ORIGINAL ARTICLE

Infant and Young Child Feeding (IYCF) Practices and Nutritional Status of Children Under Five in Urban Slums of Surat: A Longitudinal Study

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ABSTRACT

Background: Optimal infant and young child feeding (IYCF) practices are critical for preventing malnutrition, particularly in urban slum populations in India. **Aims & Objectives**: To assess IYCF practices and document the nutritional status of children under five years residing in urban slums. **Methodology**: A prospective longitudinal study was conducted among 170 children under five years, followed for two months. Anthropometric measurements were recorded at baseline, one month, and two months. Nutritional status was assessed, and IYCF indicators—Minimum Meal Frequency (MMF), Minimum Dietary Diversity (MDD), and Minimum Acceptable Diet (MAD)—were evaluated. **Results**: Low birth weight (<2.5 kg) was observed in 24.7% of children. At baseline, 15.4% were wasted, 32.9% underweight, and 39.4% stunted. Significant weight gain was noted during follow-up (0.47 ± 0.67 kg at one month; 0.69 ± 0.97 kg at two months; $p < 0.001$), with wasting declining to 8.8%. Early initiation of breastfeeding occurred in 74.7%, and 91.2% received colostrum. MMF, MDD, and MAD were met by 58.9%, 53.6%, and 32.1% respectively. Pre-lacteal feeding was reported in 16.5%. No significant association was found between IYCF indicators and nutritional status. **Conclusion**: Although short-term counselling reduced wasting, chronic malnutrition remained high, highlighting the need for sustained, integrated interventions focusing on IYCF practices, maternal education, and food security in urban slums.

KEYWORDS

Infant and Young Child Feeding; Stunting; Wasting; Underweight

INTRODUCTION

Child malnutrition remains a major public health challenge in India. Optimal Infant and Young Child Feeding (IYCF) practices—including exclusive breastfeeding for six months, timely initiation of complementary feeding, and age-appropriate dietary diversity and feeding frequency—are essential for preventing severe acute malnutrition, promoting linear growth, reducing micronutrient deficiencies, and protecting against infections. (1,2). Globally, 39% of children under five are stunted, with the highest vulnerability between 13–24 months, while wasting peaks between 37–48 months(3,4). NFHS-5 (2019–2021) reports 35.5% stunting, 19.3% wasting, 7.7% severe wasting, and 32.1% underweight among Indian children under five(5).

IYCF practices are often suboptimal in urban slums due to poverty, food insecurity, limited healthcare access, poor living conditions, low maternal education, and socio-cultural norms(2,6,7). Surat, Gujarat, with rapidly growing slums such as

Azadnagar and Rasulabad, represents high-risk communities with inadequate sanitation, nutrition, and health services. These areas, under the Urban Health Training Centre (UHTC) of Government Medical College, Surat, are suitable for assessing IYCF practices and nutritional outcomes.

Aim: To assess IYCF practices among under-five children in selected urban slums of Surat.

Objectives:

- Document nutritional status of under-five children.
- Evaluate feeding practices and adherence to IYCF guidelines.

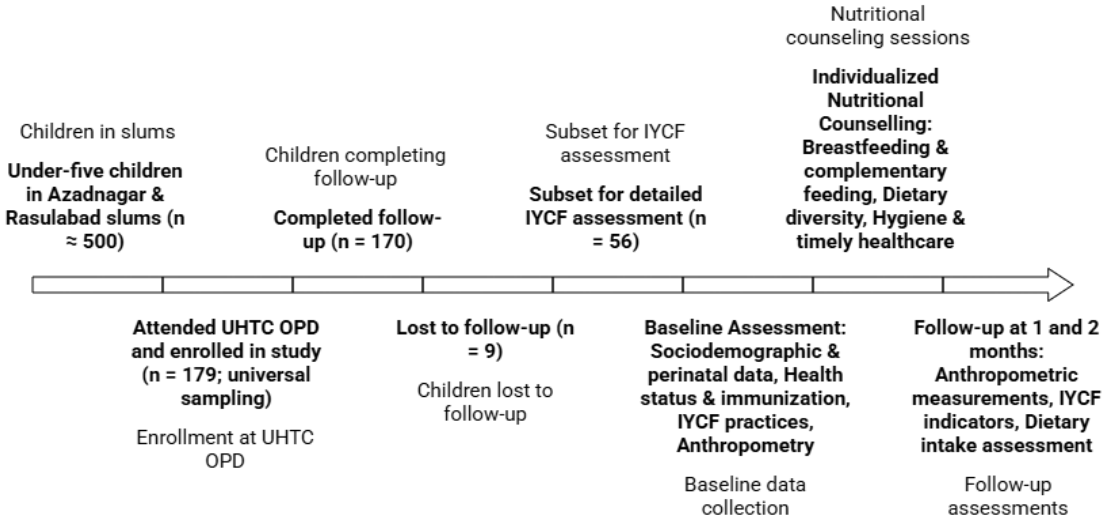
Material & Methods

Study Type & Design: A prospective longitudinal study was conducted in the urban slum field practice areas of Azadnagar and Rasulabad, under the Urban Health Training Centre (UHTC) of Government Medical College, Surat. The Department of Community Medicine conducts a twice-weekly field OPD providing routine outpatient, immunization, and counselling services.

Study Setting and Duration: The study was carried out over one year, from July 2022 to July 2023, in slums with limited health and nutrition resources.

Study Population and Sampling: All under-five children attending the UHTC OPD during the study period were eligible. Universal sampling was employed, inviting all children after community mobilization. Of the estimated 500 children in the catchment area, 179 were enrolled, and 170 completed one- and two-month follow-ups (9 lost to follow-up). A subset of 56 children completed detailed IYCF follow-up and were included in corresponding analyses. Written informed consent was obtained from caregivers. The methodology is as shown in figure 1.

Figure 1: Flowchart of Methodology



Inclusion Criteria: Children aged 0–59 months whose caregivers consented to participate.

Exclusion Criteria: Critically ill children and those whose caregivers declined participation.

Data Collection: Data were collected by trained personnel using a pre-tested, semi-structured electronic questionnaire (Google Forms) covering individual characteristics, sociodemographic factors, perinatal history, infant feeding practices (breastfeeding initiation, colostrum feeding, MDD, MMF, MAD), and health variables (immunization, recent illness, antenatal visits). The questionnaire was piloted in the same slum, and pilot data were excluded from the main study.

Anthropometric Measurements: Anthropometry was performed at baseline, one-month, and two-month follow-ups. Weight was measured using a calibrated digital scale (minimal clothing, no footwear), length with an infantometer for children <2 years or a stadiometer for children ≥2 years, and mid-upper arm circumference (MUAC) on the left arm using Shakir's tape. Z-scores—height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ)—were calculated according to World Health Organization (WHO) Child Growth Standards(8–10).

Working Definitions: Nutritional status and Infant and Young Child Feeding (IYCF) indicators were defined as per WHO guidelines(8,11). Stunting was defined as HAZ < -2 SD, wasting as WHZ < -2 SD, and underweight as WAZ < -2 SD. Minimum dietary diversity (MDD) was defined as consumption of ≥4 of 7 food groups in the preceding 24 hours. Minimum meal frequency (MMF) was based on age and breastfeeding status, while minimum acceptable diet (MAD) was defined as a composite of MDD and MMF for children aged 6–23 months. Dietary intake was assessed using a 24-hour recall method(12).

Counselling Intervention and Follow-Up: After baseline assessment, individualized nutritional counselling was provided to mothers or caregivers based on child nutritional and feeding status. Topics included breastfeeding, complementary feeding, dietary diversity, hygiene, and timely healthcare seeking. Follow-up visits were scheduled at one and two months, with phone reminders and community health worker support to ensure adherence.

Data Management and Statistical Analysis: Data from Google Forms were exported to IBM SPSS version 25. Descriptive statistics summarized demographic, feeding, and nutritional variables. Continuous variables were expressed as mean ± SD, categorical variables as proportions. Paired t-tests assessed anthropometric changes; Chi-square tests examined associations between IYCF indicators and nutritional status. Missing data were handled using complete-case (listwise) deletion.

Ethical Considerations: Ethical approval was obtained from the Human Research and Ethical Committee of Government Medical College, Surat (Approval No. GMCS/STU/ETHICS/Approval/29070/23). Written informed consent was obtained from caregivers. Confidentiality was maintained, and caregivers were informed of their right to withdraw at any time without affecting healthcare services.

RESULTS

Participant Characteristics: A total of 170 children under five years and their mothers residing in urban slums of Surat were enrolled. The mean birth weight was 2.70 ± 0.61 kg (median 2.60 kg; range 1.00–4.15 kg), with 24.7% (n = 42) classified as low birth weight (<2.5 kg). Mothers' mean age was 25.6 ± 4.3 years, and 82.2% (n = 139) were not formally employed. The average household size was 5.89 ± 2.90 members, including 2.34 ± 1.43 children per family. Institutional deliveries accounted for 96.5%, with 69.4% in government and 27.1% in private facilities. Most births (95.9%) were full-term.

Anthropometric Measurements and Growth Trends: Anthropometric data recorded at baseline and subsequent follow-ups are summarized in Table 1. The mean weight increased from 9.50 ± 3.14 kg at baseline to 9.99 ± 3.10 kg at the first follow-up and 10.21 ± 3.08 kg at the second follow-up. Mean mid-upper arm circumference (MUAC) was 14.0 ± 1.35 cm, with 82.9% of children classified as normal, 14.1% moderately malnourished, and 2.9% severely malnourished. The mean length/height was 78.0 ± 15.1 cm.

Table 1 Anthropometric Measurements of Children (n = 170)

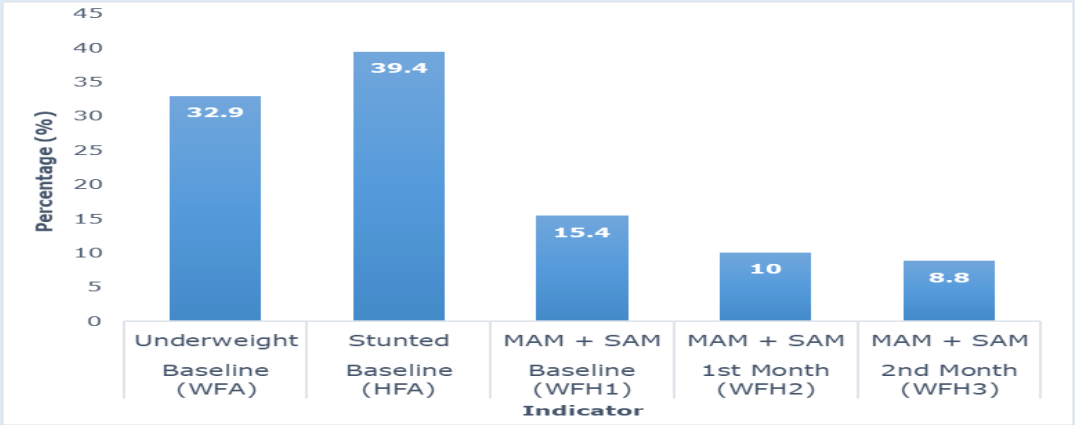
Measurement	Mean + SD	Median	Range
Weight at baseline (kg)	9.50 + 3.14	9.13	2.30 – 16.7
Weight at 1st follow-up (kg)	9.99 + 3.10	10.0	2.50 – 18.8
Weight at 2nd follow-up (kg)	10.21 + 3.08	10.0	2.70 – 18.0
MUAC (cm)	14.0 + 1.35	14.0	10.0 – 18.0
Length/Height (cm)	78.0 + 15.1	77.0	50 – 108

Nutritional Status and Transitions Over Time: Table 2 depicts nutritional status based on standard anthropometric indices. At baseline, 15.4% of children had moderate or severe acute malnutrition (MAM + SAM) by weight-for-height (WFH) z-scores. This prevalence declined to 10.0% at the first follow-up and 8.8% at the second follow-up, indicating improvement following intervention. Underweight (weight-for-age, WFA) prevalence was 32.9%, while 39.4% were stunted (height-for-age, HFA). Transition analysis showed that 11 children recovered from MAM + SAM during the two-month follow-up (Figure 2, Table 2).

Table 2 Transitions in Weight-for-Height Status

From / To	WFH2 MAM+SAM	WFH2 Normal+	Total
WFH1 MAM+SAM	15	11	26
WFH1 Normal+	2	141	143
Total	17	152	169
From / To	**WFH3 MAM+SAM**	**WFH3 Normal+**	**Total**
WFH1 MAM+SAM	11	15	26
WFH1 Normal+	3	140	143
Total	14	155	169

Figure 2 Nutritional Status of Children Under Five Based on Anthropometric Indices and Transitions Over Two Months (n = 170)



Infant and Young Child Feeding (IYCF) Practices: IYCF indicators are presented in Table 3. Breastfeeding initiation within one hour occurred in 74.7%, and 91.2% of children received colostrum. However, only 58.9% met minimum meal frequency (MMF), 53.6% met minimum dietary diversity (MDD), and 32.1% met minimum acceptable diet (MAD). Pre-lacteal feeding was reported in 16.5% of cases.

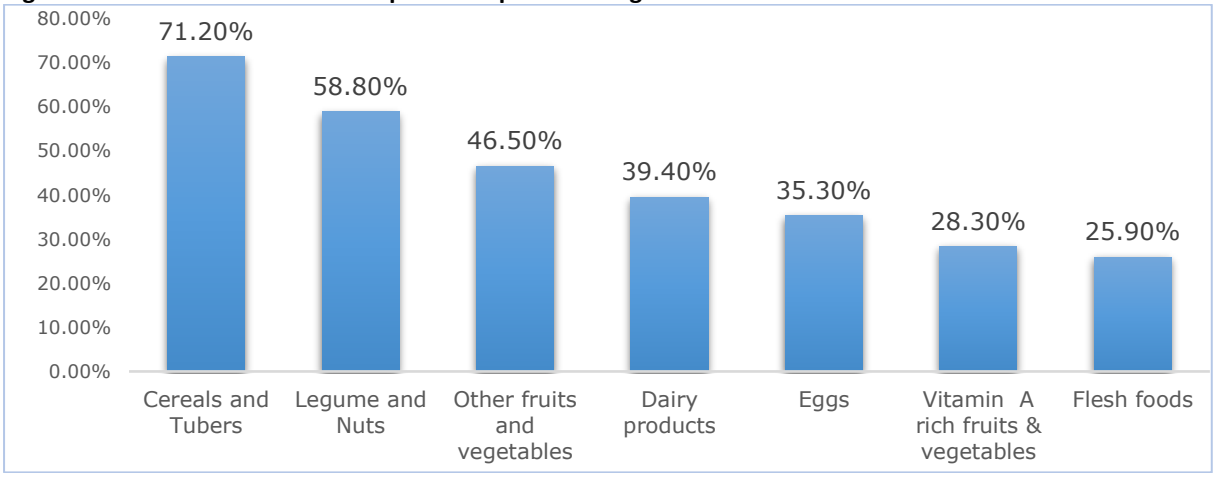
Table 3 Infant and Young Child Feeding Practices (n = 170)

IYCF Indicator	Category	n	%
Minimum Meal Frequency (MMF)	Met	33	58.9%
	Not Met	23	41.1%
Minimum Dietary Diversity (MDD)	Met	30	53.6%
	Not Met	26	46.4%
Minimum Acceptable Diet (MAD)	Met	18	32.1%
	Not Met	38	67.9%
Breastfeeding Initiation	Within 1 hour	127	74.7%
	After 1 hour	40	23.5%
	Not started	3	1.8%
Colostrum Feeding	Given	155	91.2%
	Not given	15	8.8%
Pre-lacteal Feeding	Not given	142	83.5%
	Given	28	16.5%

Distribution of Food Group Consumption Among Under-Five Children

Analysis of food group consumption reflect limited dietary diversity, with lower intake of animal-source and micronutrient-rich foods (Figure 3).

Figure 3: Distribution of Food Group Consumption Among Under-Five Children



Association Between Feeding Indicators and Nutritional Status at First Month

Among 56 children assessed at one month, those meeting IYCF indicators (MMF, MDD, MAD) showed a trend toward better nutritional status across WFH, WFA, and HFA indices; however, associations were not statistically significant ($p > 0.05$), indicating that feeding practices alone may not fully account for nutritional outcomes (Table 4).

Table 4 Association Between Feeding Indicators and Nutritional Status at First Month (n=56)

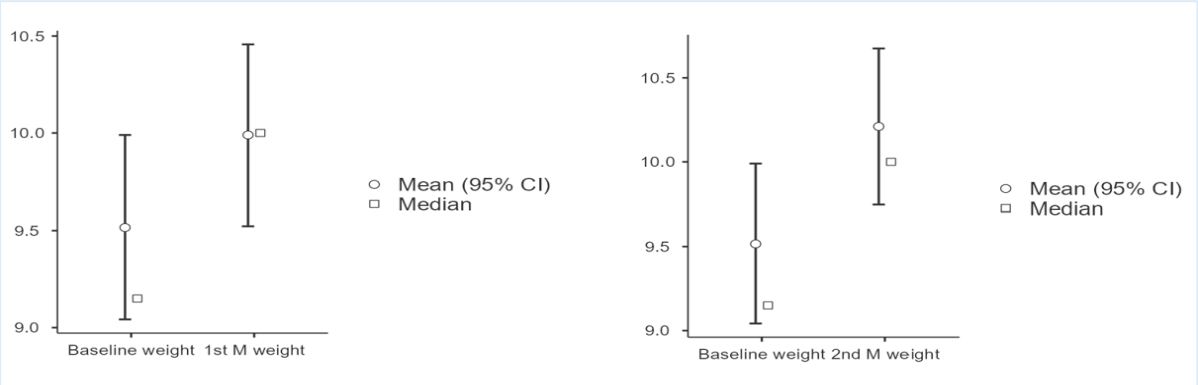
Nutritional Status	Feeding Indicator	Met (Poor NS/Normal+)	Not Met (Poor NS/Normal+)
WFH	MMF	5/28	3/20
	MDD	2/28	6/20
	MAD	2/16	6/32
WFA	MMF	10/23	10/13
	MDD	13/17	7/19
	MAD	6/12	14/24
HFA	MMF	12/21	7/16
	MDD	11/19	8/18
	MAD	8/10	11/27

**Poor nutritional status: WFH = MAM+SAM; WFA = Underweight; HFA = Stunted*

Changes in Weight Over Time

Statistically significant weight gains were observed during the follow-up period. From baseline to one month, the mean weight increased by 0.47 ± 0.67 kg ($t = 6.35$, $p < 0.001$). From baseline to two months, the increase was 0.69 ± 0.97 kg ($t = 5.31$, $p < 0.001$), indicating effective short-term improvement following the nutritional counselling intervention. (Figure 4)

Figure 4: Changes in Weight Over Time



Complementary Feeding Frequency and Nutritional Status

Analysis of complementary feeding frequency revealed no significant differences in feeding frequency between malnourished and normal children across wasting ($p = 0.814$), stunting ($p = 0.469$), and underweight status ($p = 0.154$). This suggests that feeding frequency alone may not be a strong predictor of nutritional outcomes in this population.

DISCUSSION

This study assessed nutritional status, growth patterns, and Infant and Young Child Feeding (IYCF) practices among children under five in urban slums of Surat, emphasizing persistent malnutrition challenges in socioeconomically vulnerable populations.

Participant Characteristics and Early Risk Factors

Nearly one-quarter (24.7%) of children were low birth weight (LBW), a well-established risk factor for subsequent growth faltering and poor nutritional outcomes(1). Despite a high rate of institutional deliveries (96.5%), large household sizes and overcrowding likely increased caregiving burdens and nutritional stress. These findings highlight the urgent need to enhance antenatal care, improve maternal nutrition, and promote family planning in resource-constrained urban slum settings to mitigate early malnutrition risks.

Anthropometric Outcomes and Growth Trends

Baseline prevalence of wasting (15.4%), underweight (32.9%), and stunting (39.4%) correspond with national data from NFHS-5 and NMMS(5,13) and parallel findings in similar urban poor settings(2). Statistically significant weight gains over two months ($p < 0.001$) indicate potential

efficacy of brief nutritional counselling interventions(14). However, persistent stunting—an indicator of chronic undernutrition—suggests short-term interventions inadequately address linear growth deficits, underscoring the need for sustained, multifaceted strategies (11).

Nutritional Status Transitions

Weight-for-height (WFH) malnutrition decreased from 15.4% to 8.8% over two months, consistent with intervention studies in slum populations demonstrating benefits of continuous counselling and follow-up(15). Nevertheless, ongoing prevalence and risk of relapse indicate that without sustained nutritional, environmental, and socioeconomic support, vulnerability persists(12).

Infant and Young Child Feeding Practices

Early initiation of breastfeeding (74.7%) and colostrum feeding (91.2%) were relatively high, yet complementary feeding indicators were suboptimal: only 32.1% met the Minimum Acceptable Diet (MAD), 53.6% met Minimum Dietary Diversity (MDD), and 58.9% met Minimum Meal Frequency (MMF). These align with NFHS, NMMS, and other Indian slum studies, highlighting persistent gaps in maternal knowledge, food access, and empowerment(5,13). The persistence of pre-lacteal feeding (16.5%) reflects entrenched cultural practices that impede exclusive breastfeeding despite medical recommendations(16). Low consumption of animal-source foods, vitamin A-rich fruits and vegetables, and flesh foods further limits micronutrient intake, contributing to high stunting and underweight rates(7).

Associations Between Feeding Indicators and Nutritional Outcomes

Children meeting IYCF indicators (MMF, MDD, MAD) tended toward better nutritional outcomes (WFH, WFA, HFA), though associations were not statistically significant—likely due to small sample size (n = 56). This supports existing evidence that adequate feeding practices are necessary but insufficient alone to reverse malnutrition without addressing comorbid factors such as infections, food insecurity, and maternal health(17).

Findings suggest that short-term nutritional counselling can reduce acute malnutrition in urban slum children but is inadequate for persistent underweight and stunting. Integrated, multisectoral interventions are essential, including community-based IYCF promotion, dietary diversification, culturally tailored behaviour change communication, and longer follow-up. Strengthening antenatal care and maternal nutrition alongside poverty alleviation and sanitation improvements is critical to disrupt the malnutrition cycle in urban slums. Future research should incorporate larger samples, extended follow-ups, and broader determinants such as food security and infectious disease burden to comprehensively address child nutrition dynamics.

CONCLUSION

The study demonstrates a high burden of chronic undernutrition among children under five in the urban slums of Surat, with persistent stunting (39.4%) and underweight (32.9%), despite improvements in acute malnutrition following short-term nutritional counselling. Early breastfeeding practices were largely adequate, but complementary feeding practices—including dietary diversity and minimum acceptable diet—remained suboptimal. While individualized counselling led to statistically significant short-term weight gain and recovery from moderate and severe wasting, adherence to recommended IYCF indicators alone was not significantly associated with nutritional outcomes. These findings suggest that short-term behavioural interventions can improve immediate anthropometric outcomes, but they are insufficient to address underlying determinants of chronic malnutrition.

RECOMMENDATION

- Enhance IYCF Practices: Strengthen counselling to improve complementary feeding, dietary diversity, and minimum acceptable diet, addressing suboptimal practices identified in the study.
- Support Maternal and Caregiver Capacity: Implement targeted nutrition education and peer-support interventions to reinforce proper feeding behaviours and child care practices.
- Integrate Nutrition and Growth Monitoring: Combine counselling with nutrient-rich food support and routine anthropometric follow-up to reduce acute malnutrition and promote sustained child growth.

LIMITATION OF THE STUDY

Limitations include a brief two-month follow-up restricting assessment of sustained growth effects, lack of a control group limiting causal inference, and a relatively small follow-up cohort reducing power to detect significant associations between feeding and nutritional status. Future studies should use larger cohorts, include control groups, extend follow-up duration, and apply more sensitive outcome measures to better capture the complexity of nutrition and growth trajectories in these settings.

RELEVANCE OF THE STUDY

This study adds to existing knowledge by providing recent, community-based evidence on the nutritional status and IYCF practices of under-five children in urban slums of Surat. It demonstrates that while individualized counselling can improve short-term weight gain and reduce acute malnutrition, chronic undernutrition—including stunting and underweight—persists. The findings emphasize the limitations of short-term interventions and highlight the need for integrated strategies combining feeding counselling, maternal education, and improved access to nutrient-rich foods to achieve sustained child growth.

AUTHORS CONTRIBUTION

DC- conception and design, acquisition of data, analysis and interpretation, drafting the article, final approval of the version to be published. JG- acquisition of data, analysis and interpretation, drafting the article, final approval of the version to be published. SN- acquisition of data, final approval of the version to be published. AM- acquisition of data, final approval of the version to be published. NTC- conception and design, revising it critically for important intellectual content, final approval of the version to be published. JKK- revising it critically for important intellectual content

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Nil

CONFLICT OF INTEREST

There is no conflict of Interest.

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DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the author(s) used ChatGPT (OpenAI) to assist in drafting, refining, and organizing the manuscript text for clarity, technical precision, and language consistency. After using this tool, the author(s) reviewed, edited, and approved all content and take full responsibility for the accuracy, integrity, and originality of the publication.

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