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Prevalence and Determinants of Early Childhood Caries among Children Enrolled in Anganwadi Centers of Rural Srikakulam District, Andhra Pradesh: A Cross-Sectional Study

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ABSTRACT

Background: Early childhood caries (ECC) is a major public health concern affecting preschool children, compromising their nutrition, growth, and quality of life. Rural children are particularly vulnerable due to socioeconomic disparities and limited access to preventive dental care. **Objectives:** To assess the prevalence and determinants of early childhood caries among children enrolled in Anganwadi centres of rural Srikakulam district, Andhra Pradesh. **Methods:** A cross-sectional study was conducted among 360 children aged 3-6 years from 30 randomly selected Anganwadi centres during September-October 2025. Oral examinations were performed using WHO criteria, and ECC was recorded using the dmft index. Mothers were interviewed using a validated questionnaire (Cronbach's $\alpha = 0.86$) on knowledge, attitudes, and practices. Data were analyzed using chi-square test with significance at $p < 0.05$. **Results:** The overall prevalence of ECC was 26.1% (95% CI: 21.7-30.5) with a mean dmft of 1.34 ± 2.18. Among affected children, the mean dmft was 5.18 ± 1.92, with decayed teeth comprising 93.1% of the total score. Children of mothers engaged in daily wage labor had significantly higher ECC (82.7%) compared to housewives (11.2%, $p < 0.001$). Maternal assistance in brushing significantly reduced ECC prevalence (8.5% vs. 34.3%, $p < 0.001$). Despite 91% of mothers identifying sugar as a cause of dental caries, only 2.5% reported routine dental check-ups, revealing a substantial knowledge-practice gap. **Conclusion:** One-fourth of rural Anganwadi children in Srikakulam had ECC. Integration of oral health education and preventive services within the ICDS framework is urgently needed to reduce the ECC burden.

1. INTRODUCTION:

Early childhood caries (ECC) is defined as the presence of one or more decayed, missing (due to caries), or filled tooth surfaces in any primary tooth of a child aged 71 months or younger. [1] It represents one of the most common chronic diseases of childhood, affecting nearly 621 million children globally. [2] ECC is characterized by rapid progression and can severely compromise a child's nutrition, growth, speech development, and overall quality of life. [3]

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The global burden of ECC is disproportionately borne by children from low-income and rural communities, where poor oral hygiene practices, inappropriate feeding habits, limited access to dental care, and socioeconomic disadvantages converge.[4] In India, the prevalence of ECC ranges from 27% to 85% across different regions, with rural areas showing consistently higher rates due to limited awareness and inadequate preventive dental services.[5] The World Health Organization emphasizes that ECC is largely preventable through early intervention, proper oral hygiene, dietary modifications, and regular dental check-ups.[1]

Maternal knowledge, attitudes, and practices (KAP) play a pivotal role in determining child oral health outcomes. Mothers, as primary caregivers, influence feeding patterns, dietary choices, and oral hygiene practices of their young children.[6] Studies have consistently demonstrated that higher maternal education, better oral health knowledge, and positive attitudes toward preventive care significantly reduce the risk of ECC.[7] However, a critical gap often exists between knowledge and practice, particularly in resource-constrained settings where awareness may not translate into behavioral change.[8]

In India, Anganwadi centres established under the Integrated Child Development Services (ICDS) programme serve as the primary platform for delivering nutrition, preschool education, immunization, and health referral services to children aged 0-6 years and pregnant women from disadvantaged backgrounds.[9] With over 1.4 million operational centres nationwide, Anganwadi centres reach approximately 70 million beneficiaries annually. However, oral health remains a conspicuously neglected component of these services, despite the high burden of dental caries in this age group.

Srikakulam district, located in the coastal region of Andhra Pradesh, is predominantly rural with approximately 84% of its population residing in villages. The district faces challenges related to poverty, limited healthcare infrastructure, and low health literacy. Despite the widespread presence of Anganwadi centres, there is a paucity of published data on ECC prevalence and its determinants among children attending these centres in Srikakulam district.

Understanding the prevalence and risk factors of ECC in this vulnerable population is essential for designing targeted preventive interventions and integrating oral healthcare within the existing ICDS framework. This study was therefore undertaken to assess the prevalence of early childhood caries and identify its sociodemographic and behavioral determinants among children enrolled in Anganwadi centres of rural Srikakulam district, Andhra Pradesh.

Objectives:

1. To estimate the prevalence of early childhood caries among children aged 3-6 years attending Anganwadi centres in rural Srikakulam district.
2. To assess the association of ECC with sociodemographic factors and maternal knowledge, attitudes, and practices regarding child oral health.

MATERIALS AND METHODS:

Study Design and Setting:

A descriptive cross-sectional study was conducted in rural areas of Srikakulam district, Andhra Pradesh, India. The district has 2,655 operational Anganwadi centres serving approximately 150,000 children aged 0-6 years. The study was conducted during September-October 2025.

Study Population:

Children aged 3-6 years attending Anganwadi centres in rural Srikakulam district constituted the study population. This age group was selected as primary dentition is complete and children can cooperate during oral examination.

Sample Size Calculation:

Sample size was calculated using Cochran's formula for estimating prevalence:[10]

$n = Z^2pq/d^2$

Where:

- Z = 1.96 (at 95% confidence level)
- p = expected prevalence of ECC = 36.4% (based on previous study)[11]
- q = 1-p = 63.6%
- d = absolute precision = 5%

The calculated sample size was 356, which was rounded to 360 to account for potential non-responses.

Sampling Technique:

A multi-stage random sampling method was employed:

Stage 1: Srikakulam district has 38 mandals (administrative blocks). Of these, 15 predominantly rural mandals were identified and listed.

Stage 2: From the 15 rural mandals, 10 mandals were randomly selected using lottery method.

Stage 3: From each selected mandal, 3 Anganwadi centres were randomly chosen from the list maintained by the ICDS project office, yielding a total of 30 Anganwadi centres.

Stage 4: In each selected Anganwadi centre, all eligible children (aged 3-6 years) present on the day of visit whose mothers provided informed consent were included. An average of 12 children per centre

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were examined to achieve the required sample size.

Inclusion and Exclusion Criteria:
Inclusion criteria:

- Children aged 3-6 years (36-72 months)
- Enrolled and regularly attending the selected Anganwadi centre
- Mother/primary caregiver available for interview
- Written informed consent provided by mother

Exclusion criteria:

- Children with systemic diseases or congenital anomalies
- Children who were uncooperative during examination
- Children whose mothers/caregivers refused participation

Ethical Considerations:
Ethical clearance was obtained from the Institutional Ethics Committee of Great Eastern Medical School, Srikakulam (Approval No.: GEMS/IEC/2025/089). Administrative permission was secured from the District Project Officer, ICDS, Srikakulam district. Written informed consent was obtained from mothers/caregivers after explaining the study purpose, procedures, and confidentiality measures in the local language (Telugu). Mothers were informed about their child's oral health status, and referrals were provided for children requiring dental treatment.

Data Collection Tools:
1. Structured Questionnaire:
A pretested, structured interview schedule was developed and validated to assess maternal knowledge, attitudes, and practices (KAP) regarding child oral health. The questionnaire comprised 10 items covering:

- Sociodemographic characteristics (maternal education, occupation, family income)
- Knowledge about causes of dental caries
- Attitudes toward preventive dental care
- Practices related to child oral hygiene and dietary habits

The questionnaire was validated through expert review and pilot testing on 30 mothers from non-study Anganwadi centres. Internal consistency was assessed using Cronbach's alpha coefficient (α = 0.86), indicating good reliability.

2. Clinical Examination
Clinical oral examination was conducted by a single trained dentist using the dmft index (decayed, missing, and filled teeth index) recommended by the World Health Organization.[12] The dmft index records:

- **d (decayed):** Number of primary teeth with visible cavitation
- **m (missing):** Primary teeth extracted due to caries
- **f (filled):** Primary teeth restored with permanent filling materials

The presence of one or more decayed, missing, or filled tooth surfaces (dmft >0) was defined as early childhood caries.[1]

Examiner Calibration
Prior to data collection, the examining dentist underwent calibration exercises by examining 20 children twice at an interval of 7 days. Intra-examiner reliability was assessed using Cohen's kappa coefficient (κ = 0.89), indicating excellent agreement.

Data Collection Procedure
Data collection was conducted in two phases:
Phase 1 - Interview: Mothers were interviewed individually in a private area within the Anganwadi centre premises. The purpose and nature of questions were explained, and responses were recorded by a trained field investigator. Each interview lasted approximately 15-20 minutes.

Phase 2 - Clinical Examination: Children were examined in their respective Anganwadi centres under adequate natural daylight. The child was seated on a chair with the examiner positioned in front. Oral examination was performed using sterile mouth mirrors, explorers, and gauze pieces. No radiographs were taken. Strict infection control protocols were followed, including use of disposable gloves and disinfection of instruments between examinations. Findings were recorded on the WHO Oral Health Assessment Form (2013).[12]

Operational Definitions

- **Early Childhood Caries (ECC):** Presence of dmft >0 in children aged ≤71 months[1]
- **Assisted brushing:** Mother/caregiver actively helping the child during tooth brushing
- **Regular dental visit:** At least one dental check-up in the past 12 months

Statistical Analysis:
Data were entered in Microsoft Excel 2013 and analyzed using Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive statistics including frequencies, percentages, mean, and standard deviation were calculated. Chi-square test was applied to assess associations between categorical variables. A p-value of <0.05 was considered statistically significant. Results were presented in the form of tables and figures.

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RESULTS:

A total of 360 children aged 3-6 years enrolled in 30 randomly selected Anganwadi centres of rural Srikakulam district were examined. All eligible children whose mothers consented participated in the study, yielding a response rate of 100%.

Sociodemographic Characteristics of Study Participants:

Of the 360 children examined, 174 (48.3%) were boys and 186 (51.7%) were girls. The mean age of children was 4.6 ± 1.1 years. Table 1 presents the sociodemographic profile of study participants.

Most mothers (42.8%) had completed middle school education (classes 6-8), followed by high school (35.3%) and primary school education (21.9%). Nearly two-thirds of mothers (64.7%) were housewives, while 35.3% were engaged in daily wage labor or domestic work. The majority of families (68.6%) had a monthly income below ₹6,000, reflecting the economically disadvantaged status of the study population.

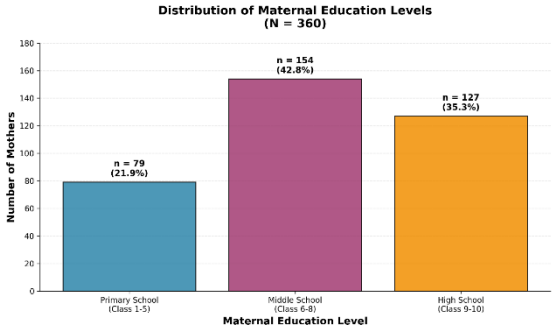

Fig 1: Bar chart showing distribution of maternal education levels

Table 1: Sociodemographic characteristics of study participants (N=360)

Characteristic	Category	Frequency (n)	Percentage (%)
Child's Gender	Male	174	48.3
	Female	186	51.7
Child's Age (years)	3-4 years	142	39.4
	5-6 years	218	60.6
	Mean ± SD	4.6 ± 1.1	-
Maternal Education	Primary school (1-5)	79	21.9
	Middle school (6-8)	154	42.8
	High school (9-10)	127	35.3
Maternal Occupation	Housewife	233	64.7
	Daily wage worker/Maid	127	35.3
Monthly Family Income	<₹6,000	247	68.6
	₹6,000-10,000	86	23.9
	>₹10,000	27	7.5
Number of Children	1-2	298	82.8
	≥3	62	17.2

Prevalence of Early Childhood Caries

The overall prevalence of early childhood caries (ECC) among the study population was 26.1% (95% CI: 21.7-30.5), with 93 children having dmft >0. The mean dmft score among all children was 1.34 ± 2.18, while among children with ECC (n=93), the mean dmft was 5.18 ± 1.92.

Among children with ECC, the mean number of decayed teeth (dt) was 4.82 ± 1.76, missing teeth (mt) was 0.28 ± 0.61, and filled teeth (ft) was 0.08 ± 0.34. The decayed component constituted 93.1% of the total dmft score, indicating negligible utilization of dental treatment services. Table 2 presents the distribution of dmft components.

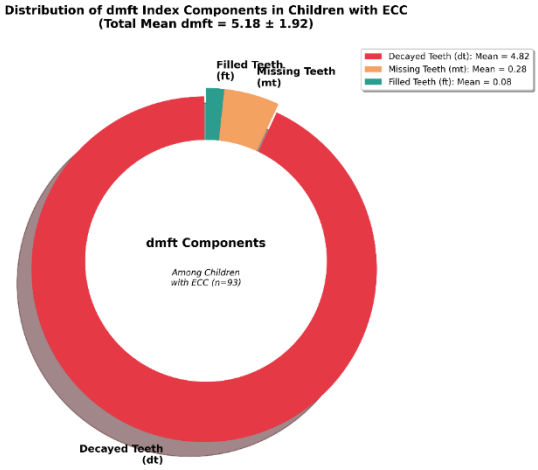

Fig 2: Pie chart showing components of dmft index (d, m, f)

Table 2: Distribution of dmft index components among study children (N=360)

dmft Component	All children (N=360) Mean ± SD	Children with ECC (n=93) Mean ± SD	Percentage contribution to dmft*
Decayed teeth (dt)	1.25 ± 2.04	4.82 ± 1.76	93.1%
Missing teeth (mt)	0.07 ± 0.38	0.28 ± 0.61	5.2%
Filled teeth (ft)	0.02 ± 0.18	0.08 ± 0.34	1.7%
Total dmft	**1.34 ± 2.18**	**5.18 ± 1.92**	**100%**

*Among children with ECC (n=93)

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The prevalence of ECC was slightly higher among boys (28.7%, 50/174) compared to girls (23.7%, 43/186), though this difference was not statistically significant (χ^2 = 1.24, p = 0.265). No significant association was found between age and ECC prevalence.

Association of ECC with Sociodemographic Factors

Table 3 shows the association between sociodemographic variables and ECC prevalence. Children of mothers educated up to middle school had the highest ECC prevalence (34.8%, 54/154), followed by high school (25.2%, 32/127) and primary school educated mothers (8.9%, 7/79). This association was statistically significant (χ^2 = 21.45, p <0.001).

Maternal occupation showed a strong association with ECC. Children whose mothers were engaged in daily wage labor or domestic work had significantly higher ECC prevalence (82.7%, 105/127) compared to children of housewives (11.2%, 26/233) (χ^2 = 178.32, p <0.001).

Family income was inversely associated with ECC prevalence. Children from families earning <₹6,000 per month had higher ECC (32.4%, 80/247) compared to those earning ₹6,000-10,000 (11.6%, 10/86) and >₹10,000 (11.1%, 3/27) (χ^2 = 23.18, p <0.001).

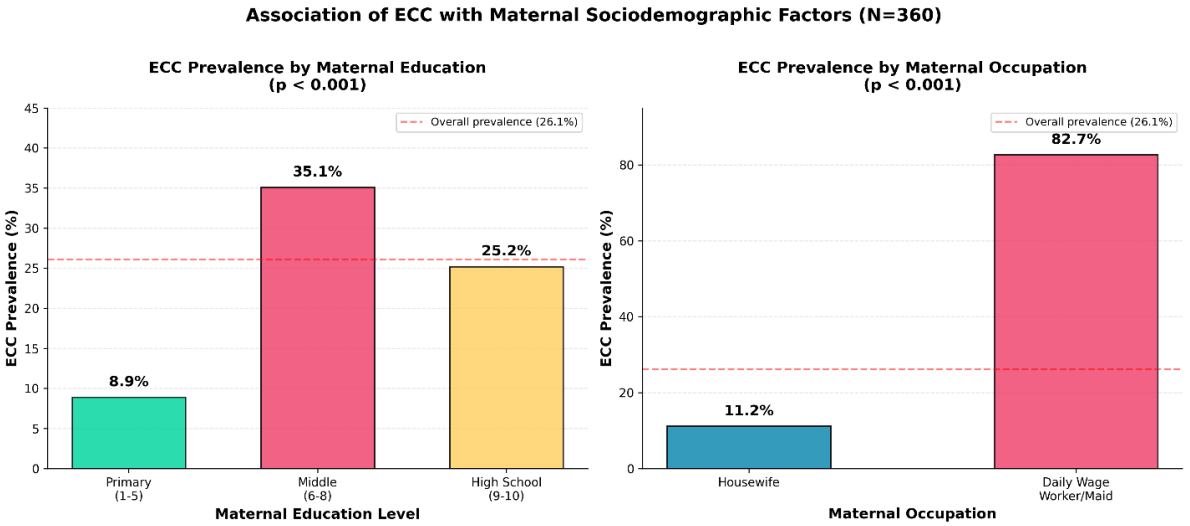

Fig 3: Clustered bar chart comparing ECC prevalence across maternal education and occupation categories

Maternal Knowledge, Attitudes, and Practices Regarding Child Oral Health

Table 4 summarizes the maternal KAP findings. The majority of mothers (91.1%, 328/360) correctly identified sugar and sweet consumption as a major cause of dental caries. However, only 36.4% (131/360) knew that milk teeth are important and should be cared for.

Regarding attitudes, 90.3% (325/360) of mothers agreed that children should brush their teeth twice daily. However, only 8.6% (31/360) believed that dental check-ups should be done routinely even without pain or visible problems.

A significant knowledge-practice gap was observed. While 90.3% mothers advocated twice-daily brushing, only 2.2% (8/360) reported that their children actually practiced it. Similarly, despite awareness about the importance of dental care, only 2.5% (9/360) mothers reported taking their child for routine dental check-ups in the past year.

Table 4: Maternal knowledge, attitudes, and practices regarding child oral health (N=360)

Domain	Item	Response	n	%
Knowledge	Sugar/sweets cause tooth decay	Correct	328	91.1
		Incorrect	32	8.9
	Milk teeth are important	Correct	131	36.4
		Incorrect	229	63.6
	Fluoride prevents cavities	Correct	87	24.2
		Incorrect	273	75.8
Attitude	Children should brush twice daily	Agree	325	90.3
		Disagree	35	9.7
	Regular dental check-ups needed	Agree	31	8.6

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		Disagree	329	91.4
	Milk teeth don't need treatment	Agree	243	67.5
		Disagree	117	32.5
Practice	Child brushes twice daily	Yes	8	2.2
		No	352	97.8
	Mother assists in brushing	Yes	118	32.8
		No	242	67.2
	Routine dental visits (past year)	Yes	9	2.5
		No	351	97.5
	Bottle feeding at night	Yes	11	3.1
		No	349	96.9

Association of Oral Hygiene Practices with ECC

Table 5 demonstrates the association between oral hygiene practices and ECC prevalence. Maternal assistance during tooth brushing was significantly protective against ECC. Children whose mothers assisted them during brushing had significantly lower ECC prevalence (8.5%, 10/118) compared to children who brushed without assistance (34.3%, 83/242) ($\chi^2 = 28.74$, $p < 0.001$).

Frequency of brushing also showed a significant association. Children who brushed twice daily had no caries, while those brushing once daily had 26.7% ECC prevalence, and those brushing irregularly had 42.1% prevalence ($\chi^2 = 19.83$, $p < 0.001$).

Consumption of sugary snacks between meals was significantly associated with higher ECC prevalence (38.4% vs. 16.8%, $\chi^2 = 21.65$, $p < 0.001$).

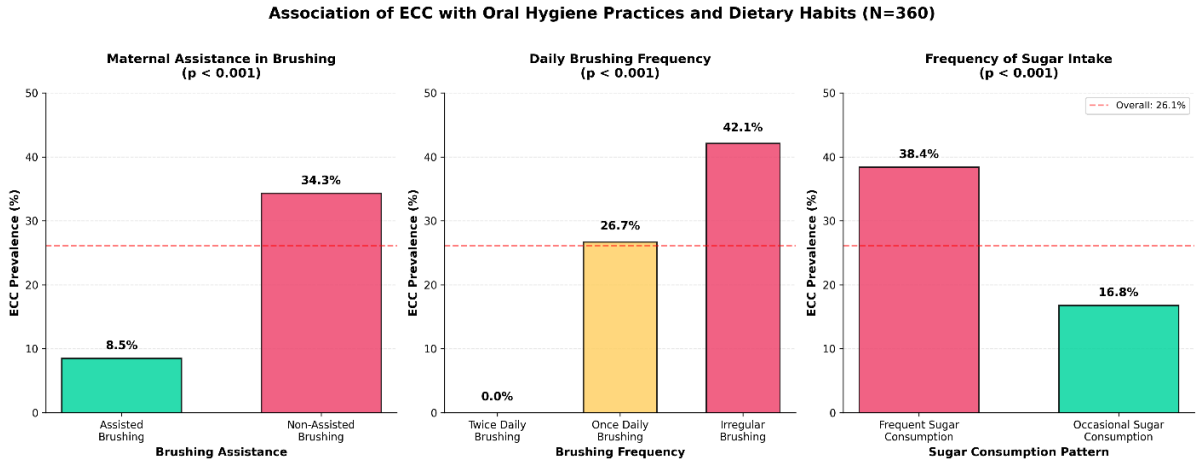

Fig 4: Grouped bar chart showing ECC prevalence by oral hygiene practices (assisted vs. non-assisted brushing, brushing frequency)

Table 5. Association of Oral Hygiene Practices and Dietary Habits with Early Childhood Caries (ECC) (N = 360)

Variable	Category	Total (n)	ECC Present n (%)	ECC Absent n (%)	χ^2 value	p-value
Assisted brushing	Yes	118	10 (8.5)	108 (91.5)	28.74	<0.001*
	No	242	83 (34.3)	159 (65.7)		
Brushing frequency	Twice daily	8	0 (0.0)	8 (100.0)	19.83	<0.001*
	Once daily	304	81 (26.7)	223 (73.3)		
	Irregular	48	12 (42.1)	26 (57.9)		
Sugar consumption	Frequent (>3 times/day)	177	68 (38.4)	109 (61.6)	21.65	<0.001*
	Occasional (≤3 times/day)	183	25 (16.8)	148 (83.2)		
Night-time bottle feeding	Yes	11	8 (72.7)	3 (27.3)	12.84	<0.001*
	No	349	85 (24.4)	264 (75.6)		
Dental visit (past year)	Yes	9	0 (0.0)	9 (100.0)	2.61	0.106
	No	351	93 (26.5)	258 (73.5)		

* Statistically significant ($p < 0.05$)

In summary, the prevalence of early childhood caries among children attending Anganwadi centres in rural Srikakulam was 26.1%. Significant risk factors identified were middle school maternal education, maternal engagement in daily wage labor, low family income, lack of assisted brushing, infrequent brushing, and frequent sugar consumption. Despite high maternal knowledge about dental caries, preventive practices were inadequate, reflecting a substantial knowledge-practice gap.

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DISCUSSION:

This cross-sectional study revealed that approximately one-fourth (26.1%) of children aged 3-6 years attending Anganwadi centres in rural Srikakulam district had early childhood caries. This finding is comparable to studies conducted in Bhilai (27%)[7] and lower than reports from Wardha district (36%).[11] The variation in ECC prevalence across different regions of India reflects differences in socioeconomic conditions, dietary patterns, oral hygiene practices, and access to dental care services. The mean dmft score of 5.18 among affected children indicates moderate caries severity, with the decayed component contributing 93.1% to the total dmft. The negligible filled teeth component (1.7%) highlights the severe underutilization of dental treatment services in rural areas, consistent with findings from other Indian studies.[13] This emphasizes that dental caries in this population remains largely untreated, potentially leading to pain, infection, and impaired quality of life.

Maternal education and occupation emerged as significant determinants of ECC. Children of mothers with middle school education showed paradoxically higher ECC (34.8%) compared to those with primary education (8.9%). This unexpected finding may be explained by the fact that mothers with middle school education are more likely to engage in daily wage labor, thereby having limited time for child supervision and oral care practices. Similarly, children of working mothers (daily wage workers/maids) had significantly higher ECC (82.7%) than those of housewives (11.2%). This strong association underscores the impact of maternal time availability and economic constraints on child oral health outcomes, as reported by Folayan et al.[14]

Despite 91% of mothers correctly identifying sugar as a cause of dental caries, only 2.5% reported routine dental check-ups, and merely 2.2% practiced twice-daily brushing. This substantial knowledge-practice gap has been consistently documented in similar studies and reflects barriers such as lack of accessibility to dental services, economic constraints, and competing priorities in resource-limited settings.[8] The protective effect of assisted brushing (8.5% ECC vs. 34.3% without assistance) reinforces the crucial role of parental involvement in establishing effective oral hygiene habits during early childhood.[15]

Implications for Policy and Practice

The findings highlight the urgent need to integrate oral health services within the existing Anganwadi infrastructure. Training Anganwadi workers to provide basic oral health education, demonstrate proper brushing techniques, and identify children requiring dental referral could substantially improve oral health outcomes. Periodic dental screening camps and establishment of referral linkages with primary health centres would ensure timely treatment of dental problems.

Strengths and Limitations

The study's strengths include adequate sample size, standardized WHO criteria for ECC assessment, and validated questionnaire. However, limitations include cross-sectional design precluding causality assessment, single-district focus limiting generalizability, and potential recall bias in maternal responses. Additionally, psychosocial factors and dietary habits were not explored in detail.

In conclusion, ECC prevalence among rural Anganwadi children in Srikakulam is substantial and associated with maternal occupation, education, and oral hygiene practices. Bridging the knowledge-practice gap through targeted interventions and integration of preventive oral healthcare within ICDS is essential to reduce the ECC burden in this vulnerable population.

CONCLUSION

Early childhood caries affected approximately one-fourth of children attending rural Anganwadi centres in Srikakulam district, with maternal occupation, education level, and oral hygiene practices emerging as significant determinants. The predominance of untreated decayed teeth (93.1% of dmft) underscores the severe underutilization of dental treatment services in rural areas. Although maternal knowledge about dental caries was appreciable, a substantial knowledge-practice gap was evident, with negligible rates of routine dental visits (2.5%) and twice-daily brushing (2.2%). These findings highlight the urgent need to integrate oral health education, supervised brushing programs, and preventive dental services within the existing ICDS infrastructure. Training Anganwadi workers to deliver basic oral health counseling and establishing referral linkages with primary health centers can substantially reduce the burden of early childhood caries in this vulnerable population.

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