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Research Article

Undernutrition and its contributing factors among children aged 6–24 months attending a tertiary care hospital: A cross-sectional descriptive study

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Highlights/Key Messages

- Many children aged 6–24 months were undernourished.
- Food quantity and variety were often inadequate.
- Family income and maternal education affected child nutrition.
- Feeding during illness needs greater attention.
- Community support can help improve child nutrition.

Background
Undernutrition continues to be a major concern among Sri Lankan children under the age of 2 years, despite the country's good maternal and child health indicators. The first 1000 days of life are crucial for proper growth and neurological development, and failing to meet nutritional demands during this time can lead to long-term consequences. While the economic crisis has worsened household food insecurity, there is very limited information on how this has affected complementary feeding (CF), particularly during childhood illness, when specific nutritional interventions may be able to reverse their growth faltering.

Objective
This study assessed the prevalence of undernutrition and the factors contributing to it among infants and young children attending a tertiary care centre.

Methods
A cross-sectional descriptive study was conducted at Colombo South Teaching Hospital (CSTH) involving 246 children aged 6–24 months. Anthropometric measurements were used to evaluate nutritional status, while CF practices and socio-demographic variables were assessed via an interviewer-administered questionnaire. Descriptive statistics and chi-square testing were used for data analysis.

Results
Among those studied, 14.6% were underweight, 18.3% were stunted, and 24.8% had wasting. Both stunting and wasting were significantly associated with poor maternal education ($p<0.05$) and lower household income ($p<0.01$). Inadequate CF, particularly low quantity, was a major contributor, increasing the odds of underweight (Odds Ratio/OR=3.2), stunting (OR=4.5), and wasting (OR=2.1). Although meal frequency and food consistency were mostly appropriate, the diversity guidelines were met in only 76.8% of cases. Offering extra meals was seen in 78% during illness, but few provided energy-dense (21%) or favourite foods (43%).

Conclusion
While frequency was generally adequate among 6–24-month-old children attending the paediatric clinic or ward at CSTH, shortcomings remained in the quantity of food, dietary diversity, and feeding during illness. Interventions, particularly maternal education for low-income families, are important for improving nutrition in this age group.

Keywords: undernutrition, complementary feeding, socioeconomic disparities, feeding during illness

Introduction

Undernutrition is defined as a lack of adequate energy and nutrients to meet the body's needs for maintaining good health (Maleta, 2006). It includes various conditions such as stunting (low length-for-age), wasting (low weight-for-length), underweight (low weight-for-age), and micronutrient deficiencies (Grantham-McGregor & Ani, 2001; Black et al., 2008; Bekelman, 2018). Internationally, undernutrition remains a major public health problem for both developed and developing countries (Worku et al., 2021).

The first two years of life are crucial for optimal nutrition, growth, and development (Moghaddam et al., 2015). The period from 6 to 24 months is particularly sensitive, as nutritional deficiencies during this window are common and can lead to irreversible consequences, including impaired cognitive ability and reduced educational and economic performance (Worku et al., 2021).

Sri Lanka continues to face a substantial burden of childhood malnutrition. In one representative 2022 sample, 43.4% of children under five had one or more nutritional problems: 15.3% were underweight, 10.1% were wasted, and 9.2% stunted—all showing an upward shift (Central Bank of Sri Lanka, 2023). This deterioration in nutritional status occurred amid the severe economic crisis Sri Lanka has experienced since 2020. During the crisis, food insecurity and malnutrition became highly prevalent, while inflation reached 60% in June 2022, significantly limiting families' ability to afford adequate nutrition (Rahman et al., 2022).
Child undernutrition in Sri Lanka is associated with maternal, household, and socioeconomic conditions. A mother's height and the family's wealth were found to be the strongest predictors of stunting in children (Rannan-Eliya et al. 2013). Other important issues like food insecurity, alcoholism, and poor living conditions—especially in the estate sector—have also been highlighted (Jayawardena et al. 2014). Additionally, factors such as maternal employment, having many siblings, and low monthly income are closely linked to child undernutrition (Galgamuwa et al. 2017).

Inappropriate complementary feeding practices are also common in Sri Lanka, particularly in tea estate sectors and among families with lower maternal education and socioeconomic status, as demonstrated in an analysis of Demographic and Health Survey data involving 2106 children aged 6–23 months (Senarath et al., 2011).

Despite the data cited above, there is limited recent local evidence evaluating the contributing factors and complementary feeding practices among children aged 6–24 months in Sri Lanka, particularly in the context of the recent economic crisis and rising food insecurity. Therefore, this study was conducted to assess undernutrition and its contributing factors among children aged 6–24 months attending a tertiary care hospital in Sri Lanka.

Methods

Study Design and Setting

This cross-sectional descriptive study was conducted over a six-month period, from January to July 2024, at Colombo South Teaching Hospital (CSTH), a tertiary care hospital in Sri Lanka. The study population comprised children aged 6–24 months and their primary caregivers.

Study Population and Sampling

Children aged 6–24 months attending the paediatric clinic or ward at CSTH with their primary caregiver were considered for recruitment (N=246). Written informed consent was obtained from all caregivers.

- Recruitment was conducted on clinic and ward days when the researcher was available for data collection. During these periods, all eligible children who met the inclusion criteria were invited to participate, regardless of nutritional status, diagnosis, or feeding practices.
- Outpatients (n = 152): These children were recruited from the routine vaccination clinic, where they attended for scheduled immunisations during the data-collection period.
- Inpatients (n = 94): These children were admitted with acute illnesses of ⩽2 days' duration. Common admission reasons included:
  - suspected dengue requiring monitoring (e.g., low platelet counts),
  - admissions for vaccination under observation due to previous allergic reactions,
  - minor head injuries requiring short observation,
  - suspected accidental poisoning,
  - and other short-duration acute presentations

Children with acute illnesses lasting more than 2 days were excluded to minimise the influence of acute disease on anthropometric measurements. Anthropometric measurements for inpatients were obtained immediately upon admission, before initiation of treatment or further clinical progression, ensuring that any acute illness present at the time had minimal opportunity to affect measurements.

Sample Size Calculation

The sample size was calculated using the standard formula: $n=Z^2pq/d^2$

For a 95% confidence level (Z = 1.96), assuming a prevalence of undernutrition (p) = 20% (Edington et al., 2000), with q = 1 − p = 80%, and a margin of error (d) = 5%, the calculation was: n = (1.96)2×0.20×0.80/(0.05)2=245.86. This was rounded up to a final sample size of 246 participants.

Inclusion Criteria

- Children aged 6–24 months attending the clinic or ward with their primary caregiver.

Exclusion Criteria

- Children with acute illness > 2 days' duration.
- Children with congenital anomalies or chronic illnesses known to affect growth.
- Children presenting with dehydration (e.g., acute diarrhoea) or oedematous conditions (e.g., nephrotic syndrome).
- Children for whom a primary caregiver was not available.

Caregiver Definition

The primary caregiver was defined as the parent or guardian directly responsible for feeding and daily care. This was most often the mother. Where the mother was unavailable, the father or grandmother was included if they had primary

caregiving responsibility. Children accompanied by bystanders or temporary caregivers were excluded.

Data Collection and Analysis

Data were collected using a structured, interviewer-administered questionnaire developed for this study. The questionnaire captured socio-demographic characteristics and complementary feeding practices according to WHO Infant and Young Child Feeding (IYCF) indicators (World Health Organization, 2021), including initiation age, feeding frequency, dietary diversity, and food consistency. A 24-hour dietary recall was performed using household utensils and visual aids to improve accuracy.

Anthropometric measurements (weight and length) were obtained using standard equipment in accordance with WHO protocols, and values were plotted on WHO growth charts. Nutritional indicators (underweight, stunting, wasting) were defined using the −2SD cut-off. Anthropometric measurements were taken by trained researchers and house officers following prior training in measurement procedures. Data were analysed using SPSS version 20.

Ethical Considerations

Ethical approval was obtained from the Ethics Review Committee of CSTH. The study participants were children aged 6–24 months. Written informed consent for participation and data collection was obtained from their parents or primary caregivers prior to enrolment. Confidentiality was maintained through an anonymised data collection method, and results were disseminated via academic channels.

Results

The study sampled 246 children aged 6–24 months. The age and sex distribution of the study participants is shown in Table 1.

Table 1. Age and sex distribution of sample children

Category	Frequency (n=246)	Percentage
Child Age (months)		
6 - 11	58	23.5%
12 - 17	105	42.6%
18 – 24	83	33.7%
Sex		
Male	115	46.7%
Female	131	53.2%

The prevalence of undernutrition was as follows 14.6% of children were underweight, 18.3% were stunted, and 24.8% were wasted. Among those with wasting, 16% had moderate acute malnutrition and 9% had severe acute malnutrition. When including those at risk, the total prevalence of wasting was 39.3%. The distribution of undernutrition types by severity is illustrated in Figure 1.

The sociodemographic characteristics of the sample caregivers are summarised in Table 2.

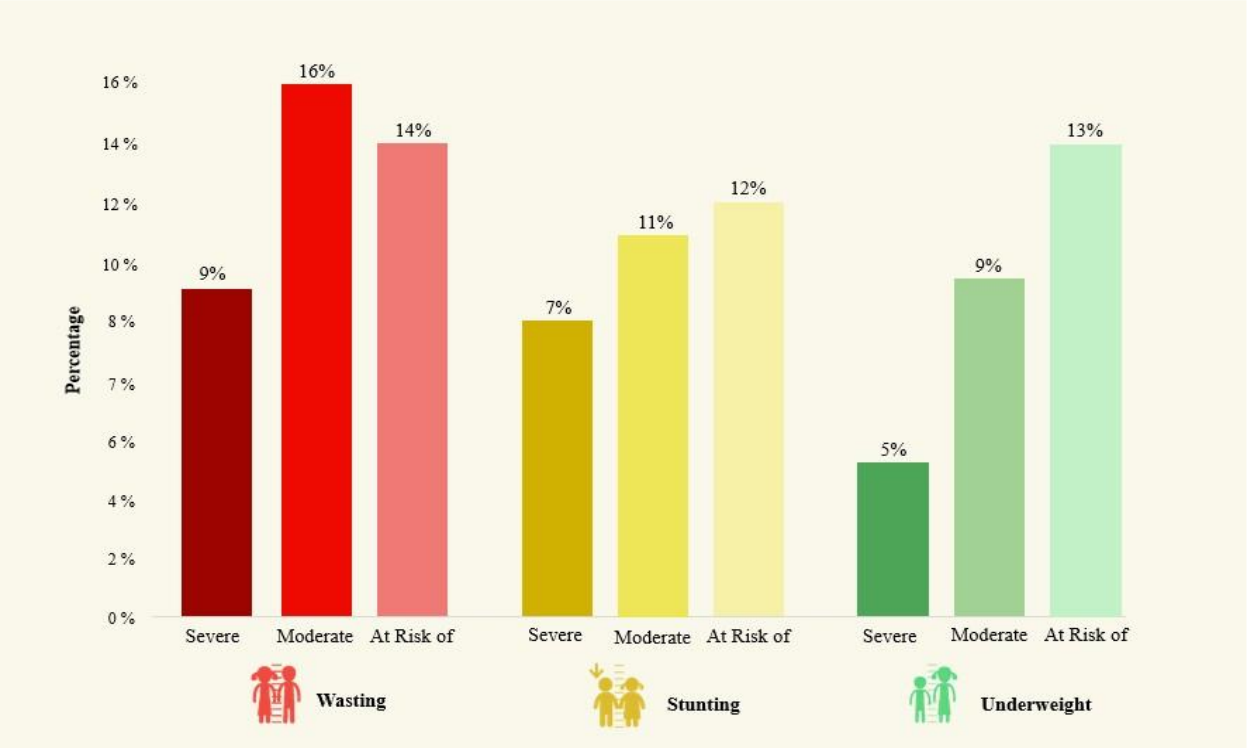


Figure 1. Distribution of Undernutrition types by severity in children aged 6–24 months

Note: Underweight, stunting, and wasting were defined as weight-for-age, length-for-age, and weight-for-length Z-scores < −2 SD, respectively. Children with Z-scores between −1 SD and −2 SD were classified as being at risk of the corresponding condition (World Health Organization, 2006).

Table 2. Sociodemographic characteristics of caregivers of children aged 6–24 months

Category	Frequency (n=246)	Percentage
Maternal Age		
<19y	4	1.7%
20–24y	40	16.2%
25–29y	63	25.6%
30–34y	101	41.0%
>35y	38	15.4%
Caregiver's Education		
Primary School	13	5.3%
Grade 6-10	29	11.7%
O/L (Ordinary Level)	110	44.7%
A/L (Advanced Level)	67	27.2%
College/University	27	11%
Annual Household Income		
<Rs 20,000*	9	3.7%
Rs 20,000–49,999	108	43.9%
Rs 50,000–99,999	91	37.0%
>Rs 100,000	38	15.4%
Marital status		
Married	242	98.4%
Separated/Divorced	2	0.8%
Widowed	2	0.8%
Religion		
Buddhist	187	76.0%
Hindu	23	9.3%
Catholic	15	6.1%
Muslim	11	4.5%
Christian	5	2.0%
Other	5	2.0%

* During the study period (January–July 2024), the approximate exchange rate was 1 Sri Lankan Rupee (LKR) ≈ US$0.0033.

In terms of breastfeeding, 87.9% of children continued to receive breast milk after six months, and among children over one year of age (n=188), 85% were continuing breastfeeding. Other IYCF indicators, assessed as either adequate or inadequate, are presented in Table 3.

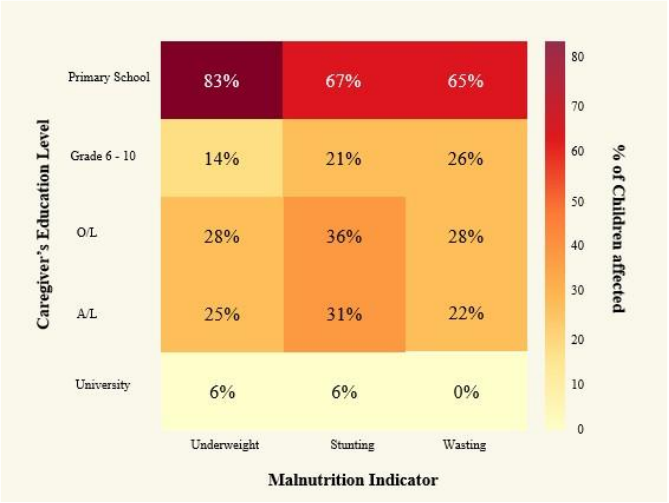
Table 3. Infant and Young Child Feeding (IYCF) Practices Among Children Aged 6–24 Months (n = 246)

Indicator	Adequate	Inadequate
Timely CF Initiation	155 (63%)	91 (37%)
Meal Frequency Adequacy	227 (92.3%)	19 (7.7%)
Food Consistency Adequacy	229 (93%)	17 (23.2%)
Dietary Diversity Adequacy	189 (76.8%)	57 (23.2%)
Use of Iron-Rich Foods	131 (53.3%) (Daily)	115 (46.7%) (Occasional/Never)
Use of Vitamin C – Rich Foods	91 (37%)	155 (63%)

Note: Meal frequency and timely initiation of complementary feeding were classified according to WHO Infant and Young Child Feeding recommendations (World Health Organization, 2021). Food consistency, dietary diversity, daily consumption of iron-rich foods, and the addition of vitamin C-rich foods to meals were assessed against national infant feeding recommendations (Ministry of Healthcare and Nutrition, 2007).

A gradient in the prevalence of underweight, stunting, and wasting was observed across maternal education categories. As depicted in Figure 2, the highest levels of stunting (67%), wasting (65%), and underweight (83%) were found in children of mothers who had primary education only. None of the children of graduated mothers was wasted.

Figure 2. Association Between Maternal Education and Nutritional Status of Children



Note: O/L = General Certificate of Education Ordinary Level; A/L = General Certificate of Education Advanced Level. Percentages indicate the proportion of children within each caregiver education category who met the criteria for the respective nutritional indicator. Underweight, stunting, and wasting were defined as weight-for-age, length-for-age, and weight-for-length Z-scores < −2 standard deviations (SD), respectively (World Health Organization, 2006)

Household income was also inversely related to nutritional status. Children from the lowest income category showed the highest rates of severe wasting (20%) and stunting (80%). Maternal age was also significantly linked with child nutrition outcomes. Children of adolescent mothers had the highest risk (100% underweight, 50% wasted). The 30–34-

year-olds had the best outcomes, with greater than 79% of children within the normal range for weight-for-age. For the higher age groups, the children of mothers above 35 years of age showed a greater risk for stunting, despite reduced rates of wasting.

The link between inadequate CF quantity and wasting is illustrated in Figure 3. Inadequate CF was significantly associated with underweight (OR = 3.2, $p < 0.001$), stunting (OR = 4.5, $p < 0.001$), and wasting (OR = 2.1, $p = 0.043$).

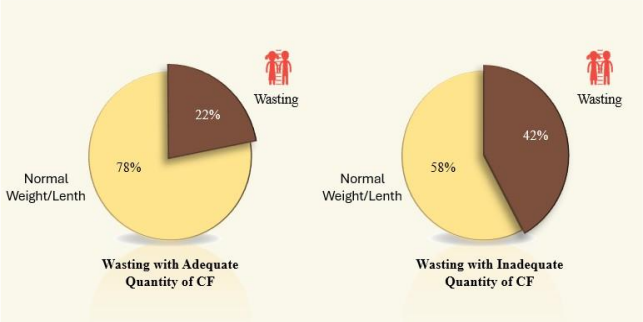


Figure 3. Wasting Risk by Feeding Volume

Stunting was significantly associated with inadequate dietary diversity ($\chi^2 = 9.67$, $p < 0.01$). Lack of daily intake of iron-rich foods was significantly associated with an increased prevalence of wasting ($\chi^2 = 15.4$, $p < 0.001$).

Regarding feeding practices during illness, 77.6% of caregivers offered extra meals. Further, 83.3% maintained a feeding frequency of at least three times a day. 20.7% of caregivers added extra oil to food to increase its energy density, and 43.1% provided the child's preferred or favourite foods to stimulate appetite. 61% of caregivers reported increased frequency of breastfeeding during illness, while 39% did not. In addition, 66.3% of caregivers actively stimulated their children to eat.

The distribution of the mostly affected population subgroups—teenage mothers, households with incomes below Rs. 20,000, and mothers with only primary education—is illustrated in Figure 4.

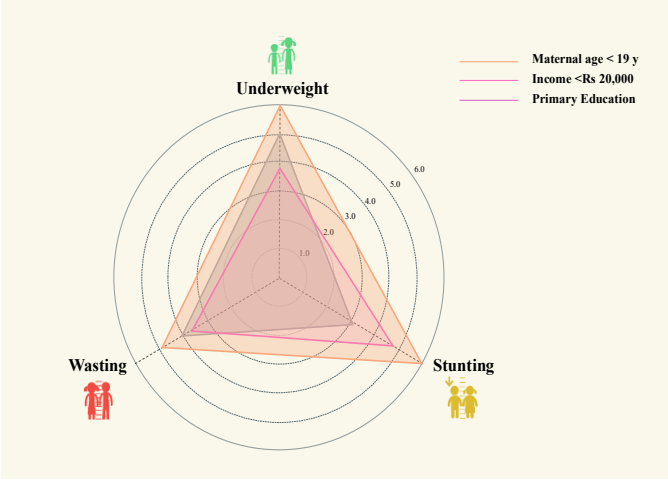


Figure 4. Intersection of social factors with types of malnutrition

Discussion

This study highlights a substantial burden of undernutrition among children aged 6–24 months attending a tertiary care hospital in urban Sri Lanka, with wasting (24.8% moderate/severe; 39.3% including at-risk cases) emerging as the most prevalent form, followed by stunting (18.3%) and underweight (14.6%). When compared to community-based data from the Gampaha district—which reported stunting, wasting, and underweight rates of 16.3%, 9.5%, and 18.7%, respectively, among children aged 2–5 years (Dissanayake et al., 2023)—these hospital-based findings suggest a higher prevalence of acute malnutrition, particularly wasting, in this clinical population. This difference may partly reflect the older sample in that study, as well as the hospital-based nature of the present sample. In addition, the present study was conducted in the aftermath of an economic crisis in Sri Lanka, which has been associated with increased food insecurity and worsening child nutrition indicators nationally (Central Bank of Sri Lanka, 2023; Matthias & Jayasinghe, 2022).

Although stunting in our sample was lower than the global average of 22.3% (World Health Organization, 2023), the level of wasting remains far above the global estimate of 6.8% and is concerning. Comparisons with Indian data (IIPS & ICF, 2021) indicate that Sri Lanka's prior gains in child nutrition may have been reversed following the 2022 economic crisis.

The steep gradient in undernutrition prevalence—from 83% underweight among children of primary-educated mothers to 0% in university-educated households—reflects the threshold effect described in sub-Saharan Africa, where maternal education beyond secondary level was critical for reducing stunting (Makoka & Masibo, 2015). This suggests that, while Sri Lanka's free primary education policies are beneficial, they may be insufficient without parallel investments in girls' secondary education and women's economic empowerment.

Children from the lowest-income households showed the highest levels of severe wasting and stunting, while those from higher-income households demonstrated significantly better nutritional outcomes. This gradient underscores the strong influence of income on food security, dietary diversity, and access to nutrient-rich foods—factors that have been strained by the recent economic crisis.

A U-shaped association was observed between maternal age and child undernutrition, where children of both adolescent and older mothers faced higher nutritional risks, while those born to mothers aged 30–34 years had the best outcomes. This suggests possibility of vulnerabilities at both ends of the maternal age spectrum, requiring age-specific strategies within maternal and child nutrition programs.

CF practices were generally good but showed some gaps. Lower quantities of CF were fed to malnourished infants, but a cross-sectional study does not inform us whether this is cause or effect; it is likely both. These findings are consistent with previous Sri Lankan evidence. Senarath et al. (2011) reported that inappropriate complementary feeding practices were more common among children from

socioeconomically disadvantaged households and among mothers with lower educational attainment. Similarly, Bandara et al. (2014) demonstrated that while breastfeeding practices were generally favourable, complementary feeding during the latter half of infancy frequently failed to meet recommended standards for adequacy and quality. Qualitative research from rural Sri Lanka has also identified deficiencies in caregiver knowledge and practices related to responsive feeding, which may contribute to inadequate dietary intake among young children (Pallewaththa et al., 2019).

Continued breastfeeding in this population is commendably high (87.9%), consistent with global guidance (North et al., 2021). However, inadequate complementary feeding—particularly limited dietary diversity and low nutrient density—may contribute to unmet nutritional needs after 6 months, underscoring the need to strengthen the quality of complementary foods rather than reduce breastfeeding duration.

There were gaps in feeding practices during illness, particularly a failure to add oil or offer preferred foods, despite increased energy needs during these episodes (Food and Nutrition Centre, 2012). These findings emphasise the need for strengthened caregiver education on age-appropriate complementary feeding and feeding during illness, along with broader interventions to address socioeconomic barriers to accessing nutrient-dense foods.

Limitations

This study has several limitations. First, the cross-sectional design prevents assessment of temporal relationships; therefore, we cannot determine the direction of causality between the examined factors and child nutritional status or feeding patterns. Second, as a hospital-based study drawing participants from both inpatient wards and outpatient vaccination clinics, the findings may not be generalisable to the wider community of children aged 6–24 months. Moreover, possible differences between inpatient and outpatient populations were not separately examined, which may have obscured distinct risk factors or associations unique to each group. Third, there may be residual confounding due to unmeasured variables such as birth weight, maternal nutritional status, household food security, infection burden, maternal employment, and family size. Finally, several subgroup analyses involved small sample sizes, limiting statistical power to detect meaningful differences and reducing the stability of the estimates.

Conclusions

In conclusion, this study shows that children aged 6–24 months attending an urban clinic face a high burden of undernutrition. Key contributors include inadequate CF practices—particularly insufficient dietary diversity and quantity—and inadequate feeding during illness. Undernutrition was strongly associated with lower maternal education, lower household income, and maternal age at both younger and older extremes. These findings underscore the need for targeted community-level interventions to strengthen caregiver education, support access to nutrient-dense complementary foods, and address socioeconomic barriers.

Author Contributions

MBNM: methodology, investigation, formal analysis, writing - original draft. SG: Conceptualization, methodology, supervision, writing - review & editing. Both authors then critically reviewed the following versions. Both authors have read and approved the final version of the paper and its submission and have given consent for publication.

Declaration of Generative AI and AI-Assisted Technologies in Scientific Writing

The authors used CHATGPT 4.0 as an editing tool to improve grammar and readability. No part of the content, data analysis, or interpretation was generated by AI. The authors take full responsibility for all aspects of the manuscript.

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None

Data Availability Statement

The data supporting the findings of this study are presented within the article. The underlying dataset is not publicly available because of ethical and confidentiality restrictions relating to the protection of participant information.

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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