

## Hemoglobin and Erythrocyte Levels in Correlation to Periodontal Status in First Trimester Pregnancy

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### Abstract

Periodontal alteration in pregnancy is occurs frequently due to hormonal imbalance situation. Several studies have tried to link anemia based on the level of hemoglobin and erythrocyte in both of gingivitis and periodontitis patients during pregnancy.

This study is aimed to analyze the relationship between periodontal conditions in first trimester pregnancy with anemia based on level of hematologic status. One hundred five pregnant women (first trimester pregnancy) were participated in this cross-sectional study. Plaque index (PI), calculus index (CI), oral hygiene index score (OHIs) and periodontal condition were examined. Hemoglobin and erythrocyte levels were collected from peripheral blood vein and measured. Mean  $\pm$  standard deviation value were analyzed. Significance difference ( $p < 0.05$ ) was found within level of hematologic (hemoglobin  $10.56 \pm 0.89$  g/dL) – erythrocyte ( $3.73 \pm 0.71$  million/mcL) in gingivitis group. No significance difference ( $p > 0.05$ ) was found within level of hematologic (hemoglobin  $10.95 \pm 2.26$  g/dL) – erythrocyte ( $4.11 \pm 0.79$  million/mcL) in periodontitis.

There is a strong correlation within hematologic levels in the first trimester pregnancy with gingivitis. However, no correlation was proved amongst hematologic levels in periodontitis at first trimester pregnancy.

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### Introduction

Periodontitis is an inflammatory disease on dental supporting tissue that caused by microorganism. It characterized with a destruction of periodontal ligament and alveolar bone leading to formation of periodontal pocket, gingival recession or both.<sup>1,2</sup> The incident of periodontitis in Indonesia was about 4.9 million people (US Survey Bureau, International Data Base, 2004). Anemia was a reduction condition of hemoglobin level in blood circulation. The incident of anemia in first trimester pregnancy

was about 50-79%. Several studies have tried to prove the link between periodontitis and anemia.<sup>3,4</sup> Some previous cross-sectional and longitudinal clinical studies have reported an increasing incidence of periodontal disease during pregnancy.<sup>5,6</sup>

Agarwal et al. (2009) reported in total thirty periodontitis subjects with hemoglobin level  $< 15$  mg/dl which did periodontal therapy, showed significant improvement of hemoglobin and erythrocyte levels.<sup>7</sup> Hutter et al. (2001) concluded that periodontitis subject has lower level of hemoglobin and erythrocyte. This finding is probably due to the systemic elevation of pro-inflammatory cytokines (Interleukin-1, Interleukin-6, Tumor Necrosis Factor- $\alpha$ ) in periodontitis condition.<sup>8</sup> Anemia in periodontitis occasionally accompanied by elevation production of TNF, IL-1 and Interferon as a response to periodontal microorganism invasion.<sup>9</sup> Anemia could be found also in some chronic diseases such as bacterial infection, fungal, and neoplasm.<sup>8</sup>

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Recently, periodontal condition in pregnancy could be use an indicator for the possibilities of premature birth, low birth weight baby, eclampsia. Pregnancy itself did not cause periodontal disease. The possible mechanism explained the link for these gingival alterations are unclear but various hypotheses have been proposed. Gingivitis and periodontitis in pregnancy is caused by bacterial plaque. Pregnancy will predispose the response of periodontal tissue.<sup>3,9</sup>

This study is aimed to analyze the relationship between periodontal conditions in first trimester pregnancy with anemia based on hemoglobin and erythrocyte levels. This result could reveal plausible link about periodontal alteration and pregnancy condition.

### Materials and methods

One hundred five pregnant women in Obstetrics and Gynecology Division, Cipto Mangunkusumo National Hospital, Universitas Indonesia were recruited. Subjects were divided into three groups (gingivitis, periodontitis and control). Subject with first trimester pregnancy with or without periodontitis was included. Subject with history of diabetes mellitus, smoking and other infection disease was excluded. Plaque index (PI), calculus index (CI), oral hygiene index score (OHIs) and periodontal condition were examined. Hemoglobin and erythrocyte levels were collected from peripheral blood vein and measured. This ethical permission for this study was approved by ethical committee Faculty of Dentistry, Universitas Indonesia.

### Results

Total 105 subjects were divided into gingivitis group (N=35), periodontitis group (N=35) and control/normal group (N=35). As shown in Table.1, subject aged 20 – 36 years old with mean are 27 years old. The mean age of pregnancy is eight and half weeks. Mean level of hematologic status are hemoglobin (11.28 g/dL) and erythrocyte (4.13 million/mcL).

Using Kolmogorov Smirnov test, the hematologic data (hemoglobin – erythrocyte level) has a normal distribution (p value > 0.05) (Table.2).

Subject	Mean (SD)	Min – Max
Age (year)	26.89 (4.02)	20 – 36
Pregnancy Age (week)	8.53 (3.49)	1 – 12
Hemoglobin (g/dL)	11.28 (1.04)	8.00 – 12.90
Erythrocyte (million/mcL)	4.13 (0.69)	3.00 – 5.96

**Table 1.** Mean, Standard Deviation, Minimum-Maximum of Age, Pregnancy Age, Level of Hematologic Status (Hemoglobin, Erythrocyte).

Subject	N	p value
<b>Hemoglobin (g/dL)</b>		0.841*
Gingivitis	35	0.990*
Periodontitis	35	0.662*
Control	35	0.578*
<b>Erythrocyte (million/mcL)</b>		1.166*
Gingivitis	35	1.583*
Periodontitis	35	0.935*
Control	35	1.231*

Kolmogorov Smirnov Test, \*p value > 0.05 (normal distribution)

**Table 2.** Normality Test of Hematologic Status (Hemoglobin – Erythrocyte Level) with Periodontal Status.

Subject	N	Mean (SD)	p value
<b>Hemoglobin (g/dL)</b>			0.000*
Gingivitis	35	10.56 (0.89)	
Control	35	11.99 (0.58)	
<b>Hemoglobin (g/dL)</b>			0.884
Periodontitis	35	10.95 (2.26)	
Control	35	11.99 (0.58)	
<b>Erythrocyte (million/mcL)</b>			0.000*
Gingivitis	35	3.73 (0.71)	
Control	35	4.54 (0.33)	
<b>Erythrocyte (million/mcL)</b>			0.597
Periodontitis	35	4.11 (0.79)	
Control	35	4.54 (0.33)	

Independent T-test, \*p value < 0.05 (significance difference)

**Table 3.** Mean, Standard Deviation, Minimum-Maximum and Significance Difference Test of Periodontal Status with Level of Hematologic Status (Hemoglobin, Erythrocyte).

As shown in Table.3, there was a significance differences between hematologic status (hemoglobin - erythrocyte level) in

gingivitis group with  $p$  value = 0.000. The mean  $\pm$  SD of hemoglobin's level in gingivitis group ( $10.56 \pm 0.89$  g/dL) was significantly lower compared with control group ( $11.99 \pm 0.58$  g/dL). The mean  $\pm$  SD of erythrocyte's level in gingivitis group ( $3.73 \pm 0.71$  million/mcL) was significantly lower compared with control group ( $4.54 \pm 0.33$  million/mcL). In contrast with gingivitis group, there was no significance differences between periodontitis with hemoglobin's level in periodontitis ( $10.95 \pm 2.26$  g/dL) compared to control group ( $11.99 \pm 0.58$  g/dL) ( $p = 0.884$ ) and erythrocyte's level in periodontitis ( $4.11 \pm 0.79$  million/mcl) compared to control group ( $4.54 \pm 0.33$  million/mcl) ( $p = 0.597$ ).

### Discussion

Based on the result shown in table.3, it can be concluded that hematologic level (hemoglobin - erythrocyte) were significantly higher in control group compared with gingivitis and periodontitis groups. It is possibly because in the infection situation, production of pro-inflammatory cytokines like interleukin-1 (IL-1), interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- $\alpha$ ) were increased. The improvement of cytokines levels will directly suppress the hematologic (hemoglobin - erythrocytes) levels sistemically.<sup>8,9</sup> Significance difference level of hemoglobin - erythrocytes was found in gingivitis compared to control with  $p$  value is 0.000, in contrast there is no significance difference in periodontitis compared to control group in both hemoglobin level ( $10.95 \pm 2.26$  g/dL) and erythrocytes level ( $4.11 \pm 0.79$  million/mcl) ( $p > 0.05$ ). These findings might reveal the highest production stage of pro-inflammatory cytokines was in gingivitis. Our result in accordance with Hutter et al. (2001) that stated periodontitis subject has lower level of hemoglobin and erythrocyte.<sup>8</sup>

No significance ( $p = 0.884$ ) result was found at hemoglobin level in periodontitis ( $10.95 \pm 2.26$  g/dL) compared to control group ( $11.99 \pm 0.58$  g/dL). In addition, no significance difference ( $p = 0.597$ ) found at erythrocytes level in periodontitis ( $4.11 \pm 0.79$  million/mcl) compared to control group ( $4.54 \pm 0.33$  million/mcl). These findings might occur because of chronic progress in periodontitis which the production of pro-inflammatory cytokines was almost close to the normal condition.<sup>5,6</sup> Taylor et al. (2011) stated

that periodontal therapy could effectively improve the level of hemoglobin systemically.<sup>10</sup>

Previous studies by Thompson et al. in Figueiro (2010) reported an abnormal blood and blood chemistry test results in 39 consecutive dental patients.<sup>6</sup> Their results of this small sample-sized study are that many patients were uninformed of their medical statuses when they arrived for dental treatment. Besides performing this research, we also encourage our subject to aware and have a broad knowledge about their periodontal status and their pregnancy condition.

### Conclusions

There is a strong correlation within hematologic levels (hemoglobin - erythrocytes) in the first trimester pregnancy with gingivitis. However, no correlation was proved amongst hematologic levels (hemoglobin - erythrocytes) in periodontitis at first trimester pregnancy.

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### Declaration of Interest

The authors report no conflict of interest.

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