

Depression status in relation to dental caries and salivary C-Reactive Protein among 17 years old secondary school female in Baghdad City/Iraq.

Noor A. Al-Bazaz⁽¹⁾, Nada Jafer MH Radhi⁽²⁾

<https://doi.org/10.26477/jbcd.v33i1.2921>

ABSTRACT

Background: Depression is a state of low mood and aversion to activity, it can affect a person's thoughts, behavior and sense of well-being. It can affect oral health and lead to an increased risk of dental caries. Dental caries is the most common oral infectious diseases that stresses the immune system and causes changes in cellular and molecular components of peripheral blood and C-Reactive Protein is one of these components, considered a key biomarker of inflammation. This study was conducted to assess the effect of depression status on dental caries among 17 years old secondary school female students in relation to salivary C-Reactive Protein.

Materials and Methods: A cross sectional study was carried and the whole sample composed of 500 female students selected from First Alrasafa Directorate schools in Baghdad/ Iraq. Consent form was achieved from the ethical approval committee in College of Dentistry/University of Baghdad. All students were subjected to Children Depression Inventory questionnaire by Kovacs in 2011. Dental caries was registered according to Manji et al. 1989, Decay (1-4) Missing-Filled surface index. Subsamples were selected from high and low grade of depression to analyze C-Reactive Protein.

Results: The percentage of occurrence of depression was 100%. The mean value of caries experience and severity were found to be higher among female students with high depression grade in comparison with low depression grade. The mean value for C-Reactive Protein was higher in high depression grade. There is a diversity in the results of caries experience with C-Reactive Protein. The percentage of depression occurrence was 100% which means a high degree of depression, and this could be due to the life difficulties, tension and economic issues that all lead to mental problems. The severity of dental caries increased as a result of stress and anxiety that may cause poor dental health. Psychological factors interact through complex pathophysiological and behavioral mechanisms that may cause elevated C-Reactive Protein.

Conclusion: Depression has a negative impact on a person's oral health including dental caries. Elevated C-Reactive Protein levels have been associated with psychological depression.

Key words: Depression, Children Depression Inventory, Dental caries, C-Reactive Protein. (Received: 12/12/2020, Accepted: 19/1/2021)

INTRODUCTION

Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest or pleasure in most or all normal activities⁽¹⁾. It can be considered as one of the significant causes of mortality and morbidity and a contributor to the global burden of disease⁽²⁾. It can affect oral health as a result of neglecting oral hygiene procedures, cariogenic nutrition, and avoidance of necessary dental care which leads to an increased risk of dental caries⁽³⁾.

Children Depression Inventory (CDI) is one of various approaches that are available to measure depression for children and adolescent⁽⁴⁾.

It is self-report as the person being evaluated records his/ her answers on the test sheet, other than giving verbal answers to questions, then analyzed by the examiner⁽⁵⁾.

Reliability and validity of the depression inventory scale CDI2 -were guaranteed as this scale was used and tested for its reliability and validity earlier by Salman, 2014 and Muwafaq, in 2019^(5,6,7). Depression like dental caries, both are chronic diseases. Dental caries is a preventable - disease, bacterially established and progressed when acid producing by bacteria utilizes dietary sugars, diffuses into the tooth and dissolves its minerals, causing demineralization^(8,9). Dental caries is the biggest threat to oral health and by far the most common oral infection disease. It has been well proven that the oral cavity contains some of the most varied and vast flora in the entire human body that cause infection which can also seriously stress the immune system and diminish its ability to deal with other infections and diseases. Infection causes changes in cellular and molecular components of peripheral blood - and C-Reactive Protein is one of these components, considered a key biomarker of - inflammation⁽¹⁰⁾. It - is" an acute phase protein produced by liver and widely used as a marker of inflammation⁽¹¹⁾. Elevated

(1) Master Student, Department of preventive dentistry, College of Dentistry, University of Baghdad.

(2) Assistant Professor, Department of preventive dentistry, College of Dentistry, University of Baghdad.

Corresponding author, salwanby@gmail.net

levels of this protein has been associated with psychological depression ⁽¹²⁾. Since there is no previous Iraqi study regarding the effect of depression on dental caries among 17 years old secondary school female students in Baghdad / Iraq in relation to salivary C-Reactive Protein, this study was conducted. The study hypothesis was that depression has no effects upon salivary C-Reactive Protein in relation to oral health status.

MATERIALS AND METHODS

The current study was carried out in Baghdad/Iraq starting from November, 2019; till July, 2020. Total sample involved 500 randomly selected females students aged 17 years from secondary schools in First Alrasafa Directorate in Baghdad/Iraq in which their total number was 9567 students using specific statistical program called Epi Info 7 (is a public software package designed for the global public health community of practitioners and researchers) ⁽¹³⁾.

Official consent was received from the Iraqi Ministry of Education and - from schools authority to observe the students without obligation and to ensure help. The age was calculated according to last birthday according to World Health Organization, 1997 ⁽¹⁴⁾. A scale called Children's Depression Inventory (CDI2) was used to divide the sample into three groups according to the severity of depression (low, medium, high grade). Arabic version and translation validity of CDI2 was obtained by Salman in 2014 and Muwafaq in 2019, by two translators who translated the items of the test from its original language to the target language (Arabic) in Ministry of higher education and scientific research ^(6,7). All sample was requested to fill all items of the scale questionnaire by themselves. Subgroups of 45 students were taken arbitrarily from high grade and 45 students from low grade of depression to make comparisons regarding salivary C-Reactive Protein. Oral health assessments were carried out according to the basic procedures of the oral health which surveys of the World Health Organization 1997 ⁽¹⁴⁾.

Dental caries was recorded according to Manji *et al.* (1989) ⁽¹⁵⁾ index criteria; this criteria permit for recording caries lesion for permanent teeth by its severity. Clinical examinations were carried out using plane mouth dental mirrors and probe. Unstimulated salivary samples were collected in

sterile screw capped tubes ⁽¹⁶⁾, then taken to the laboratory for centrifugation and analysis. In the saliva of 90 students, C-Reactive protein concentration in mg/dl was measured by ELISA Kit using Enzyme Linked Immuno-Sorbent Assay (ELISA) machine. The principle of reagent preparation, technique assay and calculation of results were all completed according to manufactures procedure instructions.

Statistical package for social sciences (SPSS version 21) was used for data description, presentation and analysis. For quantitative variables, mean and standard error were used. One Way Analysis Of Variance (ANOVA) was used to identify differences. Pearson correlation test was used for correlation between quantitative variables ⁽¹⁷⁾. For the level of significance, it was Not significant $P > 0.05$, Significant $P \leq 0.05$.

RESULTS

Table 1 shows the distribution of sample according to depression grades . It was found that the higher occurrence (49%) was for low depression grade followed by medium grade (23.8%) then high grade (18.2%) was the lowest.

Table 1: Distribution of the sample according to depression grade.

Groups	Number	%
Low	245	49.00
Medium	164	32.80
High	91	18.20

Caries experience - in each grade of depression is shown in Table 2. For decay surface (Ds), Missing surfaces (Ms) and DMFs, the higher value was among high grade of depression. the fillings component (Fs) of DMFs index, higher value was among medium grade.

Table 3 demonstrates the mean values of caries severity represented by grades of lesion (D1-4). The mean of all grades of lesion severity was higher among high grade of depression.

Concerning Table 4, it showed the result of salivary C-Reactive Protein according to depression grades, the mean value was higher in high grade with significant difference among groups.

Table 2: Dental caries experience according to depression grade

Variables	Low		Medium		High		F	Probability Value
	Mean	SE	Mean	SE	Mean	SE		
DS	7.992	0.345	8.366	0.401	10.626	0.494	8.773	0.000*
MS	0.469	0.127	0.415	0.168	0.769	0.258	0.875	0.418
FS	21.637	0.156	2.829	0.201	2.527	0.273	12.080	0.000*
DMFS	10.098	0.352	11.610	0.416	13.923	0.589	16.638	0.000*

Degree of freedom=2, SE: standard error, Ds: Decay surface, Ms: Missing surfaces, Fs: Fillings surface, *=significant at p≤0.05.

Table 3: Caries severity represented by grades of lesion according to depression grade

Variables	Low		Medium		High		F	Probability Value
	Mean	SE	Mean	SE	Mean	SE		
D1	6.082	0.241	6.720	0.297	7.407	0.336	4.594	0.011*
D2	1.869	0.101	1.732	0.121	3.044	0.179	22.537	0.000*
D3	0.078	0.021	0.067	0.023	0.110	0.043	0.501	0.606
D4	0.010	0.011	0.000	0.000	0.011	0.011	1.293	0.275

SE: standard error, Decay (1-4) Missing-Filled surface index, *=significant at p≤0.05

Table 4: Salivary C-Reactive protein in ml/min according to depression grade

Variables	Groups				df	Probability Value
	High		Low			
	Mean	SE	Mean	SE		
CRP	2.625	0.143	1.399	0.068	88	0.000*

SE: standard error , df: Degree of freedom, CRP: C- Reactive Protein.

In Table 5, the correlation coefficient of caries experience with C-Reactive Protein according to grades of depression can be seen. For low depression grade, the relations goes in weak positive direction except for Decay surface which goes in weak negative direction. Regarding high

depression grade, all relations go in weak negative direction. There was a significance in low depression grade for the relation between Missing surfaces and C-Reactive Protein, while other relations shows no significance.

Table 5: Correlation coefficient of caries experience with C-Reactive Protein according to grades of depression.

Groups		C-Reactive Protein	
		R	P
Low Depression	DS	-0.186	0.220
	MS	0.406	0.006*
	FS	0.108	0.481
	DMFs	0.027	0.860
High Depression	DS	-0.116	0.447
	MS	-0.080	0.599
	FS	-0.266	0.077
	DMFS	-0.227	0.134

Ds: Decay surface, Ms: Missing surfaces, Fs: Fillings Surface, *= significant at $p \leq 0.05$.

Correlation coefficient of caries severity was represented by D_{1-4} with C-Reactive Protein according to different grades of depression demonstrated in table 6. For all depression grades, the correlations were in weak negative non-

significant direction except for D_3 (grade 3) of high depression grade, it was weak positive, however the correlation of D_4 (grade 4) of low grade depression shows a significant relation.

Table 6: Correlation coefficient of caries severity with C-Reactive Protein according to different grade of depression

Groups		C-Reactive Protein	
		R	P
Low depression	D1	-0.174	0.253
	D2	-0.225	0.137
	D3	-0.083	0.586
	D4	.	0.000*
High depression	D1	-0.152	0.318
	D2	-0.038	0.806
	D3	0.002	0.991
	D4	-0.291	0.053

Decay (1-4), *= significant at $p \leq 0.05$.

DISCUSSION

All female students included in the study have symptom of depression (percentage of depression occurrence is 100%), and this could be due to the difficult life conditions represented by stress and financial difficulties that all lead to severe psychological problems^(18,19). The mean values of caries experience concerning Decayed, Missing surfaces and DMFs values were higher among high grade of depression. Also caries severity represented by grades of lesion washigher in high depression grade, this result is in agree with other studies^(6,20). The reasons for these results could be due to:

- Behavioral effects of stress and anxiety in depressed patients may cause poor dental health. It

can be difficult to have the discipline to follow a strict tooth care routine when battling a mental health condition. Depressed people are also more

likely to skip visits to the dentist due to dental fear especially in females⁽²¹⁾.

- Depression causes diminishing in immune system function causing activation and colonization of pathogenic and cariogenic bacteria⁽²⁰⁾.
- Increased tendency to have sweet food to give happiness and pleasure to the brain, and this type of food is cariogenic and ends with the development of dental caries^(22,23).
- Increased carbohydrate intake as a result of decrease serotonin metabolism which occurs during depression, and this will provide a noble environment for the development of acidic uric bacteria⁽²³⁾.

Filled component of DMFs index (filled surface) was higher in medium and high grade than low grade of depression and this could be due to mysophobia (germophobia) which is "a term used to describe a pathological fear of germs, bacteria, uncleanliness, contamination, and infection".

Depressed people are at higher risk of developing phobias and may start focusing on germs, increased use of hygiene measures and try to visit dentist whenever they have decay as a result of depressed mentality⁽²⁴⁾. The mean value for C-Reactive Protein was higher in high depression grade with significant difference. This result goes in line with some other studies^(25,26). The underlying mechanism between inflammation and depression is not fully understood. Systemic inflammation and psychological factors interact through complex pathophysiological and behavioral mechanisms. First, inflammation may lead to depression as proinflammatory cytokines might contribute to decreased production of serotonin and increased production of kynurenic and quinolinic acids⁽²⁷⁾ that leads to decreased production of trophic factors, including brain-derived neurotrophic factor, a factor associated with depression. Second, depression may also lead to inflammation. Psychological stress activates the hypothalamic-pituitary-adrenocortical axis and sympathetic nervous system, which releases stress and depressive hormones. These hormones, together with cytokine release, initiate the acute-phase response triggering inflammation.^(28,29)

The diversity in the results of caries experience with C-Reactive Protein has many explanations. For positive correlations, this may be attributed first to the immune response during caries progression, development and thus indicative of inflammation. Similar results were concluded by the previous studies⁽³⁰⁾. Negative correlations of caries experience with C-Reactive Protein can be explained by the fact that dental caries is a multifactorial disease, caused by complex interactions among acid-producing bacteria, fermentable carbohydrates and many host factors including saliva rather than to be related to single factor⁽³¹⁾. Also presence of abundant proteins in human saliva such as amylases, proline rich proteins, statherin, histatin, mucin and cystatins that have a "double edged swords" role, so any modification indicate various physiological and pathological fluctuations^(32,33). They may play a protective role or may increase colonization of microorganism depending on their location and action⁽³⁴⁾.

CONCLUSION

The percentage of depression occurrence was 100%. Caries experience was found to be higher among high depression grade. The same result for caries severity grade 1 (D₁) and grade 2 (D₂) produced significant differences. The correlations

of Salivary C-Reactive Protein with caries experience and caries severity showed diversity in the results.

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المستخلص:

الخلفية: الاكتئاب هو حالة من المزاج المنخفض والنفور من النشاط، ويمكن أن تؤثر على أفكار الشخص، والسلوك والشعور بالرفاهية. ويمكن أن يؤثر على صحة الفم ويؤدي إلى زيادة خطر تسوس الأسنان. تسوس الأسنان هو أكثر الأمراض المعدية شيوعاً في الفم التي تضغط على الجهاز المناعي ويسبب تغييرات في المكونات الخلوية والجزيئية من الدم المحيطي وان البروتين المتفاعل العالي - سي هو واحد من هذه المكونات ويعتبر علامة حيوية رئيسية للالتهاب. وكان الهدف من هذه الدراسة لتقييم تأثير حالة الاكتئاب على تسوس الأسنان في عمر 17 سنة من طالبات المدارس الثانوية في ما يتعلق البروتين المتفاعل العالي - سي.

المواد وطرق العمل: تم إجراء دراسة مقطعية تتكون العينة الإجمالية من 500 طالبة تم اختيارهن من مدارس مديرية الرصافة الأولى في بغداد/العراق. تم الحصول على نموذج الموافقة من لجنة الموافقة الأخلاقية في كلية طب الأسنان/ جامعة بغداد. وخضع جميع الطلاب لاستبيان جرد اكتئاب الأطفال من قبل كوفاكس في عام 2011. تم تسجيل تسوس الأسنان وفقاً لمؤشر شدة التسوس 1-4 Decay لمانجي وآخرون 1989. تم اختيار مجموعات فرعية من الدرجة العالية والمنخفضة من الاكتئاب لتحليل البروتين المتفاعل العالي - سي.

النتائج: كانت نسبة حدوث الاكتئاب 100%. ووجد أن القيم الوسطية لشدة تسوس أعلى بين الطالبات اللاتي اتصفن باكتئاب مرتفع. وكان متوسط قيمة بروتين C التفاعلي أعلى في درجة الاكتئاب العالية. هناك تنوع في نتائج تجربة تسوس مع البروتين المتفاعل العالي - سي . تبلغ نسبة حدوث الاكتئاب 100%، وهذا يعني درجة عالية من الاكتئاب وقد يكون ذلك بسبب الصعوبات الحياتية والتوتر والقضايا الاقتصادية التي تؤدي جميعها إلى مشاكل عقلية. ازدادت شدة تسوس الأسنان نتيجة للإجهاد والقلق الذي قد يسبب سوء صحة الأسنان. تتفاعل العوامل النفسية من خلال البيات الفسيولوجيا المرضية والسلوكية المعقدة التي قد تسبب ارتفاع البروتين المتفاعل العالي - سي . الاستنتاجات: الاكتئاب له تأثير سلبي على صحة الفم للشخص بما في ذلك تسوس الأسنان. ان ارتفاع مستويات البروتين المتفاعل العالي - سي قد ارتبط مع الاكتئاب.

