# Correlation Of Pregnant Oral Health Scoring Models With Inflammatory Protein Markers Scd14 And Prostaglandins

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**ABSTRACT**

***Background:*** *To analyse correlation of pregnant oral health scoring model with inflammatory protein markers sCD14 and prostaglandins.*
***Method:*** *A cross-sectional consisted of 80 pregnant women who met inclusion criteria used consecutive sampling.*
***Result:*** *The POSC-p model which was based on oral health scoring, components of salivary condition was significantly correlated with sCD14 and the POSC-p model and combined of oral health scoring was significantly correlated with prostaglandins.*
***Conclusion:*** *The POSC-p score model and the sCD14 of clinical examination have correlation consist of tooth decay, occlusion and salivary condition consist of salivary pH level, salivary volume and salivary buffer. However, there was no substantial correlation between the pregnant oral health scoring model of felt need and the pregnant oral health scoring for salivary conditions or the combined POSC-p score and sCD14 levels and POSC-p Scores (combined) significant correlation with sCD14.*



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**INTRODUCTION**

One of the most important phases of a woman's life is pregnancy.[1] Throughout pregnancy, multiple physiological and hormonal changes occur.[1] Oral self-care is the most important and effective treatment for pregnant women in order to protect them from diseases, maintain oral-mouth hygiene, and avoid oral diseases.[2] Each individual's motivation is a crucial success factor to maintain oral health.[3] Pregnant Oral Self-Care (POSC-p) refers to the role of pregnant women who practice oral self-care.

Oral Health Scoring (OHS) is a numerical assessment of one's overall oral health. OHS components include the necessity to express feelings and determine the normative need for oral diseases. Self-assessment includes the perceived feeling such as pain, functions, and appearance.[4]

Various studies on oral health assessments and interventions for pregnant women in Indonesia have included their knowledge, attitude, and action[5,6], oral health[7], DMFT index or caries states[6,8], PUFA index [9], which have been regularly conducted [6,7,8], as well as the salivary states.[10] In Indonesia, however, the use of integrated metrics as a scoring system has not been examined.

Saliva is a diagnostic biomarker that has not been widely employed; because it plays a similar function to serum, its development has risen. Moreover, it reflects the physiological condition of the body in the oral cavity and systemic disorders.[11] By assessing inflammatory markers that may be quantified in saliva, biochemical investigations on saliva can be performed. [12]

Dental pulp has a strong regenerative ability due to the existence of stem cell progenitors in the tissue.[13] Acid solution derived from caries-exposed dentin releases reparative signal, which regulates reparative dental synthetic, angiogenesis, and innervation.[13] As a result, in response to caries, the dental pulp dynamically reacts with inflammation, mineralization protein expression, and/or reparative dentin production by odontoblast-like cells produced from dental pulp mesenchymal stem cells.[13]

Studies related to the protein function of saliva as an indicator to predict risk of illnesses have been intensively investigated.[14] Protein markers in biological fluids may be precisely quantified and produced, giving vital information about the body's response to illnesses or therapy, including long-term monitoring of oral diseases. It serves as an early illness indicator and is a feasible choice for oral diagnostics.[14]

Inflammatory protein markers consisting of sCD14[15,16], prostaglandin[17], macrophage dan monocytes, neopterin (NEO), and acute inflammatory marker sialic acid (SA), C-reactive protein (CRP) as well as the Interleukin-6 (IL-6) protein are elevated during pregnancy[18], especially during the first and second trimester of pregnancy with the risk factor of a development for pre-eclampsia. We're evaluating their relevance in predicting medical problems in pregnant women.[19]. Nonetheless, this study is only investigating sCD14 and prostaglandin as they are inflammatory indicators that rise during pregnancy and are early diagnostic indicator to detect health issues in pregnant women.

Circulating CRP level is a systemic inflammatory marker associated to periodontal disease, chronic bacterial infection, and elevated pro-inflammation cytokines and prostaglandins.[20] In comparison to control and healthy patients, this elevated inflammatory marker was identified in the amniotic fluid of pregnant women with periodontitis and preterm labor. [21,22]

Inflammatory mediators that depart the systemic circulation and pass the chorioamniotic barrier will eventually emerge in amniotic fluid.[23] Bacteria transported by blood products, particularly lipopolysaccharides

(LPS), produce chorio-amniotic plexus fusion of PGE and TNF-α. Inflammatory mediator cells originating in the host encourage premature membrane rupture prior to birth, resulting in preterm labor. [23]

sCD14 protein play its role in inflammatory disease by controlling system immune response.[15,16] Several clinical studies have reported a significant increase of sCD14 serum level in inflammation condition.[24] The upregulated sCD14 level was found in the serum of a patient with chronic periodontitis. [15,16]

Alteration in local sCD14 level is a substantial susceptibility factor for human periodontal ligament stem cells (hPDLSCs). A distinct pathogen of hPDLSCs contributes to the development of periodontitis.[25] A significantly higher level of sCD14 concentration in saliva is found in active caries.[15,16] sCD14 is a co-receptor involved in the identification of Gram-positive bacteria, bacteria that cause dental caries, and Gram-negative bacteria.[26]

Inflammation can be triggered by elevated amounts of chemical mediators, such as prostaglandins, and the changes in the fibrinolytic system. The link between higher hormone levels and chemical variables may result in alterations in vascular responsiveness and replacement of connective tissue in the periodontium, which may cause inflammation during pregnancy.[27]

A prior description has encouraged the researchers to determine a central theme of the research. Since oral health issues for pregnant women are extensive, it requires specific attention in order to give therapy that may be initiated based on a full assessment on the patient's oral health using a scoring system that has been evaluated for its capacity to determine protein markers of inflammation. The purpose of this study is to analyze pregnant oral self-care health scoring with inflammatory protein markers sCD14 and prostaglandin. According description above the hypothetical in present study is the pregnant oral health scoring model based on the oral health score is measured by perceived feelings (felt need) and normative needs, and the salivary state is strongly related to sCD14 and prostaglandins as inflammatory markers.

## RESEARCH METHOD

This study utilized a cross-sectional analysis of pregnant women who were patients at a maternal clinic. The inclusion criteria in this research were first- and second-trimester pregnant women who could communicate well and could read and write. Pregnant women who could not participate in all stages of the research, pregnant women with chronic diseases such as diabetes mellitus and hypertension and pregnant women with visible infections in body parts that could be observed by researchers that had been diagnosed by a doctor or documented in the patient's medical record were excluded.

Samples were collected using a non-probability sampling method called consecutive sampling, which involved collecting samples from all populations where data was available and collected consecutively during the research[28] in order to identify both sensitivity and specificity, which were measured by sample measurement formula.[29] The trust level for this study was 1-α =95 % ($Z_{1-\alpha}$=1,96); the sensitivity level was 75%; precision value was 15%; and the p-value was 0.5. The n-value = 0.75*0.25 (1.96/0.15*2/0.50 = 64 added 10% DO resulting in n = 1/(1-0,1)*64= 72. This formula produced a minimal measuring sample n=72 and number of samples in this study 80 pregnant women.

Variable research consist of Independent Variable (X) is Pregnant Oral Self-care Package (POSC-P) (X) model based on Oral Health Scoring, assessed by felt Needs (X1) and normative Needs (X2), Salivary condition (X3) with determining cut-off by assessing the Receiver Operating Characteristic Curve (ROC) with a maximum

score of 30.[30] Dependent Variables (Y1) is markers of Inflammation assessed by Prostaglandin (Y1a) and sCd14 (Y1b). The operational definition of the variable is attached in figure 1-3. The ELISA method was utilized to assess sCD14 levels and prostaglandins in saliva using the Human CD14 Quantikine ELISA Kit and the PTGIS/prostaglandin All reagents, working standards, and samples were made in accordance with the manufacturer's specifications.

Materials of this research are Pregnant Oral Self-care Package (POSC-P) measurement, saliva saliva was collected using the passive drool method[31], Human CD14 Quantikine ELISA Kit (Catalog DC140, R&D Systems, Minneapolis, MN, USA/item code of elisa kit in catalog) and PTGIS/prostaglandin I synthase ELISA Kit (Catalogue No.: EH3676 Wuhan Fine Biotech Co., Ltd). Setting of this research in private dental clinic, locations at cantik Clinics at Banjaran Bandung Indonesia, and periods of recruitment Desember-Januari 2021. Research has received an ethical approval recommendation from the Padjadjaran University Health Research Ethics Committee, Number: 53/UN6.KEP/EC/2020, November, 26 2020.

The content validity index (CVI) value of felt need is more than 0.76 where the CVI value perceive feeling of Form POSC-p is 0.85 indicate the value of CVI indicates a valid result. Intra- and inter-examiner variability of the POSC-p examination measuring instrument by calibrating using inter, intra examiner and duplication on process of research showed a kappa value of 0.886 and 0.819, respectively. This value indicates that inter-examiner variability has high agreement in the range of 0.81-1.00.

The results of the intra-examiner variability test showed that the first examiner's kappa value was 0.754 and the second examiner's kappa value was 0.913 indicates the variability of intra-examiner 1 has high agreement in the range 0.61-0.80 and the second examiner's kappa value has very high agreement because it is in the range of 0.81-1.00. [30]The results of the intra-examiner variability test during the research process showed that the first examiner's kappa value was 0.834 and the second examiner's kappa value was 0.881 indicates intra-examiner variability 1 and 2 have a very high agreement because they are in the range 0.81-1.00.[30] Saliva duplication testing is done for control for confounding to examine Saliva CD14 and prostaglandin testing.

A custom human protein array was used to obtain data on sCD14 in saliva samples (Quantibody Custom Array; Ray Biotech, Inc., Norcross, GA, USA). The sCD14 concentration was determined by comparing the sample signals to the standard curve.[32,33] The sCD14 level measurement result was then classified (Figure 3) as follows: 0 = not normal sCD14 level (> 2-4 mg $mL^{-1)}$; 1 = normal sCD14 level (< 2-4 mg $mL^{-1}$) [15,30,34,35].

Each well received up to 100µL of standard or sample, which was then incubated at 37 °C for 1 hour. The sample was then aspirated and washed three times. Another 100L of standard or sample was added to each well to make detection reagent B, which was then incubated for 1 hour at 37 °C. After aspirating and washing the sample five times, 90L of substrate solution were added. The next step was to incubate for 10–20 minutes at 37 °C before adding 50µL of stop solution. The result was read promptly at 450nm.[36] The processing time was around 5 hours.[30,37,38]

Data collection of the Prostaglandin in the saliva samples was quantitative detection of PTGIS in serum. Use EDTA-Na2 or heparin as an anticoagulant while collecting plasma. Within 30 minutes after collection, centrifuge samples at 1000×g for 15 minutes at 2–8 °C. The results of a typical routine operation of a PTGIS ELISA Kit are given in the order in which they were manufactured.[39] Duplication testing is done for control for confounding. The result of the measurement of Prostaglandin level was then categorized. [39]

Measure each standard and sample in duplicate. Aliquot 100ul of zero tube, 1sttube, 2ndtube, 3rdtube, 4thtube, 5thtube, 6thtube and Sample Dilution Buffer (blank) into the standard wells. Fill test sample wells with 100ul of an adequately diluted sample. Incubate: Cover the plate and incubate it at 37°C for 90 minutes. Remove the cover and remove the contents of the plate, then wash the plate twice with Wash Buffer.[39]

Analysed data using data normality testing by Kolmogorov Smirnov Assay, the testing of the POSC-p model with the inflammatory indicators sCD14 and prostaglandin based on *logistic regression test* and correlation of Clinical Examination POSC-p Score with sCD14 and Prostaglandin levels using correlation coefficient *Rank* Spearman**.** Research publications presenting significant datasets that are placed in a publicly accessible database in five years and made available on request to the corresponding author. This study was carried out in conformity with all of the rules and regulations set out by the Universitas Padjadjaran research ethics committee.

**Table 1. Operational Definition**

| Variables | Operasional Definitions | Tools and measuring techniques | Measurement results | Scales |
|---|---|---|---|---|
| **Independent Varable (X)** is Pregnant Oral Self-care Package Model (POSC-P) (X) based on Oral Health Scoring assessed through felt needs (X1) and normative Needs (X2), and Salivary condition (X3) with a maximal score of 30. | | | | |
| **Felt need (X1)** | | | | |
| Convenience (X1a) | There's no pain and sensitivity | patient perception self assessment questionnaire | 0,1 or 2<br>0 = very inconvenient<br>1 = inconvenient<br>2 = very convenient | Ordinal |
| Appearance/ aesthetics (X1b) | Feeling satisfied with appearance | patient perception self assessment questionnaire | 0, 1 or 2<br>0 = not happy with the appearance<br>1 = some appearance issues<br>2 = happy with appearance | Ordinal |
| Functionality (X1c) | Ability to eat permissible food | patient perception self assessment questionnaire | 0, 1 or 2<br>0 = very problematic<br>1 = problematic<br>2 = not problematic | Ordinal |
| **Clinical examination/*Normative need* (X2)** | | | | |
| Caries (X2a) | There is/isnt caries lesion(s); secondary caries around dental restorations. | Caries examination forms from WHO | 0, 1, 2,3 or 4<br>0 = 25-32 with cavities<br>1 = 17-24 with cavities<br>2 = 9-16 with cavities<br>3 = 1-8 with cavities<br>4 = 0 Caries (Healthy) | Ordinal |
| Periodontal Examination (X2b) | Gum pocket depth, inflammation and subgingival calculus mesial, mid and distal to the teeth in the lingual/palatal and buccal/labial areas | Modification examination form of BPE (Basic Periodontal Examination) | 0, 1, 2, 3,4<br>0= BPE Score of 577-768<br>1= BPE Score of 385-576<br>2= BPE Score of 193-384<br>3= BPE Score of 1-192<br>4 = Healthy | Ordinal |

| Variables | Operasional Definitions | Tools and measuring techniques | Measurement results | Scales |
|---|---|---|---|---|
| Dentures, if there's any (X2c) | Lack of retention, stability, surface, tooth wear/damage, freeway space (interocclusal distance) | Examination form | 0 or 1<br>0 = 10 pair of articulating dentures<br>1 = no 10-pair-articulating dentures. | Ordinal |
| Dental attrition (X2d) | Damage to enamel, dentin and cementum; loss of dimension or integrity of dental restorations. | Examination form | 0, 1 or 2<br>0 = no attrition<br>1 = only on enamel<br>2 = dentin attrition | Ordinal |
| Occlusion (X2e) | The presence of opposing teeth (natural or prosthetic) with at least ten pairs of articulating teeth. | Examination form | 0 atau 1<br>0 = malocclusion<br>1 = no malocclusion | Ordinal |
| Soft tissue/mucosa (X2f) | There's inflammation, ulceration or other pathology. | Examination | 0, 1 or 2<br>0 = there's inflammation or ulcer<br>1 = there's inflammation or ulcer<br>2 = no inflammation or ulcer | Ordinal |
| OHI (X2g) | Assessment of plaque on buccal and lingual surfaces of teeth | Turesky Modification Index | 0,1,2,3<br>0 = Plaque Total Score 0-80<br>1 = Plaque Total Score 81-160<br>2 = Plaque Total Score 161-240<br>3 = Plaque Total Score 241-320 | Ordinal |
| **Salivary Condition (X3):** | | | | |
| Salivary PH (X3h) | Unstimulated Salivary PH level | GC Litmus | 0= < 6,7 or > 7,3<br>1= 6.7-7.3 | Ordinal |
| Salivary Volume (X3i) | Normal volume collected in 5 minutes for unstimulated | Saliva tube | 0 = < 1,5<br>1 = >1,5<br>2 =1,5- 2,5 ml | Ordinal |
| Buffer (X3j) | Salivary buffer capacity testing measures the ability of saliva to minimize acid challenge | GC colorimetry scale | 0 = very low (buffer capacity 0 - 5)<br>1 = low (6 - 9) or<br>2 = high (10 - 12) | Ordinal |
| **Dependent Variabel (Y1) Inflammatory marker:** | | | | |
| Prostaglandin (Y1a) | Prostaglandin hormones detectable in saliva | Lab test: Data was collected from 5 ml of saliva and measured using an Elisa kit. | 0= Abnormal amount of prostaglandins in ≥13.4 ng/ml.<br>1= normal amount of prostaglandins in <13,4 ng / ml. | Ordinal |
| sCd14 (Y2b) | sCD14 is one of the body's sensors in the form of | Lab test: data was colected from priorly | 0= abnormal sCD14 >2-4 µg mL-1 | Ordinal |

| Variables | Operasional Definitions | Tools and measuring techniques | Measurement results | Scales |
|---|---|---|---|---|
| | proteins to help detect invading bacteria | collected-in-tube saliva and was measured using an Elisa kit | 1= normal sCD14 < 2-4 µg mL-1 | |

**Table 1.** Operational Definition of variable of research consist of Independent Variable (X) is Pregnant Oral Self-care Package (POSC-P) (X) model based on Oral Health Scoring, assessed by felt Needs (X1) and normative Needs (X2), Salivary condition (X3) with determining cut-off by assessing the Receiver Operating Characteristic Curve (ROC) with a maximum score of 30.

## RESULTS

Table 2 displays the characteristics of the respondents. It demonstrates that the average level of education for pregnant women is high school, which is 50%, and that 81.3% of them do not have a job outside the house.[30] Pregnant women have more resting burden, which is equal to 87.5%. The average pregnant woman aged 20-34 years was 83.8 percent, the average pregnant woman had one child was 76.3%, more pregnant women who did not have a high-risk pregnancy were 60%.[30]

**Table 2. The description components of POSC-p**

| The Components (POSC-p) | Answer | Amount (%) |
|---|---|---|
| **I. Felt need** | | |
| 1. Feeling convenient with their teeth. | 0 = very inconvenient | 26 (32,5) |
| | 1= inconvenient | 49 (61,3) |
| | 2= very inconvenient | 5 (6,2) |
| 2. Feeling pleased with their teeth appearance now | 0= not pleased | 20(25) |
| | 1= have a few issues | 41(51,2) |
| | 2= feeling pleased | 19(23,8) |
| 3. Having the ability to eat | | |
| | 0= big problem | 37(46,3) |
| | 1= little problem | 37(46,3) |
| **II. Normative Needs/Clinical Examination** | 2= no problem | 6(7,8) |
| 1. Crown Caries | | |
| | 0= 24-32 with cavities | 17(21,3) |
| | 1= 16-23 with cavities | 29(36,3) |
| | 2= 8-15 with cavities | 21(26,3) |
| | 3= 1-7 with cavities | 13(16,3) |
| 2. Root Caries | 4= Healthy | 0(0) |
| | 0= 24-32 root cavities | 0 (0) |
| | 1= 16-23 root cavities | 0(0) |
| | 2= 8-15 root cavities | 2(2,5) |
| | 3= 1-7 root cavities | 39(48,8) |
| 3. Periodontal Condition | 4= Healthy | 39(48,8) |
| | 0= BPE scores 577-768 | 2(2,5) |
| | 1= BPE scores 385-576 | 4(5) |
| | 2= BPE scores 193-384 | 34(42,5) |
| | 3= BPE scores 1-192 | 40(50) |
| 4. Dental Attrition | 4 = Healthy | 0(0) |
| | 0= dental attrition (1-32 teeth) | 17(21,3) |

| | | |
|---|---|---|
| | 1= email attrition (1-32 teeth) | 63(78,8) |
| 5. Condition of Dentures | 2 =no attrition | 0(0) |
| | 0= Less retention/stability, surface condition is not good, there's tooth attrition/damage/there's freeway space (interocclusal space) | 0(100) |
| | 1= Dentures are in good condition | 0(0) |
| 6. Occlusion | 0= less than 10 articulated pairs of teeth | |
| | 1= 10 articulated pairs of teeth. | 43(53,8) |
| | 0= there's inflammation and ulcer | |
| 7. Soft Tissue | 1= there's inflammation or ulcer | 37(46,3) |
| | 2= no inflammation nor ulcer | 4(5)] |
| | 0= Total Score of Plaques 241-320 | 73(91,3) |
| 8. Plaque | 1= Total Score of Plaques 161-240 | 3(3,8) |
| | 2= Total Score of Plaques 81-160 | |
| | 3= Total Score of Plaques 0-80 | 1(1,3) |
| | | 37(46,3) |
| **III.Saliva Examination** | 0= < 6,7 or > 7,3 | 36(45,0) |
| 1. Salivary pH level | 2= 6.7-7.3 | 6(7,5) |
| | 0= < 1,5 | 73(91.3) |
| 2. Salivary Volume | 1= >1,5 | 7(8.8) |
| | 2= 1,5- 2,5 ml | 22(27.5) |
| | 0= very low (buffer capacity 0 - 5) | 25(31.3) |
| 3. Buffer Capacity | 1= low (buffer capacity 6 - 9) | 33(41.3) |
| | 2= high (buffer capacity 10 - 12) | 6(7.5) |
| | | 28(35) |
| | | 46(57.5) |

**Table 2**. The description components of POSC-p consist of distribution frequency of sub variable of variable felt needs, normative needs/clinical examination and saliva examination.

Table 3 shows that the average scores of inflammatory markers assessment of sCD14 level is abnormal. Meanwhile, the pregnant women involved in this study exhibited normal levels of prostaglandin.

**Table 3. Inflammatory Markers Assessment Scores.**

| Markers of Inflammation | Answer | Total (%) |
|---|---|---|
| I. sCD14 level | 0 = Normal | 31(38.75) |
| | 1= abnormal | 49(71.25) |
| II. Prostaglandin level | 0 = Normal | 80 (100) |
| | 1= abnormal | 0 (0) |

**Table 3.** Inflammatory Markers Assessment Scores with normal sCD14 is < 2-4 µg mL-1 and normal prostaglandin is <13,4 ng / ml; shows sCD14 majority in abnormal condition but prostaglandin in normal condition.

Data normality testing by Kolmogorov Smirnov Assay was performed prior to the examination. The finding showed that the p-value was <0.05, indicating an aberrant distribution of sCD14 and Prostaglandin levels (Table 4).

**Table 4. Data normality testing of sCD14 and Prostaglandin levels**

| Variables | Statistic Measurement | | | (p-value) |
|---|---|---|---|---|
| | Average (SD) | Median | Range | |
| 1. sCD14 | 19.30 (15,71) | 22.35 | 2.27 – 62,98 | <0.001 |
| 2. Prostaglandin | 0.289 (0,030) | 0.289 | 0.241 – 0.272 | 0.200 |

**Table 4.** is data normality testing of sCD14 and Prostaglandin levels with p value is counted based on Kolmogorov-Smirnov Assay and showed significancy in sCD14 that showed that sCD14 in normal distribution.

The testing of the POSC-p model with the inflammatory indicators sCD14 and prostaglandin is shown in Table 5. Due to prostaglandin's constant value, this POSC-p model cannot be used to test prostaglandin but can be used to test sCD14; the table's evidence showed the modelling requirements have been met (Table 5).

**Table 5. POSC-p model testing with inflammatory markers sCD14 and Prostaglandin**

| Model Evaluation Indicators | Value | Category | Description |
|---|---|---|---|
| **sCD14** | | | |
| Coefficient Omnibus Test Model | p-value = -0.003 | p-value | Fit Model |
| Hosmer and Lemeshow Test | p-value = -0.301 | <0.05 | Fit Model |
| Sensitivity Prediction value | 94.6 | p- | Detecting positive |
| Specificity Prediction Value | 79.2 | value >0.05 | correctly |
| | | Over 90 | Detecting |
| | | - | negative correctly |
| **Prostaglandin** | | | |
| Coefficient Omnibus Test Model | - | - | Can't be |
| Hosmer and Lemeshow Test | - | - | processed due to |
| Sensitivity Prediction value | - | | its single value |
| Specificity Prediction Value | | | category |
| | - | - | |

**Table 5.** POSC-p model testing with inflammatory markers sCD14 and Prostaglandin based on logistic regression test.

Table 6 shown the bivariate correlation of components using clinical examination POSC-p correlation with inflammatory markers sCD14 and prostaglandins. It is revealed a statistically significant correlation between the POSC-p score and the sCD14 of clinical examination consist of tooth decay, occlusion and salivary condition consist of salivary pH level, salivary volume and salivary buffer. However, However, there was no substantial correlation between the POSC-p score of felt need and the POSC-p score for salivary conditions or the combined POSC-p score and sCD14 levels. The correlation with prostaglandin levels cannot be analyzed due to all respondents' prostaglandin levels fell within the normal range and model testing cannot be processed due to its single value category.

| POSC-p Components | sCD14 | | Prostaglandin | |
|---|---|---|---|---|
| | r | p-value | r | p-value |
| Perceived needs | | | | |
| 1. Convenience | -0.043 | 0.709 | Not aplicable | Not aplicable |
| 2. Appearance | -0.015 | 0.895 | Not aplicable | Not aplicable |
| 3. Functionality | -0.007 | 0.950 | Not aplicable | Not aplicable |
| Clinical Examination | | | | |

| | | | | |
|---|---|---|---|---|
| 1. Crown Caries | -0.183 | 0.105 | Not aplicable | Not aplicable |
| 2. Root Caries | 0.006 | 0.957 | Not aplicable | Not aplicable |
| 3. Periodontal Condition | 0.126 | 0.264 | Not aplicable | Not aplicable |
| 4. Tooth decay | -0.395 | <0.001* | Not aplicable | Not aplicable |
| 5. Dentures Condition | | - | Not aplicable | Not aplicable |
| 6. Occlusion | 0.321 | 0.002* | Not aplicable | Not aplicable |
| 7. Soft Tissue | 0.073 | 0.259 | Not aplicable | Not aplicable |
| 8. Plaque | 0,320 | 0.002* | Not aplicable | Not aplicable |
| Salivary Condition | | | | |
| 1. Salivary pH level | -0.252 | 0,026* | Not aplicable | Not aplicable |
| 2. Salivary Volume | -0.237 | 0.037* | Not aplicable | Not aplicable |
| 3. Buffer | -0.270 | 0.017* | Not aplicable | Not aplicable |
| POSC-p Scores (combined) | -0.280 | 0.012* | Not aplicable | Not aplicable |

**Table 6. Correlation of Clinical Examination POSC-p Score with sCD14 and Prostaglandin levels.**

**Table 6.** Correlation of Clinical Examination POSC-p Score with sCD14 and Prostaglandin levels. with r = Correlation coefficient Rank Spearman

The oral health scoring-based POSC-p model of salivary condition correlates considerably Using correlation analysis (Table 6) reveals that only appearance has a strong relation with sCD14 consist of tooth decay, plaque, and occlusion connect significantly with sCD14 and prostaglandin. In addition, the combined-POSC-p score showed significant correlation with sCD14 and the combined POSC-p with prostaglandin not applicable because of modeling testing. (Table 6).

## DISCUSSION

Table 2 depicts the frequency and percentage distributions of each POSC-p component. The POSC-p component is related to the perceived need that pregnant women are typically uncomfortable with their oral conditions, aesthetics, and functional issues.[30] It has been found that 61.3% of pregnant women are concerned about their dental health. One form of oral health awareness is discomfort. Oral health awareness during pregnancy is critical to safeguarding the dental health of mothers and infants. Mothers' access to dental care, particularly before and during pregnancy, and oral care habits impact not just their own oral and overall health but also that of their children.[30,40]

According to the findings (Table 2), 51.2% of pregnant women were pleased with their oral appearance. This result differed somewhat from the findings of Ferreira et al. [41], who found that 30.9% of pregnant women assessed their dental health as well. Streptococcus mutans transmission can be reduced by practicing good dental hygiene throughout pregnancy. Pregnant women are at a greater risk of passing cariogenic germs to their unborn children. This condition enhances the chances of early intervention [40]. It was shown that 46.3% of pregnant women feel oral problems (Table 2). (Table 2). This conclusion was nearly comparable to that of Soegyanto et al. [42] who found that 32% of pregnant women in their research had oral cavity problems. Oral health care awareness and behavior during pregnancy are critical for women to take care of themselves and their children. Oral health treatment is safe during pregnancy and should be suggested to promote women's dental and overall health. Enhancing women's dental health can reduce the transmission of cariogenic germs to infants, lowering the risk of caries in their future.[30,4242]

Table 3 demonstrates scores for inflammatory markers assessment. The sCD14 levels were at an abnormal rate of 71.25%; a normal range of sCD14 is at 2-4 mg/l$^{-1}$. The sCD14 levels were in the range of 2.27-62.98. This sCD14 levels range were in accordance with the research of Prester, *et al.* who stated that the

median levels of sCD14, measured by enzyme-linked immunosorbents suitable with ELISA's matrix, were found higher in active-caries group than in caries-free group; at rest 203.3 vs 167.9 ng mL-1.[16] The similarity of these results could happen due to the fact that saliva was collected from the same group of pregnant women who also had active caries. In this group, saliva was collected without being stimulated.

100% of the respondents showed their prostaglandin levels within a normal range <13,4 mg $mL^{-1}$ (Table 3). This finding is consistent with a study by Nakayama *et al.* claiming that prostaglandin levels in saliva are almost always constant during pregnancy, and increase toward delivery and decrease afterward.[43]

Table 6 shows the relationship between the POSC-p model and sCD14, which indicates that the combined components were not significantly associated with sCD14. Table 6 also indicates the data associated to the POSC-p components consisting of crown caries, root caries, periodontal conditions and soft tissue with their concentrations. This finding is in line with a study by Nishana, et. all, which mentioned that there was inconsistent result concerning a potential role of sCD14. This may happen because sCD14 is absorbed by *S. salivarius* bacteria within the oral cavity.

These findings describe that the portion of sCD14 protein has not been detected and has been de-synthesised as 55-kDa in the salivary gland. It is also secreted as proteins of the same size as hepatocytes in humans, making it a major source of sCD14 in serum. sCD14 potentially interacts with bacterial components, such as LPS and lactoferrin, and the exacerbation of the innate immune response by cleaning bacterial components may prevent oral and salivary mucous gland. LPS is aggregated by sCD14, and the process encounters phagocytosis internalization, which has no effect on LPS; therefore, sCD14 can also be used as an indicator for healthy function of the oral cavity.[44]

The above results can be addressed based on the scoping review by Reitsma *et al.* stating that when neither an accepted standard reference nor a trustworthy paradigm accuracy exists, the concept of clinical trial validation can provide substantial methodological advancements.[45]

Validation tests employing a variety of methodologies can generate index test result in the research. It will always be a continuous process involving both scientific and clinical communities in determining thresholds. At some point throughout its process, the collected information will be regarded sufficient in the future to allow more confident clinical use of the examination.[46]

The POSC-p components consisting of tooth decay, occlusion, and caries with plaque are not directly linked to the condition of the caries with sCD14 concentrations since the non-stimulated caries with saliva group shows insignificantly different levels of sCD14 secretion (p=0,168). Yet, the samples from the stimulated caries group has a significantly higher sCD14 secretion (P<0,01).[16] The level of secreted sCD14 is significantly higher among the stimulated group compared to one with rested saliva (P <0,01).[16]

The significant correlation was found between the condition of periodontal inflammation in soft tissue and sCD14 concentration. In contrary to this finding, numerous investigations have discovered a significant rise in sCD14 serum during inflammation.[24] This is possible since sCD14 is likely to be affected by factors that include race, age, and education level.[47] A significant periodontal condition is found in moderate to severe illness.[48] However, the severity of periodontal disease in this study was limited to gingivitis with no pocket depth exceeded a value of four.

The combined scores of the POSC-p model exhibit a close link to prostaglandin at p = 0.012 (Table 6). The POSC-p score proves a normal level of the prostaglandin, which means that POSC-p score doesn't relate

directly to the increased prostaglandin level. Due to the normal level of prostaglandin in pregnant women, the risk factor of low birthweight, premature birth, and pre-eclampsia is uncommon. This is assumed since prostaglandins in saliva and plasma are positively correlated.[49] In accordance with a literature, because the stimulating agent may alter the composition of saliva, the unstimulated group's saliva exhibited a substantial link with a more accurate systemic clinical status than that of the stimulated group.[50]

According to Table 6, sD14 concentration and the elements of the POSC-p clinical assessment, which include plaque, occlusion, and tooth decay, are significantly correlated. Microbes, a wide cell spectrum and signalling molecules of both innate and adaptive immune responses contribute to the inflammation state,[51] this micro inflammatory environment is equal to other chronical inflammations, which causes erosion, loss of soft tissue due to the occlusion compression, or even worse problems in periodontal tissue.[51] The data also demonstrates that the POSC-p score of salivary state is substantially linked to p-value of 0.012. This is consistent with a study by Aripin, which stated that saliva buffer had significant association with sCD14, in addition to Prester's studies that indicated the same thing. These finding were discovered because the trials used unstimulated saliva.[35]

There was no corelation between the POSC-p scores with periodontal tissue, dentures, and soft tissue. This may occur because of the important role of the sCD14 protein, which, when employed as a biomarker, helps prevent dental caries.[52] The sCD14 level is lower in active caries. It fights and is absorbed by *S. salivarius* bacteria and other bacteria within the oral cavity, this finding show that the level of sCD14 protein in saliva can decrease.[53] There's no sCD14 level found in 20 patients of the same age with 2-8 caries, yet it's detected a few weeks after treatment. This means that non-soluble sCD14 in saliva represents index of caries activity and can be used to detect early stage of caries lesions that aren't detected during oral examination.[54]

Insignificant result of periodontal disease with sCD14 is consistent with a study by Bergandi et al. that revealed insignificant result found in young-aged group. This could happen because patients with moderate and severe periodontal diseases showed high level of sCD14.[54] The patients involved in this study only had four periodontal pockets, a category of a moderate periodontitis level (Table 2).

Additionally, by reacting with bacterial substances like LPS and lactoferrin, sCD14 inhibits the innate immune response from becoming more pronounced and protects the salivary and oral mucosa. LPS is aggregated by sCD14, and the aggregation process is encountering phagocytosis internalization which gives no effect on LPS, therefore sCD14 can also be used as an indicator for healthy function of the oral cavity.[37,38,55]

The POSC-p normative need scores and POSC-p combined scores show significant prostaglandin values. This is in line with Ricciotti's study, which claimed that prostaglandins had an important role in generating inflammatory responses. Prostaglandin biosynthesis is increased, especially in inflamed tissues.[56] The normative need assessment showed that the pregnant women who took part in this study had infected tissues in both the hard and soft parts of their teeth. (Table 2).

Pregnant women experience several physiological changes. These changes might be systemic or localized, as in the mouth cavity. Oral health is an important component of overall wellness. As a result, pregnant women's oral problems must be addressed as soon as possible.[57]and must be addressed immediately consultation services or oral health screening of pregnant women in the Integrated Healthcare Centre.[58]

In addition to the normative need, a significant combined-POSC-p score can occur because almost all pregnant women have infections in hard dental and mucosal tissues as well as periodontal tissues; their salivary

pH is also in acidic and alkaline areas, putting them at risk for caries and calculus formation, which will cause further inflammation. these results are in line with research Suwargiani, et al.[59] who states that low salivary pH has a greater effect on plaque, which is near the area of vulnerable tooth surface, and saliva is the most essential biological element in protecting against dental caries. Oral health issues such as dental caries and mouth infections can occur when saliva flow is decreased.

However, there are a number of limitations to this study. The limitations in this research are that the research is only conducted in one place and does not compare results with other places, due to limited research funds. BPE scores of 3 and 4 in this study were based on clinical examination only, not confirmed by radiological examination or a full periodontal pocket chart. POSC-p model testing could not be carried out because the prostaglandin data only had one category so that the goodness of fit of the model could not be obtained.

Implications of this study is POSC-p score can assess oral health status and can check dental health status and can be a parameter in efforts to reduce infections originating from teeth in pregnant women and to increase motivation to seek treatment. Future research is to make a POSC-p assessment application so that it can be used easily by dentists from various regions and this instrument can be used in conjunction with motivation scale for health measurement instrument for pregnant women in Indonesia that periodically assesses the effects of disease and treatment.[57] Dentists and other healthcare providers must have a comprehensive knowledge of age-related physiological changes in oral tissues, common medical conditions and their dental impacts, and the connection between oral and systemic diseases. [60]

## CONCLUSION

The pregnant oral health scoring model and the sCD14 of clinical examination have correlation consist of tooth decay, occlusion and salivary condition consist of salivary pH level, salivary volume and salivary buffer. However, there was no substantial correlation between the POSC-p score of felt need and the POSC-p score for salivary conditions or the combined POSC-p score and sCD14 levels and POSC-p Scores (combined) significant correlation with sCD14.

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