

Assessment of prenatal nutritional knowledge among mothers regarding paediatric tooth development and deficiencies

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Abstract

This report presents a statistical analysis of a 166-respondent cross-sectional survey assessing what mothers know about the link between prenatal nutrition and their children's dental development. A composite Knowledge Score (0–5) was derived from five core knowledge items and used to classify respondents as having poor, moderate, or good knowledge.

Overall knowledge was modest: the mean score was 2.19 out of 5 (SD = 1.25), and only 17.5% of mothers fell into the "Good" knowledge band, while 30.1% scored "Poor." Awareness that maternal nutrition affects dental development was inconsistent across items — 75.9% of mothers agreed that calcium/vitamin D deficiency can cause soft, decay-prone teeth, yet only 14.5% correctly identified that tooth formation begins in the first trimester.

Chi-square and Kruskal–Wallis tests found that knowledge was significantly associated with work status ($p = 0.004$), regularity of antenatal supplement intake ($p < 0.001$), having been warned by a healthcare provider ($p < 0.001$), having received dietary guidance from a provider ($p = 0.037$), prior awareness of enamel defects ($p = 0.002$), and having heard of diseases causing tooth abnormalities ($p = 0.044$). Maternal age, education level, and parity showed no statistically significant association with knowledge in this sample.

These results point to healthcare-provider contact and consistent supplement use — rather than demographic background — as the strongest correlates of maternal dental-nutrition knowledge, suggesting that targeted antenatal counselling could meaningfully close the knowledge gap identified here.

Keywords: Prenatal, nutrition, enamel hypoplasia, cleft lip and palate, vitamins, diet, Vit D deficiency, multidisciplinary approach, ASHA workers

Introduction

Tooth development (odontogenesis) begins early in gestation — primary tooth buds form by the fifth to sixth week and crown mineralisation is underway by the first trimester^[1,2] — and maternal nutritional status, particularly intake of calcium, vitamin D, iron, and vitamins A and C, has been linked in the clinical literature to enamel quality and susceptibility to defects such as enamel hypoplasia and early childhood caries^[3–6,8,9]. Antenatal exposure to certain medicines, notably tetracycline, is also a recognised cause of permanent discoloration of a child's developing teeth^[10,11]. Maternal awareness of these links can influence antenatal dietary choices and supplement adherence.

Objectives

- Mothers' knowledge of when fetal tooth development begins and which prenatal nutrient deficiencies are linked to child dental problems;
- Attitudes toward the calcium/vitamin D–dental caries and maternal anaemia–dental health relationships;

- Reported antenatal health behaviours (supplement adherence, diet, exposure to potentially harmful substances); and
- Whether socio-demographic characteristics (age, education, work status, parity) or healthcare contact are associated with knowledge level.

Methods

1. Design and Sample

Data were collected via a self-administered structured questionnaire (Google Forms) completed by 166 mothers. Respondents were grouped by age (<25, 26–35, >35 years), highest education level, current work status, and number of children.

2. Knowledge Score Construction

A composite knowledge score (range 0–5) was constructed by summing five binary knowledge items, coded 1 for a response reflecting an evidence-consistent understanding and 0 otherwise:

Item	Correct / Knowledgeable Response
K1 — Timing of tooth formation ^[1,2]	"First 3 months of pregnancy"
K2 — Maternal diet affects child's teeth	"Yes"
K3 — Deficiency-linked nutrients (multi-select)	Selected ≥ 2 of {calcium, iron, vitamin D, vitamin A}
K4 — Ca/vitamin D deficiency → soft teeth/cavities	"Agree" or "Strongly agree"
K5 — Maternal anaemia affects child's teeth	"Yes"

Total scores were grouped into three bands: Poor (0–1), Moderate (2–3), and Good (4–5). Internal consistency across the five items was low (Cronbach's $\alpha = 0.43$), which is expected given that the items intentionally span distinct knowledge domains (embryology timing, general belief, specific nutrient recall, and two clinical-attitude statements) rather than a single unidimensional construct; the composite is therefore interpreted descriptively rather than as a strictly unidimensional psychometric scale.

3. Statistical Analysis

Descriptive statistics (frequencies, percentages, means, standard deviations) summarised sample characteristics and item-level responses. Associations between the categorical knowledge band and demographic/behavioural variables were tested using Pearson's chi-square test of independence (Cramér's V reported as effect size). Because the composite knowledge score is an ordinal/count variable, group comparisons of mean score across demographic categories additionally used the Kruskal–Wallis H test, which does not assume normality. Significance was set at $\alpha = 0.05$. All analyses were conducted in Python (pandas, SciPy).

2. Overall Knowledge Level

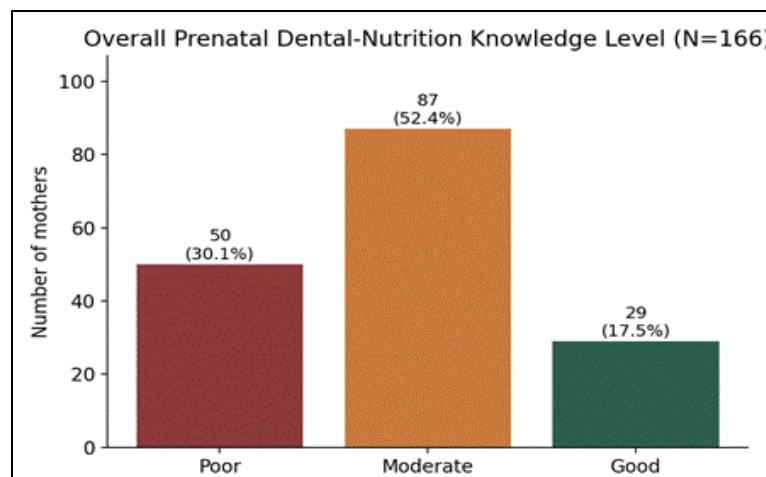


Fig 1: Distribution of overall prenatal dental-nutrition knowledge (composite score 0–5), N = 166.

The mean composite knowledge score was 2.19 (SD = 1.25; median = 2; range 0–5). Categorised, 50 mothers (30.1%) were classified as having Poor knowledge, 87 (52.4%) Moderate, and 29 (17.5%) Good.

3. Knowledge on Individual Items

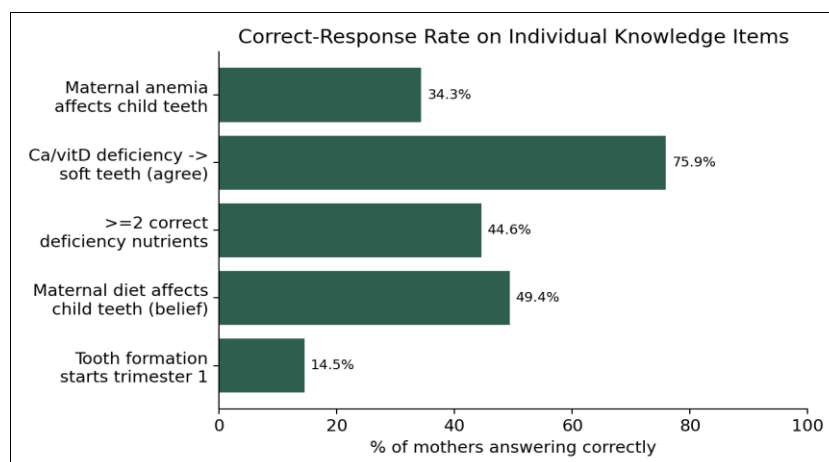


Fig 2: Percentage of mothers giving an evidence-consistent response, by knowledge item.

Results

1. Sample Characteristics

Characteristic	Category	n	%
Age	< 25 years	40	24.1
	26–35 years	102	61.4
	> 35 years	24	14.5
Education	School level	20	12.0
	College / Graduate	135	81.3
	Postgraduate / Diploma	10	6.0
Work status	Not specified	1	0.6
	Working / employed	98	59.0
	Homemaker / not working	68	41.0
Number of children	1	92	55.4
	2	52	31.3
	3 or more	22	13.3

The sample was predominantly college-educated (81.3%), aged 26–35 (61.4%), and slightly more often employed (59.0%) than homemakers (41.0%). Most respondents (55.4%) had one child.

Knowledge item	n correct / N	%
Ca/vit D deficiency → soft, decay-prone teeth (Agree/Strongly agree)	126 / 166	75.9
Believes maternal diet/health affects child's future teeth	82 / 166	49.4
Identified ≥2 correct deficiency-linked nutrients	74 / 166	44.6
Maternal anaemia affects child's teeth [7-9]	57 / 166	34.3
Correctly identified 1st-trimester tooth formation	24 / 166	14.5

Knowledge was strongest for the general clinical-attitude statement linking calcium/vitamin D to cavities (75.9% agreement) — an association well supported in the literature, where maternal vitamin D insufficiency has been associated with an increased risk of enamel defects and early childhood caries [3-6] — but weakest for the precise embryological timing of tooth formation — only 14.5% correctly selected the first trimester, while 28.3% believed teeth begin forming only after birth ("when teething starts") and 16.9% admitted not knowing, even though primary tooth formation is known to begin around gestational week 5-6 [1,2].

On the multi-select nutrient-deficiency item, calcium was the most recognised nutrient (62.0% of respondents), followed by vitamin D (38.6%), iron (32.5%), vitamin A (27.1%), and vitamin C (16.9%); 16.9% selected "I don't know."

Regarding potentially harmful antenatal exposures, 60.2% of mothers reported none of the listed exposures, 15.1% preferred not to say, and the remainder reported at least one exposure — most commonly heavy antibiotics such as tetracycline (12.0%) — a drug well documented to cause permanent discoloration of a child's developing teeth when taken after the first trimester [10,11] — or unsupervised pain-relief medication (7.8%).

Antenatal Behaviours and Healthcare Contact

Behaviour / exposure	n	% of 166
Took supplements all through pregnancy	48	28.9
Took supplements sometimes / off and on	60	36.1
Did not take supplements	32	19.3
Not applicable (e.g. currently pregnant, early stage)	26	15.7
Received dietary guidance from a Gynaecologist/Obstetrician	67	40.4
Received dietary guidance from a Nutritionist/Dietician	32	19.3
Received dietary guidance from a Dentist	29	17.5
Received no dietary guidance from any provider	38	22.9
Warned by a provider about medicines/habits affecting baby's teeth/bones	90	54.2
Heard of diseases in pregnancy causing tooth abnormalities	90	54.2
Noticed/heard of enamel defects (white/brown spots, pits) in children	95	57.2

4. Inferential Statistics: Correlates of Knowledge

Socio-demographic Correlates

Variable	Test	Statistic	df	p-value	Effect size
Age group	Kruskal-Wallis	H = 4.13	2	0.127	—
Age group (categorical)	Chi-square	$\chi^2 = 6.68$	4	0.154	V = 0.14
Education level	Kruskal-Wallis	H = 3.38	3	0.336	—
Education level (categorical)	Chi-square	$\chi^2 = 4.48$	6	0.612	V = 0.12
Work status	Kruskal-Wallis	H = 8.40	1	0.004*	—
Work status (categorical)	Chi-square	$\chi^2 = 5.33$	2	0.070	V = 0.18
Number of children	Kruskal-Wallis	H = 0.39	2	0.823	—
Number of children (categorical)	Chi-square	$\chi^2 = 1.96$	4	0.744	V = 0.08

*Statistically significant at $\alpha = 0.05$.

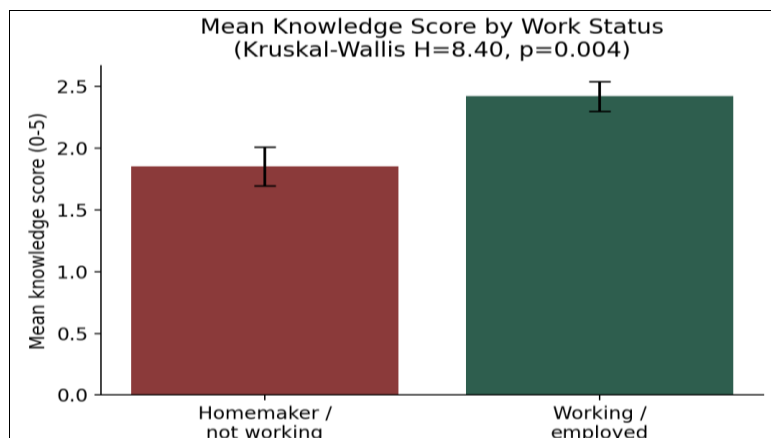


Fig 3: Mean composite knowledge score by work status, with standard error bars.

Working/employed mothers scored significantly higher on average (mean = 2.42, SD = 1.17) than homemakers (mean = 1.85, SD = 1.30; Kruskal–Wallis H = 8.40, p = 0.004). Age, education level, and parity showed no statistically significant relationship with knowledge score or knowledge category in this sample, although the chi-square test for work status vs. knowledge category approached but did not reach significance at the categorical level (p = 0.070) — the more sensitive Kruskal–Wallis test on the continuous score confirms a genuine difference.

Healthcare Contact and Behavioural Correlates

Variable	χ^2	df	p-value	Cramér's V
Antenatal supplement adherence	30.45	6	<0.001*	0.30
Warned by provider (meds/habits → teeth)	14.39	2	<0.001*	0.29
Noticed/heard of enamel defects	12.46	2	0.002*	0.27
Guided by a provider on diet–teeth link	13.38	6	0.037*	0.20
Heard of diseases causing tooth abnormalities	6.24	2	0.044*	0.19

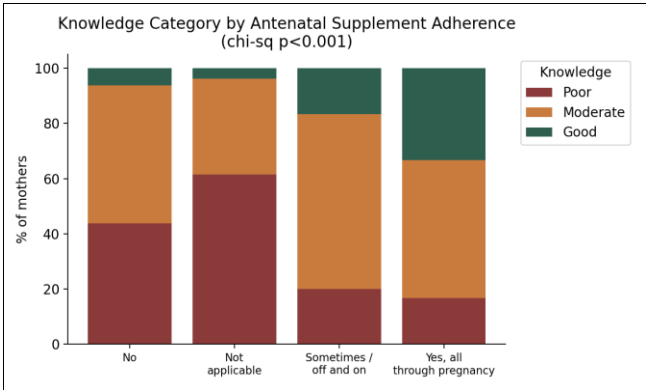


Fig 4: Knowledge category distribution by regularity of antenatal supplement intake.

Every behavioural/healthcare-contact variable tested was significantly associated with knowledge category. The clearest gradient was seen for supplement adherence: only 16.7% of mothers who took supplements throughout pregnancy fell into the Poor-knowledge band, versus 43.8% of those who did not take supplements at all. Mothers who had been explicitly warned by a healthcare provider about medicines/habits affecting their baby's teeth or bones, or who had received dietary guidance from any provider, were likewise more concentrated in the Moderate/Good knowledge bands.

Because this is a cross-sectional survey, the direction of these associations cannot be established: mothers with greater baseline dental-nutrition knowledge may be more likely to seek out or adhere to antenatal guidance, or, conversely, receiving guidance may itself have built their knowledge. Both pathways are plausible and likely act together.

Discussion

Overall, prenatal dental-nutrition knowledge in this sample was moderate-to-low, with a clear gap between general awareness (most mothers accept that maternal nutrition matters for dental health in principle) and precise knowledge (few could identify the correct developmental

window or the full range of relevant nutrients). This pattern — high agreement with broad statements but low accuracy on specific facts — mirrors comparable knowledge-attitude surveys of maternal oral-health knowledge, which have similarly reported that a large minority to majority of mother's lack awareness of the pregnancy-oral health link, first-tooth eruption timing, or the causes of early childhood caries, despite generally favourable attitudes [12–15]. A 2023 scoping review synthesising 67 studies on pregnant women's oral-health knowledge, attitudes, practices and literacy reached the same conclusion at a broader scale: knowledge is patchy and socially patterned, attitudes are generally favourable, but translation into precise, actionable understanding — and into consistent preventive practice — remains limited across settings [21]. This suggests that public messaging has conveyed a general association without conveying the underlying mechanism or timing, and that the gap identified here is not an isolated finding but part of a broader, internationally replicated pattern in maternal oral-health knowledge research.

The specific shape of the gap in this sample is also informative. Nearly three-quarters of mothers endorsed the general, clinically simple statement that calcium/vitamin D deficiency causes soft, decay-prone teeth, yet fewer than one in six could place tooth formation in the correct trimester, and over a quarter believed dental development begins only after birth. This is consistent with a broader finding in health-literacy research that lay knowledge tends to be organised around cause-and-effect slogans (“diet affects teeth”) rather than around the underlying biological timeline, a distinction that matters clinically because the window for nutritional intervention — the first trimester, when primary tooth buds and crown mineralisation are already underway [1,2] — will have already closed by the time many mothers believe dental development starts. A comparable disconnect between broad awareness and specific procedural or timing knowledge was also reported among expectant mothers in a Polish maternity-ward sample, where women held some correct oral-health beliefs but were commonly unaware of the appropriate timing for their child's first dental visit [22].

Beyond the enamel-focused deficiencies surveyed here (calcium, vitamin D, iron), prenatal nutrition is also causally linked to a more severe class of dental/craniofacial outcome that the knowledge score does not test: orofacial clefting. A national case-control study in Norway found that folic acid supplementation of at least 400 micrograms per day in early pregnancy reduced the risk of isolated cleft lip, with or without cleft palate, by roughly a third (adjusted odds ratio 0.61) [27], and children born with cleft lip and/or palate go on to show substantially elevated rates of dental anomalies in the affected arch — most commonly agenesis of the cleft-side lateral incisor, present in an estimated 28–66% of cases, together with supernumerary teeth, enamel defects, and delayed eruption [28] — making cleft status itself a dental-development outcome with a nutritional prevention component. None of the five knowledge items in this survey addressed folic acid or its role in preventing structural, rather than purely qualitative (enamel), defects, even though closure of the lip and palate occurs within the same first-trimester window that only 14.5% of mothers here correctly identified. This is a notable gap for future survey design,

since folic acid supplementation is both among the most robustly evidenced and the most actionable of all prenatal-nutrition messages relevant to child oral and dental health.

The consistent, significant relationship between knowledge and provider contact (guidance received, being warned, and supplement adherence) — but the absence of a relationship with education level — suggests that formal education alone does not close this knowledge gap; direct antenatal counselling appears to be the more actionable lever. This interpretation is strengthened by intervention evidence from outside this dataset: randomised and quasi-experimental trials of antenatal oral-health education have repeatedly found that structured counselling measurably improves mothers' oral-health knowledge and, in some cases, downstream behaviours and clinical outcomes. A cluster-randomised trial of an oral-health talk and video for mothers in rural Nigeria significantly improved awareness of natal teeth relative to a no-intervention control ^[17]; a randomised oral-health promotion programme for pregnant women in Shanghai produced statistically significant gains in oral-health knowledge alongside improved periodontal outcomes ^[18]; and a multi-centre Australian trial of a midwifery-initiated oral-health pathway improved knowledge and service uptake among pregnant women who received the intervention ^[19]. Because this survey is cross-sectional, it cannot itself distinguish selection (more knowledgeable mothers seek out guidance) from a causal effect of counselling on knowledge, but the convergence of an experimental literature showing that counselling reliably raises knowledge makes the causal pathway — provider contact building maternal knowledge, rather than the reverse — the more parsimonious of the two explanations, even though both almost certainly operate together. This is encouraging from a public-health perspective, as provider-delivered counselling is a modifiable point of intervention, whereas maternal age, education, and parity are not.

An important practical dimension this survey did not capture is which cadre of provider delivered dietary guidance: the questionnaire distinguished obstetricians, nutritionists/dietitians, and dentists, but did not separately ask about contact with Accredited Social Health Activists (ASHAs) — India's frontline community health workers, who are officially mandated to counsel pregnant women on diet and oral-health risk factors and are typically the first, and sometimes only, point of health contact for mothers in rural or low-income households ^[23]. Given that 22.9% of mothers here received no dietary guidance from any provider, ASHAs represent a plausible, already-existing channel for closing part of that gap: a pilot study in Uttarakhand found that ASHAs trained in motivational-interviewing-based oral-health education achieved a marked improvement in their own counselling competency and were able to deliver effective oral-health messaging to mothers of young children at low marginal cost to the health system ^[24]. This channel is not automatically ready to use, however: a cross-sectional study of ASHA workers in Davanagere, Karnataka — the same state as the present sample — found their own knowledge of the link between periodontal disease and adverse pregnancy outcomes was poor and unrelated to their age, education, or years of experience ^[25], and a separate mixed-methods study of frontline health workers' maternal nutrition-counselling knowledge in Udupi, Karnataka similarly points to variable baseline competency among this workforce ^[26]. Recording ASHA

contact specifically in future survey iterations, alongside investment in ASHA oral-health and nutrition training, would help clarify whether this already-present workforce could extend the counselling effect documented here for obstetricians and dentists to the substantial minority of mothers who currently receive no dietary guidance at all.

The absence of an education effect alongside a strong provider-contact effect is also consistent with a broader distinction in the health-literacy literature between formal educational attainment and health (or oral-health) literacy specifically: the two are correlated but not interchangeable constructs, and the latter is shaped as much by exposure to targeted health information and social/professional context as by years of schooling. The scoping review noted above concluded that pregnant women's oral-health literacy is strongly related to their socio professional environment and living context rather than education level in isolation ^[21], which fits this sample's pattern of significant provider-contact effects and a null education effect.

The work-status finding (employed mothers scoring higher, mean 2.42 vs 1.85) may reflect greater exposure to health information through workplace networks, higher household income enabling better antenatal care access, or unmeasured confounders such as urban residence; this survey cannot distinguish between these explanations. This finding also has some support in the broader maternal health-literacy literature: a cross-sectional study of maternal health literacy among third-trimester pregnant women in Thailand identified being employed, along with older age and higher educational attainment, as an independent positive predictor of maternal health literacy in multivariable analysis, alongside being married ^[20] — though, notably, that same study found these socio-demographic factors together explained only a modest share of the variance in literacy, underscoring that employment status is at best a partial proxy for the underlying determinants (information access, provider contact, health system engagement) that more directly drive knowledge. A comparable Italian survey similarly found that receiving advice during pregnancy, rather than education level alone, was independently associated with better maternal oral-health knowledge ^[12], reinforcing the pattern seen here that active engagement with the healthcare system — whether through employment-linked information access or direct provider contact — outweighs static demographic characteristics as a correlate of knowledge.

Limitations

- Convenience/self-selected sample via an online form, which may not represent mothers with lower digital access or literacy, and limits generalisability.

Conclusion

Mothers in this sample generally accepted that prenatal nutrition affects children's teeth, but specific, actionable knowledge—particularly regarding the timing of tooth development and the full range of relevant nutrients—was limited, with nearly one-third demonstrating poor overall knowledge. Knowledge was not significantly explained by age, education, or parity, but was consistently and significantly higher among mothers who had contact with healthcare providers regarding diet and pregnancy and among those who adhered to prescribed antenatal supplementation.

These findings highlight the importance of strengthening routine antenatal counselling, particularly through explicit discussion of when tooth development begins and which micronutrients are essential for healthy dental development. An interdisciplinary approach involving gynaecologists, dentists, and other antenatal healthcare providers could help integrate oral health and nutrition education into routine prenatal care. Dentists can provide specific guidance on prenatal factors affecting tooth development, while gynaecologists can reinforce this information during regular antenatal visits. ASHA workers can further support this approach by delivering basic oral health and nutrition messages at the community level, reinforcing counselling provided at healthcare facilities, and encouraging mothers to seek timely dental care when required.

Such coordinated efforts may improve maternal knowledge, promote appropriate nutritional practices during pregnancy, and potentially contribute to better oral health outcomes in children.

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