

Correlation between Oral-Health-Related Quality of Life and Salivary Cortisol Level in Children Ages 8–10 Years

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Abstract

Caries is a hard-tissue disease commonly found on untreated teeth and may lead to pulp inflammation; thus, children with caries would feel discomfort that could influence their quality of life. Salivary cortisol level is known as an oral cavity inflammatory biomarker to analyze the quality of life through salivary cortisol in 8- to 10-year-old children with caries. Respondent criteria are children ages 8-10 years who live in the same house and who do not have systemic diseases. Data were collected by filling out a modified version of the Child Perceptions Questionnaire 8-10, and respondents' saliva samples were collected 2 hours after the respondents awoke. A Salimetrics cortisol kit was used to analyze the cortisol level. Data were analyzed statistically by a Pearson test.

The result shows weak correlations with positive value. Children with a high caries incidence have a low oral-health-related quality of life (OHRQoL) status and a low salivary cortisol level. OHRQoL in a caries incidence has a weak correlation with salivary cortisol level in children ages 8-10 years. OHRQoL in a caries incidence in this study is one of a few factors that influence correlation in salivary cortisol level, and vice versa.

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Introduction

Children have a high risk of chronic infection in their teeth.¹ Among the possible infections, caries is one of the tooth-related chronic infection sources with pulpitis as a manifestation. Pulpitis can cause discomfort in children, thereby limiting their ability for daily activities and leading to functional disturbances, eating difficulties, and general-health deterioration. Therefore, oral health affects children's health condition and influences their quality of life status.²

In health a science, quality of life is used to measure comfort or health status from its influencing fields.³ Untreated dental caries often causes physical, social, and psychological complaints. Thus, caries incidence affects one's

daily activities and quality of life.⁴ The qualities of life related to children's oral health includes four measures such as physical functioning, role functioning, social functioning and emotional functioning.⁵

Other than influencing quality of life, pulp inflammation due to caries in children also triggers cortisol secretion through the HPA axis system as a bodily homeostasis response. Cortisol acts by reducing the immune cells' response during inflammation so that further damage on host cells is also reduced. However, high levels of cortisol for a long period would also decrease the immune cells' response during bacterial invasion.⁶ Salivary cortisol is commonly used as an inflammatory biomarker because it could show a similar level with cortisol in the blood plasma. Moreover, the sample-gathering method is less invasive than taking blood samples.⁶

A number of previous researches have shown chronic inflammation on children's teeth could limit children's daily activities and cause physical disturbances, thereby decreasing the children's quality of life. Quality of life is measured by a questionnaire for children and accompanied by reports from their parents.⁵ The

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researches on salivary cortisol level could also measure children's anxiety or stress level caused by chronic tooth infection.⁷ On the other hand, no researches have looked for the correlation between oral-health-related quality of life (OHRQoL) and salivary cortisol level in children.

Materials and methods

This was an observational analytic research with a cross-sectional method. Inclusion criteria of the subjects were children ages 8-10 years who had no history of systemic diseases. Research respondents were children who lived in the same house. The minimum number of samples needed in this experiment was 34. The respondents then filled out a validated modified Child Perceptions Questionnaire 8-10, which consisted of 11 valid questions. Each question was accompanied by Likert scale for the answer, with the criteria as follows: 1 for "5 times or more," 2 for "3-4 times," 3 for "1-2 times," and 4 for "has no effect." Questionnaire consistency was tested with Cronbach's alpha. On another day, salivary samples from respondents were taken 2 hours after they awoke and were analyzed with ELISA using a Salimetrics salivary cortisol kit. Data from the questionnaire and of salivary cortisol level were then statistically analyzed using a Pearson correlation test if the data were normally distributed.

Results

This research was performed to analyze the correlation between OHRQoL and salivary cortisol level in children ages 8-10 years. The design was observational analytic with a minimum of 34 children respondents in accordance with inclusion criteria.

OHRQoL was measured by a modified Child Perceptions Questionnaire 8-10. Before questionnaire analysis, a qualitative test for validity and reliability was performed using a correlation test and Cronbach's alpha test. A Cronbach's alpha coefficient score greater than 0.8 shows good internal consistency, and a score within the 0.4-0.6 range shows sufficient consistency. From this research, a score of 0.831 was achieved from Cronbach's alpha test. Question validity has a prerequisite based on r value compared with calculated r-value; thus, 11 of 25 questions were deemed valid. The

OHRQoL score in this research is the sum of the scores from all answers.

The respondents of this research were 35 children from two orphanage foundations—19 children from Panti Asuhan Muslimin/Muslimin Orphanage (54.3%) and 16 children from Panti Asuhan Putera Setia/Putera Setia Orphanage (45.7%). The age distribution of respondents was as follows: 11 children were 8 years old (31.4%), 8 children were 9 years old (22.9%), and 16 children were 10 years old (45.7%).

Upon completion of the correlation test, OHRQoL and salivary cortisol level had a weak positive correlation. A correlation test using a Pearson test can be performed only when the data are numeric and have normal distribution ($p > 0.05$). Because the data in this research are numeric and have normal distribution, a Pearson test can be used.

Table 1 shows nonsignificant correlation between OHRQoL and salivary cortisol level, with p-value 0.451 ($p > 0.05$). A correlation coefficient strength (r) value at 0.2-0.4 shows weak correlation. The r-value of this research was 0.316, meaning weak correlation strength.

Oral Health-Related Quality of Life		
	r	0,316
Saliva Cortisol	p	0,451
	n	35

Table 1. Nonsignificant correlation between OHRQoL and salivary cortisol level. p-value 0.451 ($p > 0.05$).

Discussion

This research was performed to analyze caries-related quality of life with salivary cortisol level on children ages 8-10 years. OHRQoL measurement through caries incidence using decay, missing, filling teeth (DMFT) index, while oral health-related quality of life score was a result of individual perception of children's oral cavity problems, especially caries, set out in a validated and modified Child Perceptions Questionnaire 8-10. Validation results showed a bigger calculated r value than the r-value table, indicated 11 of 25 questions were deemed valid in the questionnaire. The questions' reliability was tested using Cronbach's alpha. A Cronbach's alpha coefficient value of 0.4-0.6 was considered as having sufficient consistency. The coefficient score of 0.831 in the questionnaire meant good internal consistency.⁸

The number of respondents in the research fulfilled the minimum sample size calculated from the sample-size formula for correlation analysis. Data assembly was performed using consecutive sampling, where every qualified research respondent was included until the necessary number of samples was gathered. The reason for choosing children ages 8-10 years as the respondents of this research was based on the knowledge that one of several factors contributing to OHRQoL measurement is children's cognitive development. One of the commonly used instruments to measure OHRQoL is the Child Perceptions Questionnaire rating a specific age group. The children's age groups categorized by the instrument are 6-7 years old, 8-10 years old, and 11-14 years old. These categories were created based on homogenous cognitive level among children in the same age range.⁹ Age factor was also considered in this research to limit external factors that may influence cortisol level variation, such as puberty. Puberty hormones affect cortisol secretion in the human body; therefore, the difference in salivary cortisol level between prepuberty children and peripuberty children is clear. This consideration became a base in choosing the age group in this research.¹⁰

Other than age, the selected research respondents were children living in the same house. This consideration was based on the knowledge that external stimuli such as parenting style and socioeconomic factors influence quality of life and cortisol level.¹¹ Therefore, in this research, quality of life and cortisol level were not affected by unanalyzed external stimuli.

This research showed correlation of oral health condition in salivary cortisol level and OHRQoL. The finding was in accordance with previous research by Casamasimo (2007), which showed an influence of oral health on children's quality of life, and by Pani (2013), which summarized a correlation between oral health conditions and salivary cortisol level. Oral health issues are usually found in children.^{12,13} The most common oral cavity complaint is found to be pain and dental caries. This could lead to disturbances of daily functions, activities, and emotional condition.

Caries is one of the sources of chronic infection originating from the tooth. Among inflammatory conditions caused by caries, pulpitis is the most common. Pulpitis is caused

by cariogenic bacteria antigens infecting the pulp through dentinal tubuli. In shallow carious lesions, bacteria antigens stimulate cytokine, thus provoking the T cells to respond and cause pulpitis. The inflammation process is a physiological response marked with *rubor*, *dolor*, *calor*, *tumor*, and *functio laesa*. Therefore, as one of the causes of chronic inflammation in the oral cavity, caries can cause pain, function disturbances, and activity disturbances. The effect of these complaints might affect one's quality of life. Physiologically, during inflammation, the human body undergoes homeostasis, including cortisol hormone secretion. Consequently, when a chronic infection triggers an inflammation response, the salivary cortisol level would rise. The function of cortisol secretion in an inflammation response is to act as an anti-inflammatory agent to avoid further damage to the host cells due to antigen invasion.⁶

Knowing the role of the cortisol hormone as an anti-inflammatory agent makes it a point of interest in researches on inflammatory response.¹³ During infection, the inflammatory response triggers cortisol hormone secretion in the blood and in the saliva.¹⁴ Saliva was chosen as the sample for cortisol level measurement because the sample taking is less invasive than taking blood samples.¹⁴ Therefore, this research used salivary cortisol level as an indicator of oral-health condition. Salivary cortisol level scoring was performed by analyzing salivary samples using ELISA in µg/dl units.

In this research, salivary cortisol level tended to be lower in children with more caries or tooth decay than in children with fewer caries. It contradicts the study by previous researches which found that groups of children with caries have a higher cortisol level than do children without caries.¹³ This research did not use caries-free children as a control group. However, the findings of this research are in accordance with the theory by Gustafsson (2010), which declares that recurrent exposure of stimuli would cause hypercortisolism in the beginning and decrease over time into hypocortisolism.¹⁵ Hypocortisolism occurs as a result of accumulation of and large duration to stimuli exposure. In this case, the stimuli came from oral-health conditions. Thus, a more chronic infection means that the host could already be in the hypocortisolism phase. Children with fewer chronic infections have a higher

tendency of hypercortisolism; if no action is taken, this could lead to hypocortisolism.¹⁵

The results of statistic tests show that a higher OHRQoL score corresponds to a higher salivary cortisol level; likewise, a lower OHRQoL score corresponds to a lower salivary cortisol level. Low salivary cortisol level score shows higher DMFT Index, with big impact on respondent's ability to function and perform activities, in accordance with Gustafsson (2010).¹⁵ Thus, it can be concluded that respondents with a higher chronic infection condition have a low OHRQoL score and a low salivary cortisol level.

The correlation between OHRQoL and salivary cortisol level in children ages 8-10 years was weak in terms of strength. This is in compliance with research by Strini and Barbosa (2011), which focused on the correlation between OHRQoL and salivary cortisol level in young adults.^{16,17} The results of that research showed a weak correlation. Therefore, it can be assumed that OHRQoL gathered in this research is only one of many factors contributing to cortisol level status, and vice versa. Other factors related to cortisol level and OHRQoL are left unanalyzed in this research, such as duration and the magnitude of stimuli exposure.

Conclusions

OHRQoL status with inflammation originated from caries, as observed from the DMFT index, has a weak correlation with salivary cortisol level in children ages 8-10 years. In this research, OHRQoL is only one of many factors contributing to cortisol level, and vice versa. The process of change in OHRQoL status and salivary cortisol level is a result of a continuous and recurring process. Therefore, a follow-up longitudinal study is suggested to measure the correlation between OHRQoL status and salivary cortisol level.

Declaration of Interest

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