±SD | ±SE | T-test | p-value |
|---|---|---|---|---|
| **pH** | | | | |
| Study | 5.903±0.568 | 0.090 | 2.144 | 0.035 |
| Control | 6.225±0.763 | 0.121 | | |
| **FR** | | | | |
| Study | 0.939±0.445 | 0.070 | 3.858 | 0.000234 |
| Control | 1.248±0.241 | 0.038 | | |

**Table 3. Chemical constituents salivary IgA and calcium**

| Vars. | Groups | | | | T-test | p-value |
|---|---|---|---|---|---|---|
| | Study | | Control | | | |
| | Mean±SD | ±SE | Mean±SD | ±SE | | |
| SIGA | 0.375±0.123 | 0.019 | 0.420±0.035 | 0.006 | 2.222 | 0.031 |
| Calcium | 0.887±0.260 | 0.041 | 0.989±0.139 | 0.022 | 2.181 | 0.033 |

**Table 4. Correlation between caries, pH, and salivary flow**

| Groups | DS | | MS | | FS | | DMFT | | DMFS | |
|---|---|---|---|---|---|---|---|---|---|---|
| | R | P | R | P | R | P | R | P | R | P |
| **Control** | | | | | | | | | | |
| pH | -0.124 | 0.445 | -0.008 | 0.960 | 0.038 | 0.817 | -0.141 | 0.385 | 0.096 | 0.557 |
| FR | -0.245 | 0.127 | -0.204 | 0.207 | 0.021 | 0.900 | -0.210 | 0.194 | -0.285 | 0.075 |
| **Study** | | | | | | | | | | |
| pH | -0.524 | 0.001 | -0.187 | 0.249 | 0.140 | 0.389 | -0.540 | 0.000 | -0.500 | 0.001 |

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**Table 5. Correlation between salivary SIGA, calcium, and caries**

| Groups | SIGA | | Phosphorous | | Calcium | |
|---|---|---|---|---|---|---|
| | R | P | R | P | R | P |
| **Control** | | | | | | |
| DS | -0.386 | 0.014 | -0.218 | 0.177 | 0.028 | 0.864 |
| MS | -0.245 | 0.128 | -0.023 | 0.886 | 0.407 | 0.009 |
| FS | 0.011 | 0.947 | -0.114 | 0.484 | -0.236 | 0.143 |
| DMFT | -0.352 | 0.026 | -0.070 | 0.669 | -0.159 | 0.327 |
| DMFS | -0.410 | 0.009 | 0.082 | 0.615 | -0.133 | 0.413 |
| **Study** | | | | | | |
| DS | 0.018 | 0.913 | -0.141 | 0.385 | -0.043 | 0.794 |
| MS | -0.230 | 0.154 | -0.073 | 0.653 | 0.072 | 0.661 |
| FS | 0.077 | 0.635 | 0.038 | 0.814 | -0.034 | 0.835 |
| DMFT | -0.153 | 0.347 | -0.075 | 0.647 | 0.024 | 0.883 |
| DMFS | -0.118 | 0.468 | -0.062 | 0.703 | -0.072 | 0.660 |

## Discussion

In this study, dental caries increased in study groups compared to control groups. This finding agrees with Whitaker et al. who reported the risk of dental caries is raised in athletes (19). This may come from the mouth guard outside the mouth, increasing the risk of contamination which leads to dental caries (20). This study showed low salivary pH and flow rate with significant differences in a study group. This may be related to the intensity of exercise as mouth breathing which leads to the salivary flow rate becoming low (21). Also, it may be from low flow rate in athletes, associated with effects of oral hygiene (22). This finding agrees with Mosca et al. who reported alteration in salivary pH concerning strong evidence of eating habits (23). The intensity of sport may cause changes in pH (22). They also showed that the salivary IgA and calcium in the study group were lower. This may be due to the low mineral levels in athletes which is connected with psycho-emotional and physical feelings (24). The salivary IgA is lower, which may agree with Rico-González et al. (25).

In study of Wu et al., the negative correlation between salivary flow rate and pH with caries (26), which coincides with the result of this study, explained the indicator of caries susceptibility to salivary flow rate. But some studies disagree, suggesting that dental caries do not affect salivary flow rate (27). Also, this may be explained by the time of decrease in salivary flow leading to dental caries (28). Regarding pH, this result agrees with the study of Wu et al. (26) who reported when dental caries increase, the pH decreases. It may also be related to the connection between physical training and carbohydrates, which leads to low salivary pH and causes dental caries (29). Also, the protective salivary constituent leads to a pH fall and develops dental caries (30). This study showed a negative correlation between calcium and dental caries. This may be connected with the study of Ram et al. (31) who reported that increase in dental caries is associated with decreased salivary calcium in exercise. This also explains that poeple with more dental caries have low ion in saliva (32). Also, this study shows a negative significant relation between IgA with dental caries. This agrees with study of Leary et al. (33) who reported the low IgA due to the athletes having poor oral health which increases dental caries.

It disagrees the with study of Gómez et al. (34) who illustrated low levels of salivary IgA with increased caries activity. Maybe the IgA can fight oral cavity microbes; therefore, when it decreases, it is associated with more caries (35). Also, maybe the IgA falls through training and causes increase in dental caries (36).

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Based on the result of this study, high-intensity training, poor oral hygiene, and mouth breathing during exercise are connected with an increased prevalence of dental caries among boxers (100%). In the study group, PH and salivary flow rate showed significant differences. Salivary IgA and calcium are low in the study group, with significant differences. Considering this correlation, the result shows a negative correlation between dental caries and salivary flow rate among study players, and positive correlation between dental caries and pH control group, and also a negative correlation between salivary IgA, and calcium in a study group with dental caries with significant differences.

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