Section: Dentistry

Original Research Article

CORRELATION BETWEEN GINGIVAL CREVICULAR FLUID C-REACTIVE PROTEIN AND DENTAL CARIES ACTIVITY IN CHILDREN: AN OBSERVATIONAL STUDY

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Received : 27/02/2024
Received in revised form : 25/05/2024
Accepted : 09/06/2024

Keywords:
Dental caries, Gingival Crevicular Fluid, C-Reactive Protein, Inflammation, Pediatric dentistry, Biomarker, Oral health.

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DOI: 10.47009/jamp.2024.6.3.213

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (3); 1039-1042

Abstract

Background: Dental caries is a prevalent oral health issue among children, and inflammation may play a role in its development. This study aims to investigate the correlation between Gingival Crevicular Fluid (GCF) C-Reactive Protein (CRP) levels and dental caries activity in children. **Material and Methods:** A cross-sectional observational study was conducted involving 100 children aged 6-14 years. Participants were categorized based on age, gender, and socioeconomic status (SES). GCF samples were collected and analyzed for CRP levels, which were classified into three groups: low (< 0.3 mg/L), moderate (0.3 - 1.0 mg/L), and high (> 1.0 mg/L). Dental caries activity was assessed using a scoring system, and the correlation between CRP levels and caries activity was evaluated using Pearson's correlation coefficient. **Results:** The study population comprised 50 males and 50 females, with 30% aged 6-8 years, 40% aged 9-11 years, and 30% aged 12-14 years. SES distribution was 40% low, 40% middle, and 20% high. A significant positive correlation was found between GCF CRP levels and dental caries activity ($r = 0.68$, $p < 0.001$). Higher CRP levels were associated with increased caries activity, suggesting a potential link between inflammation and dental caries. **Conclusion:** The findings indicate that elevated GCF CRP levels are correlated with higher dental caries activity in children, highlighting the role of inflammation in caries development. GCF CRP may serve as a useful biomarker for assessing caries risk in pediatric populations.

INTRODUCTION

Dental caries, a multifactorial disease characterized by the demineralization of dental hard tissues, is one of the most common chronic conditions affecting children worldwide.[1] The etiology of dental caries involves a complex interplay between host factors, dietary habits, and microbial flora.[2] Recent research has increasingly focused on the role of inflammation in the pathogenesis of caries, particularly the involvement of systemic and local inflammatory markers.[3]

Gingival Crevicular Fluid (GCF) is an exudate derived from the gingival sulcus and serves as a valuable source of biomarkers reflecting the inflammatory status of periodontal tissues. Among these biomarkers, C-Reactive Protein (CRP) is an acute-phase protein that is widely used as an indicator of systemic inflammation.[4] Elevated levels of CRP have been associated with various inflammatory conditions, including periodontitis and cardiovascular diseases.[5] However, the relationship between CRP levels in GCF and dental caries activity remains underexplored, particularly in pediatric populations.

The purpose of this study is to investigate the correlation between GCF CRP levels and dental caries activity in children. By examining this relationship, we aim to elucidate the potential role of inflammation in caries development and explore the utility of GCF CRP as a biomarker for assessing caries risk. This study will contribute to a better understanding of the inflammatory mechanisms underlying dental caries and potentially inform preventive and therapeutic strategies for managing this common oral health problem in children.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

MATERIALS AND METHODS

Study Design and Period

This cross-sectional observational study was conducted over a period of one year, from March 2023 to February 2024.

Place of Study

The study was carried out at Sri Sai Dental College in Vikarabad, Telangana.

Study Population

The study included 100 children aged 6 to 14 years who visited the dental outpatient department at Sri Sai Dental College. Participants were selected using a convenience sampling method based on their availability and willingness to participate. Informed consent was obtained from the parents or guardians of all participants.

Inclusion Criteria

1. Children aged 6-14 years.
2. Presence of at least one deciduous or permanent tooth.
3. No history of systemic diseases or conditions affecting immune function.

Exclusion Criteria

1. Children undergoing orthodontic treatment.
2. Use of anti-inflammatory medications in the past month.
3. Presence of acute dental infections or abscesses[6].

Data Collection

Demographic information, including age, gender, and socioeconomic status, was collected through a structured questionnaire. GCF samples were obtained from each participant using a standardized protocol. GCF was collected from the gingival sulcus of a selected tooth with a microcapillary tube, ensuring minimal contamination with saliva.

Laboratory Analysis

The collected GCF samples were stored at -80°C until analysis. CRP levels in the GCF were measured using a high-sensitivity enzyme-linked immunosorbent assay (ELISA) kit. The CRP levels were classified into three groups: low (< 0.3 mg/L), moderate (0.3 - 1.0 mg/L), and high (> 1.0 mg/L).

Assessment of Dental Caries Activity

Dental caries activity was evaluated by a trained dentist using the Decayed, Missing, and Filled Teeth (DMFT) index for permanent teeth and the dmft index for primary teeth. Caries activity was categorized into three levels based on the scores: low (0-2), moderate (3-5), and high (6-8).

Statistical Analysis

Data were analyzed using SPSS software (version 25.0). Descriptive statistics were used to summarize demographic data, CRP levels, and caries activity scores. Pearson's correlation coefficient was calculated to assess the relationship between GCF CRP levels and dental caries activity. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of Sri Sai Dental College. All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

RESULTS

Demographic Characteristics

The study involved 100 children, equally divided between males and females (50% each). The age distribution was as follows: 30% were aged 6-8 years, 40% were aged 9-11 years, and 30% were aged 12-14 years. Socioeconomic status (SES) categories included 40% of participants from low SES, 40% from middle SES, and 20% from high SES (Table 1).

GCF CRP Levels and Dental Caries Activity

Participants were grouped based on their GCF CRP levels into low CRP (< 0.3 mg/L), moderate CRP (0.3 - 1.0 mg/L), and high CRP (> 1.0 mg/L). Corresponding to these groups, dental caries activity scores were categorized as low (0-2), moderate (3-5), and high (6-8). The study found that 35 participants fell into the low CRP group with low caries activity scores, 45 participants in the moderate CRP group with moderate caries activity scores, and 20 participants in the high CRP group with high caries activity scores (Table 2).

Correlation between GCF CRP Levels and Dental Caries Activity

A statistically significant positive correlation was observed between GCF CRP levels and dental caries activity, with a correlation coefficient (r) of 0.68 and a p-value of less than 0.001 (Table 3). This suggests that higher levels of CRP in GCF are associated with increased dental caries activity in children. The findings indicate that GCF CRP levels may serve as a potential biomarker for assessing the risk of dental caries in pediatric populations.

Table 1: Demographic Details of Participants

Demographic Variable	Category	N (%)
Age Group (years)	6-8	30 (30%)
	9-11	40 (40%)
	12-14	30 (30%)
Gender	Male	50 (50%)
	Female	50 (50%)
Socioeconomic Status	Low	40 (40%)

ISSN (O): 2687-5365; ISSN (P): 2753-6556

	Middle	40 (40%)
	High	20 (20%)

Table 2: GCF CRP Levels and Dental Caries Activity Scores

Group	GCF CRP Level (mg/L)	Caries Activity Score	N
Low CRP	< 0.3	0-2 (Low)	35
Moderate CRP	0.3 - 1.0	3-5 (Moderate)	45
High CRP	> 1.0	6-8 (High)	20

Table 3: Correlation between GCF CRP Levels and Dental Caries Activity

Variable	Correlation Coefficient (r)	P-value
GCF CRP Level	0.68	< 0.001

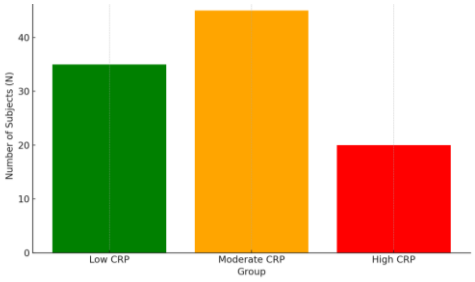

Figure No: 1 GCF CRP Levels and Dental Caries Activity Scores

DISCUSSION

This study aimed to explore the correlation between Gingival Crevicular Fluid (GCF) C-Reactive Protein (CRP) levels and dental caries activity in children. The findings revealed a significant positive correlation between elevated CRP levels and increased dental caries activity, suggesting that inflammation may play a pivotal role in the development and progression of dental caries.[8,9,]

Inflammation and Dental Caries

CRP is a well-established marker of inflammation, often associated with various systemic and local inflammatory conditions.[10,11] In the context of oral health, elevated GCF CRP levels may indicate an inflammatory response to bacterial biofilms associated with dental caries. The significant positive correlation observed in this study aligns with the hypothesis that inflammatory processes, potentially exacerbated by bacterial pathogens, contribute to the caries process. This is consistent with previous research highlighting the role of immune responses and inflammatory mediators in the etiology of dental caries.[12,13]

Implications for Caries Risk Assessment

The potential of GCF CRP as a biomarker for caries risk assessment is a notable finding. The ease of collection and non-invasive nature of GCF make it a practical medium for monitoring oral health status. CRP levels in GCF could provide valuable information about the inflammatory status of the oral environment, offering a supplementary tool for identifying children at higher risk for caries.[14] This is particularly relevant for early detection and prevention strategies, as timely interventions could mitigate the progression of caries and associated complications.

Study Limitations and Future Directions

While the study provides significant insights, there are limitations to consider. The cross-sectional design limits the ability to establish a causal relationship between CRP levels and caries activity. Longitudinal studies would be beneficial to explore the temporal relationship between inflammation and caries development. Additionally, the study's sample size and the use of convenience sampling may limit the generalizability of the findings. Future research should aim for larger, more diverse populations to validate these findings.

Another consideration is the potential influence of other factors on CRP levels, such as recent infections, systemic health conditions, or medication use. Controlling for these variables in future studies would strengthen the evidence for CRP as a specific marker for caries-related inflammation.

CONCLUSION

This study highlights the association between GCF CRP levels and dental caries activity in children, highlighting the role of inflammation in the pathogenesis of caries. These findings suggest that GCF CRP could serve as a valuable biomarker for caries risk assessment, facilitating early intervention and improved management of oral health in pediatric populations. Further research is needed to explore the mechanisms underlying this relationship and to establish GCF CRP as a standard tool in clinical practice for monitoring caries risk.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556