Maternal Dietary Intake and Presence of Colic Symptoms among Exclusively Breastfed Infants in Selected Healthcare Facilities in Akure South Local Government Area of Ondo State, Nigeria

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ABSTRACT

Background: Infantile colic, defined as inconsolable crying exceeding three hours per day, more than three days per week, for at least three weeks, remains a major concern in neonatal and infant care. Maternal dietary intake during exclusive breastfeeding has been implicated as a potential modifying factor. This study examined the association between maternal dietary intake and the occurrence of infantile colic symptoms among exclusively breastfed infants in selected primary healthcare facilities in Akure South Local Government Area, Ondo State, Nigeria.

Methods: A descriptive cross-sectional design was adopted. Using simple random sampling, 351 nursing mothers of infants aged 0–24 months attending selected healthcare facilities were recruited. Data were collected via a structured questionnaire and analysed using SPSS version 25. Descriptive statistics and chi-square test were employed.

Results: The majority of mothers demonstrated good dietary practices (52.4%), with high consumption of fruits (38.5% consumed 3–4 times/week), vegetables (43.6%), fish (42.7% at 5–7 times/week), meat/poultry (48.1% at 5–7 times/week), and processed/fast foods (58.7% at 5–7 times/week). The prevalence of infantile colic was 22.8%. Antibiotics were the predominant management strategy (80.1%). Chi-square analysis revealed no statistically significant relationship between maternal dietary intake and infantile colic (X^2=1.65, df=2, p=0.43).

Conclusion: Although overall maternal dietary quality was good, the high prevalence of infantile colic (22.8%) and predominant use of over-the-counter antibiotics as a management strategy underscores the urgent need for targeted health education and nutritional counselling among breastfeeding mothers in Nigerian primary healthcare settings.

Keywords: Infantile colic, maternal dietary intake, exclusive breastfeeding, colic prevalence, Nigeria, primary healthcare, nutritional counselling

INTRODUCTION

Infantile colic stands as one of the most distressing and frequently misunderstood conditions affecting neonates and young infants globally. Clinically defined as paroxysms of inconsolable crying lasting more than three hours per day, more than three days per week, and persisting for more than three weeks in an otherwise healthy and well-nourished infant, infantile colic was first systematically characterized by Wessel et al. in 1954, a definition that, despite the passage of seven decades, continues to serve as the foundational diagnostic criterion (Wessel et al., 1954). More recent consensus guidelines from the Rome IV Working Group have refined the diagnostic framework for clinical research, requiring caregiver-reported crying or fussing for at least 3 hours per day on 3 or more days per week, as confirmed by prospective diary monitoring (Benninga et al., 2016). Notwithstanding definitional nuances, the core clinical picture, a healthy, thriving infant exhibiting repeated, intense, and seemingly inexplicable episodes of distress, remains unambiguous and universally recognised.

The global epidemiological burden of infantile colic is substantial and cannot be understated. Systematic reviews and meta-analyses consistently report a prevalence ranging from 10% to 40% of infants worldwide, with peak symptom expression occurring at approximately six weeks of age and spontaneous resolution typically by three to six months of life (Vandenplas et al., 2015; Wolke et al., 2017). The condition demonstrates no predilection for sex, gestational age, or feeding modality, occurring with equal frequency in breastfed and formula-fed infants (Clifford et al., 2002). Within the Nigerian context, an incidence rate of 36% was documented among infants presenting to healthcare facilities in Lagos State. This figure is broadly consistent with, though at the upper boundary of, global estimates (Oshikoya et al., 2009). This high prevalence rate, combined with the substantial psychosocial toll that infantile colic imposes on families, makes it a priority public health concern demanding evidence-based investigation.

The pathophysiological mechanisms underlying infantile colic remain incompletely elucidated, a reality that has generated considerable investigative activity over recent decades. Several hypotheses have been advanced, including alterations in intestinal microbiota composition, cow's milk protein intolerance or lactose malabsorption, gastrointestinal immaturity and dysmotility, increased serotonin secretion, visceral hypersensitivity, and psychosocial factors encompassing maternal anxiety and parenting experience (Johnson et al., 2015; Camilleri et al., 2017). Emerging microbiome research has demonstrated that colicky infants harbour a distinctly dysbiotic intestinal microbiota, characterised by reduced levels of bifidobacteria and lactobacilli, elevated concentrations of gas-producing Proteobacteria, including Escherichia coli and higher levels of Klebsiella species compared to non-colicky controls (Weerth et al., 2013). These microbiological perturbations produce measurable consequences: faecal calprotectin levels, a marker of intestinal inflammation, have been documented to be twice those in colicky infants relative to healthy controls, pointing to a genuine but subtle inflammatory milieu in the neonatal gut (Ventura et al., 2006). Furthermore, increased intestinal permeability, a condition that allows the translocation of partially digested dietary macromolecules from the maternal diet into breast milk and subsequently across the immature neonatal gut wall, has been proposed as a critical link between maternal nutrition and infant symptomatology (Vandenplas et al., 2015; Halpern et al., 2015).

The role of maternal dietary intake in the genesis or amelioration of infantile colic in exclusively breastfed infants constitutes a particularly important dimension of this discourse. Human breast milk is not a static secretion; it is a biologically dynamic fluid whose composition is continuously influenced by the maternal diet, hormonal milieu, and gut microbiome. Multiple bioactive compounds from the maternal diet, including protein fragments derived from cow's milk, eggs, wheat, soy, and nuts; fat-soluble vitamins; omega-3 fatty acids, including docosahexaenoic acid (DHA); and various oligosaccharides, transit into breast milk and reach the infant in either intact or partially metabolised forms (Fukushima et al., 1997; Zhu et al., 2019). An observational study by Kidd et al. (2019) demonstrated that maternal exclusion of specific dietary components, notably caffeine, cruciferous vegetables such as broccoli and cabbage, allium vegetables including garlic and onions, legumes, spicy foods and gluten, was associated with measurable reductions in infant crying and

fussing duration. These findings have contributed to the growing clinical and scientific interest in dietary manipulation as a potentially accessible, low-risk intervention for managing infantile colic.

Despite this scientific context, critical knowledge gaps persist, particularly in sub-Saharan African settings, where cultural food practices, dietary diversity, and socioeconomic determinants of nutrition differ substantially from those of populations studied in high-income countries. In Nigeria, mothers frequently attribute infant distress to abdominal colic, and this attribution often leads to inappropriate and sometimes harmful self-treatment practices, including the unsupervised use of over-the-counter antibiotics, herbal preparations, and antispasmodic agents (Chinawa et al., 2013). The intersection of traditional food beliefs, limited maternal nutrition literacy, and inadequate healthcare counselling creates a complex environment in which infantile colic is both undertreated therapeutically and overtreated pharmacologically. Understanding the specific dietary patterns of breastfeeding mothers in this context, and their relationship, or lack thereof, with infantile colic symptomatology, is therefore not merely an academic exercise but a public health imperative.

Akure South Local Government Area, situated in Ondo State, Southwest Nigeria, provides an ecologically and demographically representative setting for this investigation. The area encompasses a heterogeneous population with varying levels of formal education, household income, and dietary access. Its 30 primary healthcare facilities, including both comprehensive health centres serving as study sites and basic health centres, represent the frontline of maternal and child health services for a predominantly urban and peri-urban population. These facilities register considerable patient throughput for immunisation, antenatal care, postnatal follow-up, and management of common childhood illnesses, making them ideal platforms for community-based maternal and infant health research. The present study was therefore designed to rigorously assess maternal dietary intake patterns and their association with the prevalence of infantile colic among exclusively breastfed infants attending selected healthcare facilities in this setting, using validated epidemiological methods and a sufficiently powered sample to generate reliable, generalizable findings. Despite the well-established global burden of infantile colic affecting between 10% and 40% of infants worldwide, and the documented predilection among Nigerian mothers to self-medicate colicky infants, often with over-the-counter antibiotics devoid of evidence-based justification, there remains a striking paucity of contextually specific, empirically grounded studies examining the relationship between the dietary intake of breastfeeding mothers and the occurrence of infantile colic symptoms among exclusively breastfed infants in Akure South Local Government Area, Ondo State, a gap this study seeks to bridge.

Research Objectives

The general objective of this study was to assess maternal dietary intake and its association with infantile colic among exclusively breastfed infants in selected healthcare facilities in Akure South Local Government Area, Ondo State, Nigeria. The specific objectives were to: (1) assess maternal dietary intake patterns; (2) determine the prevalence of infantile colic; (3) assess maternal treatment strategies for infantile colic; and (4) determine the relationship between maternal dietary intake and the presence of colic symptoms.

REVIEW

Conceptual Framework: Infantile Colic and Its Classification

Infantile colic occupies a recognised position within the taxonomic framework of functional gastrointestinal disorders (FGIDs), a broad category of conditions characterised by chronic or recurrent gastrointestinal symptoms that cannot be attributed to structural, biochemical, or infectious pathology. FGIDs are estimated to affect approximately 50% of all infants, and among affected infants, up to 75% present with symptoms meeting criteria for more than one concurrent FGID diagnosis (Vandenplas et al., 2015; Bellaiche et al., 2018). Within this category, infantile colic is estimated to have an overall incidence of approximately 20%, though considerable variability across populations and diagnostic criteria complicates precise epidemiological characterisation (Vandenplas et al., 2015). The Rome IV consensus criteria represent the most current and rigorously validated diagnostic framework, defining infantile colic for clinical research purposes as caregiver-

reported crying or fussing of at least three hours per day on three or more days per week, measured prospectively by a 24-hour behavioural diary, in an infant younger than five months of age without evidence of failure to thrive, fever, or underlying organic illness (Benninga et al., 2016).

The temporal pattern of infantile colic is a clinically informative feature. The condition manifests predominantly in the evening hours, exhibits the highest incidence rates in the first six weeks of life (with reported rates of 17–25% during peak expression), and declines sharply thereafter, to approximately 11% at eight to nine weeks of age and less than 1% by ten to twelve weeks (Wolke et al., 2017). This natural history of spontaneous resolution by approximately three to four months of age is an important clinical consideration, as it cautions against the premature initiation of pharmacological interventions while simultaneously underscoring the need for effective parental support during the symptomatic period. Studies by Garnacho-Garnacho et al. (2024) have highlighted maternal psychological well-being as a protective factor against infantile colic, suggesting a bidirectional relationship among maternal mental health, infant care quality, and colic symptom expression. This perspective enriches the understanding of infantile colic as a multidimensional condition shaped by biological, nutritional, and psychosocial determinants.

Epidemiology and Magnitude of Infantile Colic

The global epidemiological literature on infantile colic documents both significant prevalence variation and meaningful regional differences that reflect population-specific biological, dietary, and healthcare system factors. A comprehensive systematic review and meta-analysis by Wolke et al. (2017), synthesising data from 22 prospective studies, found that the pooled prevalence of infantile colic ranged from 9% to 28% across geographic settings and definitions, with a combined estimate of approximately 19.9% when applying the validated Wessel criteria. In developing-country settings, however, reported rates frequently exceed those observed in high-income countries, potentially reflecting differences in maternal nutritional status, healthcare access, infant gut microbiome colonisation patterns, and variability in the definition of colic used by treating clinicians. Helen (2024), in a recent study conducted at pediatric outpatient clinics in Wolkite Town, Ethiopia, documented a colic prevalence of 22.3% alongside significant associations with maternal psychological factors and feeding practices, findings that are broadly consonant with the prevalence reported in the present Nigerian study.

Within the Nigerian context, the documented burden of infantile colic is considerable. Oshikoya et al. (2009) reported an incidence rate of 36% in a Lagos State study conducted between April and September 2006, a figure substantially higher than the 10–30% range reported in many international studies but consistent with the upper bound of global estimates reported by Clifford et al. (2002). Chinawa et al. (2013) highlighted the significant proportion of Nigerian mothers who attribute childhood illness symptoms, including excessive crying, to abdominal colic and the attendant risk of inappropriate treatment. The present study, conducted in Akure South, documented a prevalence of 22.8%, contributing original primary data to the Nigerian epidemiological literature on this subject and providing a basis for geographic comparison within the country's diverse public health landscape.

Aetiology and Pathophysiology of Infantile Colic

The aetiology of infantile colic is multifactorial and incompletely understood. Among the most extensively investigated mechanisms is gut microbiota dysbiosis. Studies have consistently demonstrated that the intestinal microbiome of colicky infants differs qualitatively and quantitatively from that of non-colicky peers, with lower levels of bifidobacteria and Lactobacillus species, both groups recognised for anti-inflammatory and barrier-protective properties, and elevated abundances of gas-producing and pro-inflammatory Proteobacteria, including Escherichia coli and Klebsiella species (Weerth et al., 2013; Ouald Chaib et al., 2020). Barnett et al. (2025), in a comprehensive analysis of the KOALA birth cohort, demonstrated that specific early-life gut microbial configurations predicted colic, constipation, and abdominal cramps, reinforcing the centrality of the microbiome in the aetiology of infantile colic. These findings are mechanistically coherent with the observation that breastfed infants with colic exhibit visceral hyperalgesia, a lowered pain threshold in response to normal gut distension, possibly mediated by microbiota-derived signals acting on the enteric nervous system and the developing brain-gut axis (Eutamène et al., 2017; Camilleri et al., 2017).

Intestinal mucosal immaturity constitutes an additional, complementary pathophysiological dimension. During the first months of life, the neonatal gut barrier is characterised by incomplete tight junction assembly and immature immune surveillance mechanisms, a developmental state that facilitates the translocation of dietary macromolecules, including intact or partially digested proteins derived from the maternal diet, across the intestinal epithelium (Halpern et al., 2015). This increased mucosal permeability, demonstrated experimentally in both breastfed and formula-fed infants with colic by elevated urinary lactulose/mannitol ratios, provides a biologically plausible mechanism linking maternal dietary antigens to the generation of colic symptoms (Vandenplas et al., 2015). Iacovou et al. (2012) proposed that a low-FODMAP (fermentable oligosaccharides, disaccharides, monosaccharides, and polyols) maternal diet may reduce the substrate available for intestinal fermentation in the infant gut, thereby decreasing gas production and visceral distension. The role of immature hepatic bile acid synthesis and reduced intraluminal concentrations, which impair fat absorption and increase colonic fermentation, has also been advanced as a contributory mechanism (Camilleri et al., 2017).

Maternal Dietary Intake and Breast Milk Composition

The intimate relationship between maternal dietary intake and breast milk composition constitutes the biological substrate upon which the dietary hypothesis of infantile colic rests. Research conducted by Fukushima et al. (1997) established that the regular ingestion of bovine milk by breastfeeding mothers results in quantifiable levels of bovine milk peptides in breast milk, with the magnitude of secretion varying by protein source, bovine milk peptides appearing at higher concentrations than ovalbumin following equivalent maternal intake. More recently, Zhu et al. (2019) employed mass spectrometry to identify non-human peptides and proteins in human milk samples, confirming that the maternal dietary proteome makes a meaningful contribution to breast milk composition. These observations are clinically significant because dietary protein antigens, when present in breast milk at sufficient concentrations, may trigger or exacerbate immunological responses in genetically susceptible infants, precipitating a cascade of mucosal inflammation, gut dysmotility, and visceral hypersensitivity that underlie the symptomatology of colic.

Vázquez et al. (2025) conducted a mixed-methods study examining the role of nutritional advice during breastfeeding in relieving infant colic, finding that mothers who received structured dietary guidance reported greater reductions in infant colic symptoms and demonstrated improved adherence to anti-inflammatory dietary patterns. The maternal Mediterranean dietary pattern, characterised by high intake of fruits, vegetables, fish, whole grains, legumes, and olive oil, has been specifically evaluated in Lebanese mothers by Hanna (2020), who found that adherence to a dairy-free Lebanese Mediterranean diet was associated with significant reductions in colic and allergy symptom burden among exclusively breastfed infants. These findings converge with the systematic review evidence compiled by Iacovou et al. (2012), which concluded that dietary modifications, including the exclusion of cow's milk protein from the maternal diet, represent the single most consistently supported nutritional intervention for infantile colic management, albeit with heterogeneous study quality and modest effect sizes. Ćorić et al. (2022) similarly documented wide variation in maternal dietary habits and food restrictions during breastfeeding across different cultural contexts, underscoring the need for location-specific research to inform contextually appropriate nutritional guidelines.

Management Strategies and Evidence-Based

The evidence base for the pharmacological management of infantile colic is, on aggregate, disappointing. Simethicone, an anti-foaming agent widely used for the symptomatic relief of gas-related infant discomfort, has been demonstrated in multiple controlled trials to be no more effective than a placebo (Hall et al., 2012). Dicycloverine (dicyclomine), an anticholinergic agent that reduces smooth muscle spasm, was found to produce modest reductions in crying time but carries an unacceptable adverse event profile in infants under six months of age, including apnea, and is therefore contraindicated (Biagioli et al., 2016). Proton pump inhibitors, commonly prescribed for presumed gastroesophageal reflux disease in colicky infants, do not reduce crying time and contribute to gut microbiome dysbiosis, paradoxically worsening one of the key pathophysiological drivers of colic (Gieruszczak et al., 2014; Mitre et al., 2018). Ellwood et al. (2020), in a systematic review of reviews examining common interventions for infantile colic, concluded that the overall quality of evidence

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remained low to moderate across most management modalities, and that no single intervention could be recommended with high confidence for routine clinical use.

In contrast, probiotic supplementation, particularly with Lactobacillus reuteri DSM 17938- has emerged as the most consistently evidence-supported biological intervention for breastfed infants with colic. A meta-analysis by Szajewska et al. (2016) demonstrated a 2.3-fold higher probability of achieving at least a 50% reduction in crying time with L. reuteri DSM 17938 among breastfed infants compared with controls. Karaahmet and Kaya (2024) further documented that probiotic supplementation in colicky infants was associated with improvements in gastrointestinal symptoms, anthropometric parameters, and breastfeeding duration in a randomised controlled trial. The mechanisms proposed include modulation of gut microbiota composition, reduction of intestinal inflammation, downregulation of pro-inflammatory cytokine production, and restoration of mucosal barrier integrity. Moreno-Villares et al. (2024) evaluated a probiotic mixture of Bifidobacterium longum KABP042 plus Pediococcus pentosaceus KABP041 against L. reuteri DSM17938, finding comparable efficacy in colic management and advancing the case for probiotic diversification. From a maternal dietary perspective, Ostadi et al. (2024) found that a maternal dairy-free intervention could be effective in alleviating infantile colic, with parental atopy status influencing the magnitude of response, while the ESPGHAN consensus position paper on cow's milk allergy by Vandenplas et al. (2024) established clinical protocols for elimination and reintroduction of cow's milk in diagnostic and therapeutic pathways.

Exclusive Breastfeeding and Gastrointestinal Health Outcomes

The promotion of exclusive breastfeeding as the optimal infant feeding modality for the first six months of life is globally endorsed by all major health bodies, including the World Health Organisation, UNICEF, and the Nigerian Federal Ministry of Health, based on its comprehensive protective effects against gastrointestinal infection, malnutrition, atopy, and neurodevelopmental impairment. Rajesh et al. (2023) demonstrated in a questionnaire-based assessment that exclusive breastfeeding practices were significantly associated with reduced gastrointestinal morbidity and antibiotic exposure in the first year of life, while Kariyawasam et al. (2025) documented both short- and long-term nutritional and health advantages of breastfeeding relative to formula feeding. Amzat et al. (2024) specifically examined the sociocultural determinants of exclusive breastfeeding in Africa, identifying a complex interplay of family support structures, traditional beliefs, maternal employment, and access to skilled breastfeeding counselling that shapes breastfeeding duration and exclusivity in the continent.

Despite these established benefits, the relationship between exclusive breastfeeding and infantile colic remains contextually nuanced. Anwer et al. (2025), in a prospective comparative study conducted at a hospital in Karachi, Pakistan, found no significant difference in colic incidence between exclusively breastfed, exclusively formula-fed, and combination-fed infants, consistent with the classical observation of Clifford et al. (2002) that infantile colic occurs with equal frequency regardless of feeding modality. Chandran et al. (2023) adopted a multi-omic approach to characterise the association between the composition of human milk, its proteome, lipidome, and microbiome, and infant colic, identifying specific bioactive milk components associated with increased colic risk and pointing towards future precision nutrition interventions. Ghatak et al. (2021) characterised infantile colic in exclusively breastfed babies as a clinical dilemma, given the absence of standardised management protocols and the tension between the imperative to maintain breastfeeding and the desire to alleviate infant symptoms through dietary modification. These considerations underscore the complexity of the clinical landscape within which the present study is situated and reinforce the need for locally generated data to inform practice.

MATERIALS AND METHODS

Study Design and Setting

This study employed a descriptive cross-sectional research design. This design was selected as most appropriate for estimating the prevalence of infantile colic, characterising maternal dietary intake patterns, and establishing associations between dietary variables and colic outcomes within a defined population at a single

point in time. The study was conducted in Akure South Local Government Area (LGA), one of 18 LGAs in Ondo State, Southwest Nigeria. Akure South LGA encompasses 30 primary healthcare facilities distributed across 11 administrative wards, comprising three comprehensive health centres and 27 basic health centres. The comprehensive health centres serve as referral hubs for the basic health centres and offer a broader spectrum of maternal and child health services. Four healthcare facilities were selected as study sites: Comprehensive Health Centre Oke Ijebu and Comprehensive Health Centre Isolo were purposively selected for their high patient volumes. In contrast, Basic Health Centre Oke Aro and Basic Health Centre Oda were randomly selected from the roster of basic health centres within the LGA.

Study Population and Eligibility Criteria

The target population comprised nursing mothers currently engaged in exclusive breastfeeding of infants aged 0–24 months who attended immunisation, postnatal, and child welfare clinic services at the selected facilities during the study period. Inclusion criteria were: (1) currently breastfeeding exclusively, (2) infant aged 0–24 months, (3) willingness to provide informed written consent. Mothers with infants presenting with acute febrile illness, confirmed organic gastrointestinal pathology, or premature birth below 28 weeks of gestation were excluded to minimise diagnostic confounding.

Sample Size Determination and Sampling Technique

Sample size was calculated using the Leiser Fisher formula: $n = (Z^2 \times P \times (1–P)) / E^2$, where $Z = 1.96$ (95% confidence level), $P = 0.36$ (reference prevalence from Oshikoya et al., 2009), and $E = 0.05$ (5% margin of error). This yielded a sample size of 354, which was adjusted upward by 10% to account for anticipated attrition, resulting in a final target of 351 participants. Simple random sampling was applied at each facility, with eligible participants selected from the daily clinic registers using systematic random sampling to ensure proportional representation of each facility's patient load.

Research Instrument and Data Collection

Data were collected using a structured, pre-tested, interviewer-administered questionnaire comprising three sections: Section A elicited sociodemographic characteristics of the mother and infant; Section B contained the infantile colic assessment instrument, based on modified Wessel criteria adapted for primary healthcare use; and Section C assessed maternal dietary intake using a food frequency questionnaire (FFQ) capturing the frequency of consumption of eight major food groups, fruits, vegetables, dairy products, meat and poultry, fish, legumes and beans, grains and cereals, and processed/fast foods, over the preceding week. Dietary intake was scored compositionally: mothers who consumed more fruits, vegetables, legumes, and beans and less processed or fast food were classified as having good dietary intake, while those with high consumption of processed foods and low consumption of plant foods were classified as having poor dietary intake. The study supervisor validated the instrument, and face and content validity were established through a comprehensive literature review. Pre-testing was conducted in a facility not included in the main study.

Ethical Considerations

Ethical approval for this study was obtained from the Research and Ethics Committee of Obafemi Awolowo University Teaching Hospitals Complex. All participants provided written informed consent prior to enrolment. Participation was entirely voluntary, with the right to withdraw at any point without penalty. Participant anonymity was ensured through the de-identification of all data, and all collected information was used exclusively for research purposes.

Data Analysis

Completed questionnaires were reviewed for completeness and internal consistency prior to data entry. Data were entered and analysed using the Statistical Package for the Social Sciences (SPSS), version 25. Descriptive statistics, including frequencies, percentages, and proportions, were computed for all categorical variables and presented in tabular form. The chi-square (χ^2) test of association was employed to determine the

statistical relationship between maternal dietary intake (classified as good or poor) and the presence or absence of infantile colic symptoms. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Sociodemographic Characteristics of Mothers

Table 4.1: Sociodemographic Characteristics of Mothers (n = 351)

S/N	Variable	Frequency (n)	Percentage (%)
1	Age of Mother (Years)		
	19–28 years	146	41.6%
	29–38 years	167	47.6%
	39–48 years	38	10.8%
2	Household Income (Naira)		
	< 30,000	109	31.0%
	31,000–90,000	98	28.2%
	90,000–120,000	72	20.5%
	> 120,000	72	20.5%
3	Religion		
	Christianity	279	79.5%
	Muslim	72	20.5%
4	Ethnicity		
	Yoruba	296	84.3%
	Ibo	36	10.3%
	Ebira	11	3.1%
	Hausa	8	2.3%
5	Occupation		
	Civil Servant	118	33.6%
	Self-employed	218	62.1%
	Students	10	2.8%
	Unemployed	5	1.4%
6	Level of Education		
	Primary	12	3.4%
	Secondary	139	39.6%
	Tertiary	200	57.0%
7	Place of Residence		
	Urban	269	76.6%
	Rural	82	23.4%
8	Breastfeeding Initiation After Birth		

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	Immediately	54	15.4%
	< 30 minutes	195	55.6%
	30 min – 1 hour	72	20.5%
	> 1 hour	54	8.5%

A total of 351 mothers completed the questionnaire, yielding a 100% response rate. Table 4.1 presents the sociodemographic profile of the participating mothers. The age distribution revealed that the majority of mothers (47.6%) were in the 29–38-year age bracket, followed by the 19–28-year age bracket (41.6%), with the smallest proportion (10.8%) in the 39–48-year age bracket. With respect to household income, the largest category was households earning less than 30,000 Naira per month (31.0%), reflecting the predominantly low- to middle-income socioeconomic profile of the study population. Religious affiliation was dominated by Christianity (79.5%), with a Muslim minority (20.5%), while ethnic composition was overwhelmingly Yoruba (84.3%), consistent with the demographic character of Ondo State. The predominant occupational category was self-employment (62.1%), followed by civil service (33.6%). The majority of mothers (57.0%) had attained tertiary education, and 76.6% resided in urban settings. An important health behaviour finding was that 98.6% of mothers reported not smoking during pregnancy, and 98.9% reported no smokers in their immediate postnatal environment, indicating minimal exposure to a well-established colic risk factor. Regarding breastfeeding initiation, 55.6% initiated within 30 minutes of birth, an indicator of early breastfeeding compliance, and the majority of mothers had one to two children (62.4%).

Sociodemographic Characteristics of Children

Table 4.2: Sociodemographic Characteristics of Children (n = 351)

S/N	Variable	Frequency (n)	Percentage (%)
1	Gender of Child		
	Male	192	54.7%
	Female	159	45.3%
2	Age of Child (Months)		
	0–6 months	80	22.7%
	7–12 months	195	55.6%
	13–18 months	54	15.4%
	19–24 months	22	6.3%
3	Current Weight (kg)		
	1–5 kg	178	50.7%
	6–10 kg	142	40.5%
	11–15 kg	29	8.3%
4	Gestational Age at Birth (Weeks)		
	28–31 weeks	2	0.6%
	31–35 weeks	15	4.6%
	36–40 weeks	279	79.4%
	> 41 weeks	55	15.6%
5	Duration of Exclusive Breastfeeding (Months)		
	1–2 months	48	13.6%

	3–4 months	57	16.5%
	5–6 months	202	57.6%
	7–8 months	44	12.5%
6	Feeding Frequency per Day		
	On-demand	249	71.0%
	Strict schedule	102	29.0%

Table 4.2 presents the child-level sociodemographic data. Male infants constituted a slight majority (54.7%) compared with female infants (45.3%). The predominant age group was 7–12 months (55.6%), followed by 0–6 months (22.7%). The majority of children weighed between 1–5 kg at the time of assessment (50.7%), with a further 40.5% in the 6–10 kg range, consistent with the expected weight trajectories for the observed age distribution. Gestational age at birth was predominantly within the 36–40-week range (79.4%), indicating that term deliveries constituted the overwhelming majority of the sample. Crucially, no child in the sample had any pre-existing medical condition (100% absence), which is consistent with the inclusion criteria for an infantile colic study that requires a baseline of clinical health. The majority of children had been exclusively breastfed for five to six months (57.6%), reflecting good adherence to WHO exclusive breastfeeding guidelines. On-demand feeding was the prevailing practice (71.0% of mothers), which is appropriate for neonatal and infant nutritional needs.

Maternal Dietary Intake

Table 4.3: Frequency of Food Consumption Among Breastfeeding Mothers (n = 351)

S/N	Food Category	Frequency (n)	Percentage (%)
1	Fruits		
	0–2 times/week	107	30.5%
	3–4 times/week	135	38.5%
	5–7 times/week	109	31.1%
2	Vegetables		
	0–2 times/week	112	31.9%
	3–4 times/week	153	43.6%
	5–7 times/week	86	24.5%
3	Dairy Products		
	0–2 times/week	108	30.8%
	3–4 times/week	117	33.3%
	5–7 times/week	126	35.9%
4	Meat & Poultry		
	0–2 times/week	75	21.4%
	3–4 times/week	107	30.5%
	5–7 times/week	169	48.1%
5	Fish		
	0–2 times/week	66	18.8%
	3–4 times/week	135	38.5%

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	5–7 times/week	150	42.7%
6	Legumes & Beans		
	0–2 times/week	122	34.8%
	3–4 times/week	151	43.0%
	5–7 times/week	78	22.2%
7	Grains & Cereals		
	0–2 times/week	161	45.9%
	3–4 times/week	114	32.5%
	5–7 times/week	76	21.7%
8	Processed / Fast Food		
	0–2 times/week	25	7.1%
	3–4 times/week	120	34.2%
	5–7 times/week	206	58.7%

The dietary intake patterns of the 351 participating mothers were assessed using a food frequency questionnaire covering the 7 days prior to data collection. Table 4.3 presents the distribution of food group consumption frequency. With respect to protective food groups, the majority of mothers consumed fruits three to four times per week (38.5%) and vegetables three to four times per week (43.6%), indicating moderate, though not optimal, adherence to plant-based dietary recommendations. Fish consumption was relatively high, with 42.7% consuming fish five to seven times per week, reflecting the cultural significance of fish in Yoruba cuisine. Meat and poultry consumption was similarly high, with 48.1% consuming these foods five to seven times per week. Legumes and beans were consumed three to four times per week by 43.0% of participants.

Of particular public health significance is the finding related to processed and fast-food consumption: a striking majority of mothers, 58.7%, consumed processed or fast foods five to seven times per week, indicating high-frequency exposure to potentially pro-inflammatory dietary components, including saturated fats, refined carbohydrates, food additives, and artificial preservatives. Grain and cereal consumption was relatively low, with 45.9% consuming these foods 0 to 2 times per week. Based on the composite dietary scoring algorithm, slightly more than half of the mothers (52.4%) were classified as having good dietary intake. In comparison, 47.6% had poor dietary intake, indicating a population with marginal dietary quality where targeted nutritional interventions could yield meaningful health benefits.

Prevalence of Infantile Colic

Table 4.4: Prevalence of Infantile Colic Among Study Participants (n = 351)

S/N	Infantile Colic Status	Frequency (n)	Percentage (%)
1	No (absent)	271	77.2%
2	Yes (present)	80	22.8%
	Total	351	100.0%

Table 4.4 presents the data on the prevalence of infantile colic in the study population. Of the 351 infant-mother dyads assessed, 80 infants (22.8%) were reported by their mothers to have experienced symptoms consistent with infantile colic, as assessed using a Wessel-criteria-adapted screening instrument. The remaining 271 children (77.2%) showed no evidence of colic symptomatology. This prevalence rate of 22.8% is notably higher than the 16% reported by Hide and Guyer (2019) in a European paediatric cohort. However, it falls below the 36% incidence documented by Oshikoya et al. (2009) in Lagos, Nigeria, positioning the

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Akure South prevalence within the middle range of the documented global distribution and broadly consistent with the 22.3% reported by Helen (2024) in Ethiopia.

Maternal Treatment Strategies for Infantile Colic

Table 4.5: Maternal Treatment Strategies for Infantile Colic (n = 351)

S/N	Treatment Strategy	Frequency (n)	Percentage (%)
1	Antibiotics (over-the-counter)	281	80.1%
2	Applying warm water (warm compress)	24	6.8%
3	Herbs / herbal remedies	16	4.6%
4	Medications (other prescribed)	11	3.1%
5	Nospamine (antispasmodic)	19	5.4%
	Total	351	100.0%

Table 4.5 reveals a striking and clinically alarming pattern in the management strategies employed by mothers for infantile colic. The overwhelming majority of mothers — 80.1% — reported using antibiotics as their primary response to colic symptoms in their infants. This constitutes unprescribed, over-the-counter antibiotic use for a condition in which no evidence supports antibiotic therapy and for which such use carries documented risks of gut microbiome disruption, antibiotic resistance, and adverse drug reactions. Other treatment strategies reported included warm water application (6.8%), herbal remedies (4.6%), nospamine, an antispasmodic agent (5.4%), and other medications (3.1%). The near-total dominance of antibiotic self-medication in these mothers' management repertoire is highly consistent with the findings reported by Lam et al. (2019) on the widespread use of non-evidence-based pharmacological interventions for infantile colic in primary care settings in developing countries. It reinforces the urgent need for targeted health education to redirect management practices towards evidence-based approaches.

ble 4.6: Chi-Square Analysis — Relationship Between Maternal Dietary Intake and Infantile Colic (n = 351)

Variable	Colic: No	Colic: Yes	Total	df	X^2 cal	X^2 tab	p-value
Maternal Dietary Intake							
Good dietary intake	147	37	184	2	1.65	3.84	0.43
Poor dietary intake	125	42	167				
Total	272	79	351				

Note. df = degrees of freedom; X^2cal = calculated chi-square value; X^2tab = tabulated chi-square critical value; p > 0.05 = not statistically significant.

Association Between Maternal Dietary Intake and Infantile Colic

Table 4.6 presents the results of the chi-square analysis examining the relationship between maternal dietary intake and the presence of colic symptoms. Among mothers classified as having good dietary intake (n = 184), 37 infants (20.1%) had colic while 147 (79.9%) did not. Among mothers classified as having poor dietary intake (n = 167), 42 infants (25.1%) had colic while 125 (74.9%) did not. The chi-square test yielded a calculated value (X^2cal) of 1.65, against a tabulated critical value (X^2tab) of 3.84 at 2 degrees of freedom and a significance threshold of 0.05. The resultant p-value of 0.43 indicates that no statistically significant association exists between maternal dietary intake classification and the presence or absence of infantile colic symptoms ($p > 0.05$). This finding contrasts with the significant association ($p < 0.05$) reported by Evans et al. (2018), who found a positive trend between increasing maternal dietary diversity and rates of infant colic in breastfed infants, suggesting that the relationship between diet and colic may be mediated by specific dietary

components or nutritional contexts not fully captured by the composite dietary scoring approach used in this study.

DISCUSSION

This study provides original, community-based epidemiological data on the interplay between maternal dietary intake and the prevalence of infantile colic among exclusively breastfed infants attending primary healthcare facilities in Akure South, Nigeria. The discussion situates these findings within the extant literature, identifies areas of convergence and divergence, and interprets the public health implications of the results.

Sociodemographic Profile and Its Contextual Significance

The sociodemographic profile of the study population is broadly representative of the urban and peri-urban Nigerian primary healthcare setting. The predominance of mothers aged 29–38 years and the high proportion with tertiary education (57.0%) are consistent with patterns observed in similar facility-based studies in Southwest Nigeria, and may partly explain the relatively favourable dietary diversity scores observed in this cohort, as educational attainment is a known predictor of maternal nutritional literacy and dietary behaviour. The near-universal absence of maternal smoking (98.6%) is an important contextual finding, as maternal nicotine exposure, including through passive smoking, is a recognised risk factor for infantile colic through mechanisms involving altered intestinal motility and gut microbiome perturbation (Johnson et al., 2015). The high rate of early breastfeeding initiation (55.6% within 30 minutes of birth) reflects good compliance with WHO breastfeeding guidelines. It is an important protective factor for both neonatal gut health and breastfeeding success.

Maternal Dietary Intake Patterns

The finding that more than half (52.4%) of breastfeeding mothers in this study had a composite dietary classification of good is broadly consistent with the nutritional survey data reported by Ogechi (2014) in a study of lactating women in Umuahia, Nigeria, which found that cereal-based dishes and leafy vegetables were the most commonly consumed food groups. However, the present study documents a notable divergence in legume consumption patterns: while Ogechi (2014) reported less frequent daily consumption of legumes, the present data indicate moderate legume intake (43.0% consuming three to four times per week), potentially reflecting regional differences in dietary culture between Southwest (Yoruba) and Southeast (Igbo) Nigerian populations. The high frequency of fish consumption documented in this study (42.7% at five to seven times per week) is consistent with the coastal geographic character of the study setting and the cultural dietary importance of fish protein in Ondo State cuisine.

The most significant dietary concern emerging from the data is the exceptionally high frequency of processed and fast-food consumption, with 58.7% of mothers consuming these foods five to seven times per week. This level of ultra-processed food intake is a cause for nutritional concern, independent of its relationship to infantile colic, as such diets are associated with reduced dietary diversity, higher intake of sodium, saturated fat, and refined sugars, and lower consumption of micronutrients critical to breast milk quality. Karcz et al. (2020, 2021) found that awareness of breastfeeding-appropriate dietary restrictions was variable among Polish mothers and healthcare providers, and cautioned against overly restrictive elimination diets. In the Nigerian context, however, the more pressing concern is excessive consumption of processed foods rather than inappropriate dietary restriction. Vázquez et al. (2025) demonstrated that structured nutritional advice during breastfeeding can effectively modify maternal food choices to benefit infant gastrointestinal outcomes, providing evidence that targeted dietary counselling within primary healthcare facilities could yield tangible improvements in this domain.

Prevalence of Infantile Colic

The colic prevalence of 22.8% documented in this study is substantially higher than the 16% reported by Hide and Guyer (2019) in a predominantly European paediatric population, and modestly lower than the 36% documented by Oshikoya et al. (2009) in Lagos. This positioning within the global prevalence range is consistent with the findings of a systematic review by Wolke et al. (2017), which estimated a pooled global

colic prevalence of approximately 19.9%. The higher rates observed in Nigerian compared to European cohorts may reflect multiple interacting factors: differences in infant gut microbiome colonization patterns shaped by delivery mode, antibiotic exposure, and environmental microbial ecology; differences in maternal diet composition and its influence on breast milk bioactive factor profiles; variations in parental perception and interpretation of infant crying behaviour; and differences in the healthcare-seeking thresholds and coping strategies of parents across cultural contexts. The finding by Helen (2024) that 22.3% of infants attending Ethiopian paediatric outpatient clinics met colic criteria provides a useful Sub-Saharan African comparator, suggesting that the burden of infantile colic in low- and middle-income countries in the region may cluster around 20–25% when standardised assessment tools are applied.

Maternal Treatment Strategies and Self-Medication Patterns

Perhaps the most clinically alarming finding of this study is the overwhelming use of over-the-counter antibiotics by 80.1% of mothers as the primary management strategy for infantile colic. This practice lacks evidence-based justification and poses a serious public health concern amid the global burden of antimicrobial resistance. Infantile colic is a functional disorder with no infectious aetiology, and antibiotic therapy not only provides no therapeutic benefit but actively disrupts the developing intestinal microbiome, potentially exacerbating colic through the very dysbiotic mechanism that current evidence implicates in its pathogenesis (Barnett et al., 2025; Ould Chaib et al., 2020). This finding is consistent with the broader literature on antibiotic self-medication in Nigerian primary care settings. It echoes the concern raised by Chinawa et al. (2013) regarding the propensity of Nigerian caregivers to attribute infant distress to colic and to respond with pharmacological self-treatment. Lam et al. (2019) demonstrated that simethicone, rather than antibiotics, is the most commonly used pharmaceutical agent for colic relief in structured primary care settings in Singapore, suggesting that the management landscape in Akure South has yet to benefit from the educational interventions and clinical guideline dissemination that have redirected practice in higher-resourced settings. Evidence-based alternatives, including L. reuteri DSM 17938 supplementation (Szajewska et al., 2016; Venkataraman et al., 2025), structured dietary counselling (Vázquez et al., 2025), and parental reassurance with soothing techniques (Johnson et al., 2015), are either unknown or inaccessible to the majority of mothers in this cohort.

Association Between Maternal Diet and Infantile Colic

The chi-square analysis revealed no statistically significant association between maternal dietary intake (classified as good or poor using a composite scoring approach) and the presence of infantile colic symptoms ($\chi^2 = 1.65$, df = 2, p = 0.43). This finding is at variance with the statistically significant positive trend documented by Evans et al. (2018), who reported increasing colic rates with greater maternal dietary diversity in a breastfed infant cohort. Several methodological considerations may explain the divergence. First, the composite dietary classification used in this study, good versus poor, is a necessarily crude summary measure that does not capture the specific dietary components most implicated in colic pathogenesis, particularly cow's milk protein, cruciferous vegetables, allium compounds, caffeine, and gluten. Vázquez et al. (2025) and Hanna (2020) have shown that the effect of maternal diet on infant colic is most evident when specific food groups or elimination protocols are evaluated rather than when overall dietary quality is assessed. Second, the moderate sample size and binary classification of both dietary quality and colic presence may have insufficient statistical power to detect small-to-moderate associations, which would require more sensitive quantitative dietary assessment tools, such as 24-hour dietary recall combined with breast milk biomarker analysis, to detect reliably. Third, the null finding in this study is consistent with the conceptual position that infantile colic is a multifactorial condition in which maternal diet is one of several potential contributing factors, and may not exert an independent, statistically detectable effect when examined in isolation from infant gut microbiome composition, maternal psychological health (Garnacho-Garnacho et al., 2024), feeding technique, and infant temperament.

CONCLUSION

This cross-sectional study of 351 exclusively breastfeeding mother-infant dyads attending primary healthcare facilities in Akure South LGA, Ondo State, Nigeria, has generated several clinically important findings. The prevalence of infantile colic was 22.8%, consistent with regional Sub-Saharan African estimates and within the

upper bound of global epidemiological ranges. More than half of mothers (52.4%) demonstrated good overall dietary intake, with notable strengths in fish, meat, vegetable, and legume consumption. However, the high frequency of processed food consumption (58.7% consuming five to seven times per week) constitutes a significant nutritional concern. Chi-square analysis found no statistically significant association between composite maternal dietary quality and infantile colic symptoms ($p = 0.43$), suggesting that the dietary-colic association in this population may be mediated by specific nutrient exposures not captured by aggregate dietary scoring. The most alarming finding was the predominant use of over-the-counter antibiotics (80.1%) as the first-line management strategy for infantile colic, a practice devoid of evidence, potentially harmful to infant gut microbiome development, and reflective of systemic deficiencies in primary healthcare counselling for breastfeeding mothers. These findings collectively underscore the urgent need for evidence-based, community-specific health education and nutritional counselling interventions within the Akure South primary healthcare system.

RECOMMENDATIONS

Based on the empirical findings of this study, the following evidence-informed recommendations are advanced for policy, clinical practice, and future research:

1. Structured Maternal Nutrition and Colic Counselling Programmes: Primary healthcare facilities in Akure South, and by extension across Ondo State and Nigeria, should integrate structured, evidence-based nutrition counselling modules specifically designed for breastfeeding mothers into existing maternal and child health services, emphasizing the importance of dietary diversity, reduction of ultra-processed food intake, and the role of specific dietary components in breast milk quality and infant gastrointestinal health, thereby empowering mothers to make informed dietary choices that support optimal infant wellbeing.

2. Urgent Intervention to Curb Antibiotic Self-Medication for Infantile Colic: Healthcare authorities must implement targeted antibiotic stewardship and public health education campaigns directed at breastfeeding mothers and caregivers of infants, explicitly addressing the inappropriate and potentially harmful practice of self-prescribing over-the-counter antibiotics for infantile colic, a condition with no infectious aetiology, and actively redirecting caregivers towards evidence-based soothing techniques, probiotic supplementation where clinically indicated, and consultation with trained healthcare professionals before initiating any pharmacological treatment.

3. Expansion of Dietary Research Using Specific Nutrient and Biomarker Methodologies: Future studies investigating the relationship between maternal dietary intake and infantile colic in the Nigerian context should employ more granular dietary assessment tools, including validated 24-hour dietary recalls, specific food group elimination protocols, and breast milk biomarker analysis, to precisely characterize the contributions of individual dietary antigens such as cow's milk protein, gluten, cruciferous vegetables, and caffeine to colic symptom expression, thereby generating the refined, context-specific dietary guidelines needed to move clinical practice beyond generic advice towards precision nutritional counselling.

4. Policy Integration and Knowledge Translation for Public Health Benefit: The findings of this study, particularly the high colic prevalence (22.8%), the pervasive antibiotic self-medication pattern (80.1%), and the high processed food consumption burden, should be formally presented to the Ondo State Ministry of Health and the relevant local government health authorities as evidence underpinning the urgent revision and strengthening of postnatal care protocols, breastfeeding support service standards, and community health worker training curricula, so that the public health knowledge generated through this research is systematically translated into improved maternal and infant health outcomes across Ondo State and comparable Nigerian primary healthcare settings.

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