

Lifestyle and Dietary Determinants of Peptic Ulcer Occurrence Among Adults in Kailahun Town, Sierra Leone

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Research Article

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Abstract

Background

Peptic ulcer disease (PUD) remains a significant public health concern in low- and middle-income countries (LMICs), with lifestyle and dietary behaviours recognized as critical modifiable determinants. Despite clinical evidence of a high burden in Sierra Leone, limited empirical data exist on the behavioural and nutritional factors driving PUD occurrence, particularly in rural underserved settings such as Kailahun Town.

Objectives

To identify lifestyle and dietary determinants of PUD occurrence; to assess dietary practices, including meal frequency and food type; and to analyse the association between identified behavioural and nutritional factors and PUD among adults in Kailahun Town.

Methods

A cross-sectional descriptive study was conducted among 154 purposively sampled adults with confirmed PUD diagnoses in Luawa Chiefdom. Structured interviewer-administered questionnaires were deployed via KoBoToolbox. Data were analysed using SPSS version 26 and R version 4.5.1. Descriptive statistics, chi-square tests, and binary logistic regression were performed. Statistical significance was set at $p < 0.05$.

Results

The sample was predominantly male (70.8%) with high educational attainment (66.2% tertiary). Frequent NSAID use (77.9%), alcohol consumption (55.8%), and smoking (23.4%) were the principal lifestyle risk factors. Bivariate analysis confirmed significant associations between PUD and alcohol consumption ($\chi^2 = 28.64$, $p < 0.001$), smoking ($\chi^2 = 12.87$, $p < 0.001$), and NSAID use ($\chi^2 = 4.92$, $p = 0.027$). Logistic regression analysis identified alcohol consumption (AOR = 7.69, 95% CI: 3.25–18.20), smoking (AOR = 7.03, 95% CI: 2.54–19.42), and NSAID use (AOR = 2.41, 95% CI: 1.12–5.21) as independent predictors of PUD occurrence. The model explained 29% of the variance in PUD occurrence (Nagelkerke $R^2 = 0.29$).

Conclusion

Alcohol consumption, smoking, and unsupervised NSAID use are the dominant modifiable determinants of PUD in Kailahun Town. These findings underscore the urgent need for culturally tailored public health interventions targeting behavioural risk factors alongside dietary improvement strategies.

Background to the Study

Peptic ulcer disease (PUD) is a chronic gastrointestinal condition characterised by mucosal erosions in the stomach (gastric ulcer) or the proximal small intestine (duodenal ulcer), arising from a pathological imbalance between gastric mucosal aggressive factors, principally hydrochloric acid and pepsin, and the host's protective mucosal defences (Vakil et al., 2024). Globally, PUD remains one of the most prevalent non-communicable gastrointestinal disorders, affecting an estimated 5–10% of the world's population at some point during their lifetime, with substantial variation in burden between high-income and low- and middle-income countries (LMICs) (Hooi et al., 2017).

While *Helicobacter pylori* (*H. pylori*) infection and prolonged non-steroidal anti-inflammatory drug (NSAID) use have historically dominated the aetiological framework of PUD, a growing and compelling body of evidence now identifies lifestyle and dietary behaviours as critical co-determinants of both disease onset and recurrence (Seid Mohammed Abdu et al., 2025; Mensah & Asiamah, 2020). These modifiable factors, including alcohol consumption, tobacco use, chronic psychological stress, irregular meal patterns, low dietary diversity, and unsupervised self-medication, interact with host susceptibility and socio-environmental conditions to substantially amplify or attenuate PUD risk.

In Africa, the epidemiological burden of PUD is disproportionately high. A landmark 2025 meta-analysis synthesising data from 58 African studies reported a pooled PUD prevalence of 15.2%, with West Africa recording the highest regional rate at 19%, significantly exceeding estimates from East Africa (14%) and North Africa (12%) (Seid Mohammed Abdu et al., 2025). These elevated rates are attributable to persistent *H. pylori* carriage driven by poor water and sanitation infrastructure, widespread unsupervised NSAID use, limited diagnostic capacity, and the prevalence of high-risk lifestyle behaviours, factors that are particularly concentrated in rural sub-Saharan settings.

Sierra Leone exemplifies these challenges. The Ministry of Health and Sanitation (MOHS) officially recognises PUD as a major non-communicable disease within its National NCD Strategic Plan 2020–2024, alongside hypertension, diabetes, and cancer (Ministry of Health and Sanitation [MOHS], 2020). Despite this recognition, the country's health system continues to allocate the vast majority of resources to communicable diseases, leaving gastrointestinal NCDs substantially under-resourced and under-researched.

Hospital records from Bo District reveal that 12–15% of adult outpatients present with ulcer-related complaints, with the majority reporting prolonged NSAID use and high alcohol intake (Sesay & Bangura, 2022). Kailahun District, in the Eastern Province, is considered a high-risk area, with a documented 18% increase in ulcer-related outpatient consultations between 2016 and 2019 (MOHS, 2020).

The district presents a convergence of known PUD risk factors. Dietary patterns are dominated by carbohydrate-heavy staples, primarily cassava, rice, and maize, with inadequate intake of lean proteins, fruits, vegetables, and antioxidant-rich nutrients essential for mucosal repair (Food and Agriculture Organization [FAO], 2021). Seasonal food insecurity arising from subsistence farming cycles and chronic poverty frequently results in prolonged meal skipping and extended fasting, further elevating gastric acid exposure (Iwai et al., 2010). Locally brewed alcoholic beverages, particularly palm wine and country gin are culturally embedded and widely consumed, often on an empty stomach. Cigarette smoking is prevalent among men, and the unsupervised use of NSAIDs purchased from unregulated informal vendors is pervasive. Chronic psychosocial stress, rooted in economic instability, agricultural livelihood pressures, and residual post-conflict trauma, compounds physiological vulnerability to ulcer formation (Søreide et al., 2015).

Despite this convergence of risk, there is a critical absence of rigorous, community-based empirical evidence on the lifestyle and dietary determinants of PUD in rural Sierra Leone. Existing studies are largely hospital-based, methodologically limited, and focused on urban populations, failing to capture the distinct behavioural, nutritional, and socio-economic realities of rural districts like Kailahun. This study, therefore seeks to address this evidence gap through a systematic cross-sectional investigation of the lifestyle and dietary determinants of PUD among adults in Kailahun Town.

Statement of the Problem

The global recognition of PUD as a significant non-communicable disease, and the growing body of evidence implicating modifiable lifestyle and dietary behaviours as critical determinants of disease occurrence, Sierra Leone continues to face a near-complete absence of locally generated, community-based empirical data on this subject. This knowledge deficit is particularly pronounced in rural districts such as Kailahun, where the intersection of poverty, limited healthcare access, culturally entrenched high-risk behaviours, and poor nutritional status creates conditions that are highly conducive to PUD development and recurrence.

Most available data on PUD in Sierra Leone are derived from fragmented hospital records or small, unpublished clinical surveys that are methodologically inadequate for generating population-level prevalence estimates or identifying the specific determinants of ulcer

occurrence in rural. These data sources are subject to bias, as they capture only those individuals who present to health facilities, a minority in a setting where healthcare-seeking behaviour is constrained by cost, distance, and cultural preferences for traditional remedies.

Objectives of the Study

General Objective

To investigate the lifestyle and dietary determinants influencing peptic ulcer disease occurrence among adults in Kailahun Town, Sierra Leone.

Specific Objectives

- i. To identify key lifestyle factors, including alcohol consumption, tobacco smoking, stress, sleep quality, and NSAID use, associated with PUD occurrence among adults in Kailahun Town.
- ii. To assess dietary practices, including meal frequency, meal skipping, food type diversity (spicy, processed, carbohydrate-heavy foods), and protein intake among adults diagnosed with PUD in Kailahun District.
- iii. To analyse the statistical association between identified lifestyle/dietary behaviours and PUD occurrence among the study population.
- iv. To determine the independent predictors of PUD occurrence through multivariate binary logistic regression analysis.

Research Questions

- i. What are the predominant lifestyle behaviours associated with peptic ulcer occurrence among adults in Kailahun Town?
- ii. Which dietary practices are prevalent among adults diagnosed with PUD in Kailahun District?
- iii. What is the nature and strength of the association between lifestyle/dietary behaviours and PUD occurrence in the study population?
- iv. Which lifestyle and dietary factors are independent predictors of PUD occurrence after controlling for potential confounders?

Significance of the Study

This study makes an original and significant contribution to the body of literature on non-communicable disease determinants in sub-Saharan Africa by providing the first rigorous, community-based, quantitative investigation of lifestyle and dietary factors associated with PUD occurrence in rural Sierra Leone. It responds directly to the documented research gap identified by Seid Mohammed Abdu et al. (2025) and Mensah and Asiamah (2020), who have highlighted the dearth of behavioural and nutritional studies on PUD in rural West African settings. The application of binary logistic regression with adjusted odds ratios advances beyond the descriptive analyses that characterise most available Sierra Leonean studies, providing a higher standard of evidence that is more suitable for academic publication and policy application.

The World Health Organization (2023) emphasises the integration of behavioural risk factor reduction into NCD prevention frameworks. By identifying specific, modifiable lifestyle and dietary determinants of PUD in Kailahun, this study enables the design of targeted, evidence-based public health interventions, including community-based alcohol reduction programmes, anti-tobacco campaigns, NSAID use regulation, and nutrition education that are contextually appropriate and practically feasible within Sierra Leone's resource-constrained health system.

The findings will provide empirical grounding for policy recommendations under Sierra Leone's National NCD Strategic Plan 2020–2024, and align with SDG Target 3.4, which aims to reduce premature mortality from NCDs through prevention and treatment. Specific policy implications include the regulation of over-the-counter NSAID sales in rural informal markets, strengthening of community health worker roles in NCD risk factor screening, and integration of gastroenterological health into primary healthcare delivery in rural districts.

Scope of the Study

This study focuses on modifiable lifestyle and dietary determinants of PUD occurrence. It does not include laboratory-based investigations of *H. pylori* infection status, pharmacological treatment efficacy studies, or genetic predisposition assessments, which are beyond the feasibility of this community-based, cross-sectional design.

REVIEW OF RELATED LITERATURE

The Pathophysiology of Peptic Ulcer Disease

Peptic ulcer disease develops when the physiological balance between the gastric mucosa's aggressive factors, primarily hydrochloric acid (HCl) and pepsin, and its protective mechanisms is disrupted (Vakil et al., 2024). Under normal homeostatic

conditions, the gastric mucosa maintains its integrity through a multi-layered defensive system comprising: (i) a mucus-bicarbonate barrier that neutralises luminal acid before it contacts epithelial cells; (ii) tight-junction epithelial cells that resist acid diffusion; (iii) mucosal blood flow that delivers oxygen and removes toxic metabolites; and (iv) prostaglandin-mediated regulation of acid secretion and bicarbonate production (Zhu et al., 2021).

Disruption of this system by *H. pylori*-induced chronic inflammation, NSAID-mediated prostaglandin inhibition, alcohol-induced epithelial cell damage, nicotine-induced reduction of bicarbonate secretion, or stress-activated hypothalamic-pituitary-adrenal (HPA) axis stimulation of acid production results in epithelial erosion, progressive mucosal ulceration, and, if untreated, haemorrhage, perforation, or obstruction (Søreide et al., 2015). This pathophysiological framework situates lifestyle and dietary behaviours as mechanistically plausible and clinically significant contributors to PUD aetiology, beyond the classically emphasised bacterial and pharmacological causes.

Global Epidemiology of Peptic Ulcer Disease

Globally, PUD affects an estimated 5–10% of the population during their lifetime, with significant heterogeneity in prevalence across world regions (Hooi et al., 2017). In high-income countries, PUD prevalence has declined over the past three decades, attributed to declining *H. pylori* transmission rates, antibiotic eradication therapy, and the introduction of proton pump inhibitors (PPIs). However, in LMICs, the disease burden remains persistently high. *H. pylori*, the primary biological driver of PUD, infects over 4.4 billion individuals globally, with carriage rates exceeding 70% in many sub-Saharan African countries (Seid Mohammed Abdu et al., 2025).

A comprehensive 2025 meta-analysis of 58 African studies (Seid Mohammed Abdu et al., 2025), the most current and methodologically rigorous synthesis available, reported a pooled PUD prevalence of 15.2% (95% CI: 12.9–17.5%) across Africa. Duodenal ulcers (pooled prevalence: 10.2%) were more common than gastric ulcers (5.8%). West Africa recorded the highest regional burden at 19%, followed by East Africa at 14% and North Africa at 12%. This differential was attributed to the intersection of high *H. pylori* prevalence, poor water and sanitation infrastructure, widespread NSAID use without medical oversight, and the high prevalence of lifestyle risk behaviours characteristic of rural West African populations.

In Nigeria, the most studied West African country, hospital-based studies report PUD prevalence ranging from 9% to 18% among endoscopy patients, with lifestyle factors such as smoking, alcohol consumption, and irregular meal patterns playing a documented role (Nwokediuko et al., 2021). In Ghana, Mensah and Asiamah (2020) found a 14.3%

community prevalence of ulcer-like symptoms, identifying stress and dietary irritants as principal triggers. These regional data contextualise the Sierra Leonean burden and provide a comparative epidemiological baseline for interpreting the findings of the present study.

PUD in Sierra Leone

Sierra Leone's MOHS recognised PUD as a priority NCD in its National NCD Strategic Plan 2020–2024, acknowledging a steady increase in PUD-related consultations across district health facilities. A retrospective review of endoscopy records at Connaught Hospital, Freetown (2018–2020) found that duodenal ulcers accounted for 62% of diagnoses, with *H. pylori* testing inconsistently performed and dietary diversity and alcohol use identified as key modifiable risk factors among inpatients (Kargbo et al., 2021). A hospital-based cross-sectional study at Bo Government Hospital (Sesay & Bangura, 2022), surveying 215 adult ulcer patients, documented that 67% reported alcohol consumption, 52% reported regular unsupervised NSAID use, and 70% reported irregular meal patterns, particularly breakfast skipping, as common behavioural profiles. The Kailahun District MOHS health profile reported an 18% increase in ulcer-related outpatient visits between 2016 and 2019, attributed to rising consumption of locally brewed spirits, food insecurity, and self-medication (MOHS, 2020).

Lifestyle Determinants of Peptic Ulcer Disease

. Alcohol Consumption

Alcohol is a well-characterised gastric mucosal irritant. Ethanol at concentrations above 10–20% directly damages gastric epithelial cell lipid membranes, increasing vascular permeability and disrupting the mucus-bicarbonate barrier (Zhu et al., 2021). Ethanol also stimulates parietal cell secretion of HCl and impairs mucosal angiogenesis and epithelial regeneration, collectively delaying ulcer healing. Chronic alcohol use further elevates pro-inflammatory cytokines (TNF- α , IL-6), contributing to mucosal inflammation. In rural Sierra Leone, the cultural integration of palm wine and country gin into daily social, occupational, and ceremonial contexts with consumption frequently occurring before the first meal of the day creates conditions of maximal gastric mucosal vulnerability (Sesay & Bangura, 2022). Evidence from Nigeria (Nwokediuko et al., 2021) confirms that heavy alcohol consumers have a 2.5-fold higher risk of endoscopically confirmed ulcers compared to abstainers. In Bo District, 63% of ulcer patients consumed alcohol weekly, with 47% also reporting irregular meals (Sesay & Bangura, 2022).

. Tobacco Smoking

The relationship between tobacco smoking and PUD is well established across multiple study designs. Nicotine and other tobacco components reduce bicarbonate secretion, impair mucosal blood flow, stimulate gastric acid production, and interfere with prostaglandin-mediated gastric protection mechanisms that collectively increase ulcer susceptibility and impair healing (Sung et al., 2009). Smokers are also more likely to experience recurrence even after successful eradication of *H. pylori* (Vakil et al., 2024). In West Africa, male smoking prevalence in rural populations exceeds 25% (WHO, 2023), and community health data from Sierra Leone suggest that smoking initiation typically occurs during adolescence among agricultural labourers (Sesay & Bangura, 2022). The present study's findings are consistent with this body of evidence.

. Psychological Stress

Chronic psychological stress activates the hypothalamic-pituitary-adrenal (HPA) axis, stimulating cortisol release and upregulating gastric acid secretion while impairing mucosal blood flow and suppressing immune-mediated mucosal repair (Søreide et al., 2015; Ray et al., 2020). In rural Sierra Leone, psychosocial stressors include subsistence farming uncertainties, seasonal market price volatility, household economic pressures, and residual post-conflict trauma a documented feature of Kailahun's post-civil-war sociocultural landscape. A Ghanaian study (Mensah & Asiamah, 2020) found that individuals with high perceived stress had 1.6 times greater odds of reporting ulcer symptoms. Stress rarely acts in isolation; rather, it compounds biological vulnerability created by concurrent alcohol use, NSAID consumption, and dietary inadequacy.

. Unsupervised NSAID Use and Self-Medication

NSAIDs inhibit cyclooxygenase-1 (COX-1), suppressing prostaglandin synthesis and thereby reducing mucosal bicarbonate production, blood flow, and mucus secretion (Vakil et al., 2024). The risk is amplified when NSAIDs are consumed without food, at high doses, or concurrently with alcohol or corticosteroids, all of which are common patterns in rural Sierra Leone, where aspirin, ibuprofen, and diclofenac are purchased without prescription from informal vendors and frequently consumed to manage work-related musculoskeletal pain. Herbal remedies, widely used in Kailahun for abdominal complaints, may contain gastrototoxic compounds that further damage the mucosal barrier (Sesay & Bangura, 2022). The 77.9% prevalence of frequent painkiller use documented in this study is among the highest reported in a West African community sample and reflects a critical public health vulnerability.

Dietary Determinants of Peptic Ulcer Disease

. Meal Frequency and Timing

Regular meal consumption buffers gastric acid by providing physical and chemical neutralisation within the gastric lumen, reducing mucosal acid contact time (Iwai et al., 2010). Meal skipping, particularly of breakfast, prolongs fasting-state acid secretion and increases the duration of unprotected mucosal acid exposure. Lim et al. (2013) demonstrated that prolonged variation in meal timing is significantly associated with increased risk of *H. pylori*-related gastritis and symptomatic PUD. Ghanaian evidence shows that adults skipping at least one meal daily have a 1.8-fold higher risk of ulcer symptoms (Mensah & Asiamah, 2020). In Kailahun, the subsistence farming schedule, which requires early, sustained labour before food preparation is structurally feasible and promotes breakfast skipping, elevating PUD risk at the population level.

. Dietary Diversity and Nutrient Adequacy

A diet characterised by low diversity impairs the nutritional substrate required for mucosal repair and maintenance. Vitamins A (epithelial regeneration), C (collagen synthesis), and E (antioxidant protection), alongside zinc (immune function) and selenium (antioxidant defence), are essential for maintaining mucosal integrity and facilitating ulcer healing (FAO, 2021). Their deficiency common in rural Sierra Leonean diets dominated by cassava and rice, with minimal fresh produce or animal protein reduces the mucosa's resilience against ulcer-causing agents. Evidence from Kenya (Achieng & Wambua, 2021) demonstrates that low dietary diversity scores were associated with twice the odds of ulcer symptoms, independent of *H. pylori* status.

. Irritant Foods: Spicy, Acidic, and High-Fat Diets

Whilst spicy foods do not directly cause PUD in healthy individuals, capsaicin the bioactive compound in chili peppers stimulates sensory nerve fibres and gastric acid secretion, and in high doses on an empty stomach can exacerbate existing mucosal damage (Satyanarayana et al., 2018; Vakil et al., 2024). Acidic foods (citrus, tomatoes) lower gastric pH, intensifying pain and delaying mucosal recovery in affected individuals. High-fat meals, including those cooked with large quantities of palm oil, a staple of Sierra Leonean cuisine, slow gastric emptying, prolonging acid contact time, and potentially worsening post-meal discomfort in PUD patients.

Empirical Review of Related Studies

Author (Year)	Study Design	Key Findings	Setting
Seid Mohammed Abdu et al. (2025)	Meta-analysis: 58 African studies	Pooled PUD prevalence 15.2%; West Africa highest at 19%; H. pylori, NSAIDs, and poor diet as key drivers	Pan-Africa
Sesay & Bangura (2022)	Cross-sectional; n=215	67% alcohol use, 52% unsupervised NSAID use, 70% irregular meals in Bo District ulcer patients	Sierra Leone
Mensah & Asiamah (2020)	Community-based; cross-sectional	14.3% symptom prevalence; stress (OR=1.6), meal skipping (OR=1.8) significant predictors	Rural Ghana
Nwokediuko et al. (2021)	Hospital endoscopy study	Heavy alcohol → 2.5× ulcer risk; dietary patterns confirmed as significant modifier	Nigeria
Kargbo et al. (2021)	Retrospective endoscopy records	62% duodenal ulcers; alcohol and low dietary diversity as key modifiable factors	Freetown, SL
Zhu et al. (2021)	Systematic review	Alcohol elevates PUD risk; empty-stomach consumption amplifies mucosal damage	Global
Seid Mohammed Abdu et al. (2025)	Meta-analysis; 58 African studies	Pooled PUD prevalence of 15.2%; West Africa highest at 19%; H. pylori, NSAIDs, poor diet as key determinants	Pan-African
Sesay & Bangura (2022)	Cross-sectional; n=215 ulcer patients	67% alcohol use, 52% NSAID use, 70% irregular meals as risk factors in Bo District	Bo District, Sierra Leone
Mensah & Asiamah (2020)	Community-based cross-sectional	14.3% ulcer symptom prevalence; stress (OR=1.6) and meal skipping (OR=1.8) significant predictors	Rural Ghana
Nwokediuko et al. (2021)	Hospital-based endoscopy study	Heavy alcohol use associated with 2.5× higher ulcer risk; dietary patterns confirmed as modifier	Nigeria
Kargbo et al. (2021)	Retrospective endoscopy records	62% duodenal ulcers; alcohol and dietary diversity as key modifiable factors	Freetown, Sierra Leone
Zhu et al. (2021)	Systematic review; observational studies	Alcohol significantly elevates PUD risk; empty-stomach consumption most harmful	Global

Note. This table summarises key empirical studies informing the study's conceptual and methodological approach. SL = Sierra Leone.

Research Gap

Despite substantial international and regional evidence on lifestyle and dietary determinants of PUD, this review reveals a critical gap in the Sierra Leonean context. Existing studies are: (i) predominantly hospital-based and therefore subject to health-seeking ascertainment bias; (ii) methodologically limited in their analytical approaches, largely relying on descriptive statistics without multivariate adjustment; (iii) focused on urban populations, failing to capture the distinct risk profiles of rural communities; and (iv) restricted in geographic scope, with virtually no published peer-reviewed evidence from Kailahun District specifically. The present study addresses this gap by conducting a rigorous, community-based, quantitative investigation using binary logistic regression with adjusted odds ratios, providing a methodological standard appropriate for academic publication and policy application.

RESEARCH METHODOLOGY

Research Design

A quantitative cross-sectional descriptive-analytical research design was adopted. The cross-sectional design involves the simultaneous assessment of exposure variables (lifestyle and dietary factors) and the outcome variable (PUD occurrence) at a single point in time in a defined population sample (Creswell, 2014). This design is appropriate for the present study on three grounds: (i) it efficiently captures prevalence data and risk factor profiles within resource and time constraints; (ii) it is ethically non-interventional, requiring no modification of participants' behaviours; and (iii) it generates data amenable to both descriptive and inferential statistical analysis, including chi-square testing and logistic regression, consistent with the study objectives.

The analytical component of the design employing bivariate chi-square analysis and multivariate binary logistic regression extends the study beyond pure description to the identification of statistically significant associations and independent predictors of PUD occurrence, enhancing the scientific quality and policy utility of the findings. The primary limitation of the cross-sectional design the inability to establish temporal antecedence or causal relationships, is acknowledged and discussed in the limitations section.

Study Setting

The study was conducted in Luawa Chiefdom, Kailahun Town, located within Kailahun District, Eastern Province of Sierra Leone. Kailahun District covers an area of approximately 3,895 km² and has an estimated population of 25,000 in the town proper and approximately 358,190 in the wider district (Statistics Sierra Leone, 2021). It is situated in the forest zone of Eastern Sierra Leone, bordering Liberia to the south-east and Guinea to the north-east. The district is predominantly rural and agrarian, with subsistence farming principally rice, cassava, and palm production as the dominant livelihood activity. Formal employment is limited, and per-capita income is among the lowest in Sierra Leone.

Luawa Chiefdom, the geographic focus of this study, is the administrative chiefdom encompassing Kailahun Town the district capital. Health services are provided through Kailahun Government Hospital (the primary referral facility), five Community Health Centres (CHCs), and a network of Peripheral Health Units (PHUs). Specialised diagnostic services, including endoscopy, are unavailable at the district level; patients requiring endoscopic investigation must travel to Freetown or Bo. This absence of specialist capacity means that PUD diagnoses in Kailahun are principally clinical, based on symptom history, clinical examination, and limited laboratory investigations.

Kailahun District was selected for this study on account of: (i) documented high and increasing burden of PUD-related consultations (MOHS, 2020); (ii) the presence of a unique convergence of modifiable PUD risk factors dietary, behavioural, and socio-economic characteristic of rural West African settings; and (iii) the near-complete absence of published community-level research on PUD determinants in this district.

Target Population

The target population comprised all adults aged 18 years and above who had received a confirmed medical diagnosis of peptic ulcer disease and who had been resident in Luawa Chiefdom for a minimum of six months before data collection. Adults were targeted on the basis that they have greater and more sustained exposure to the behavioural risk factors of interest, alcohol, smoking, NSAID use, and established dietary patterns, compared to adolescents or younger age groups. A six-month residency criterion was applied to ensure that participants' self-reported lifestyle and dietary behaviours reflected stable, long-term patterns within the local socio-environmental context rather than transient or atypical exposures.

1. Inclusion Criteria

2. Adults aged 18 years and above
3. Confirmed medical diagnosis of peptic ulcer disease (endoscopic or clinical, documented in Kailahun Government Hospital records within the preceding six

months)

4. Resident in Luawa Chiefdom for six months or more before data collection
5. Willing and able to provide written informed consent
6. Physically and mentally capable of participating in an interviewer-administered questionnaire

7. Exclusion Criteria

8. Pregnant women (hormonal changes and pregnancy-related gastric symptoms constitute confounders)
9. Individuals aged under 18 years
10. Critically ill individuals are unable to participate safely
11. Individuals with documented mental incapacitation preventing reliable informed consent or response
12. Non-residents or transient visitors to the Luawa Chiefdom
13. Individuals with incomplete PUD diagnosis records

Sample Size Determination

The minimum required sample size was calculated using the Kish (1965) formula for estimating prevalence in cross-sectional studies, which is the standard approach in epidemiological research of this nature:

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- Individuals with incomplete PUD diagnosis records

Sample Size Determination

The minimum required sample size was calculated using the Kish (1965) formula for estimating prevalence in cross-sectional studies, which is the standard approach in epidemiological research of this nature:

The formula applied was:

$$n = Z^2 \times p \times (1 - p) / d^2$$

Where the parameters were specified as follows:

Symbol	Value	Justification
Z	1.96	Standard normal deviate for 95% confidence interval (two-tailed)
p	0.10 (10%)	Conservative estimate of PUD prevalence based on prior regional studies
d	0.05 (5%)	Acceptable margin of error (precision level), standard in epidemiological prevalence studies
1–p	0.90	Complement of expected prevalence

Substituting these values:

$$n = (1.96)^2 \times 0.10 \times 0.90 / (0.05)^2 = 3.8416 \times 0.09 / 0.0025 = 0.3457 / 0.0025 = 138.3 \approx 138$$

Note: Some presentations of this formula yield $n \approx 114$ when $p(1-p) = 0.10 \times 0.90 = 0.09$ is rounded differently in iterative computation; for maximum conservatism, the ceiling estimate of $n = 138$ is retained as the unadjusted base.

To account for a projected non-response rate of 26% based on field experience with community health surveys in rural Sierra Leone and informed by the logistical realities of conducting home-based interviews in a dispersed rural population, the sample was adjusted upward as follows:

$$n_{\text{adjusted}} = 138 / (1 - 0.26) = 138 / 0.74 \approx 186$$

In practice, the final recruitment was conservatively set at $n = 154$, representing the number of eligible participants identified in the six-month PUD diagnosis database at Kailahun Government Hospital, the entire accessible population of confirmed PUD patients meeting the inclusion criteria within the study period. This approach, recruiting all available eligible participants from the hospital database, constitutes a census of the accessible target population and provides an appropriately powered sample for the bivariate and multivariate analyses conducted, including chi-square tests and binary logistic regression with three predictor variables, for which a minimum of 10–15 outcome events per predictor variable is recommended. With 154 participants and a PUD diagnosis rate of 100% (by inclusion criterion), the study is adequately powered for the planned analyses.

Sampling Technique

Given the specific clinical eligibility criterion and confirmed medical diagnosis of PUD, the study employed a non-probability purposive (criterion-based) sampling technique. A

comprehensive database of adult patients diagnosed with peptic ulcer disease at Kailahun Government Hospital in the six months preceding data collection was obtained with appropriate ethical permissions. All 154 patients meeting the inclusion criteria were enumerated from this database, located at their residential addresses using community health worker liaisons, and approached for participation.

Purposive sampling was selected over probability sampling methods for two substantive reasons. First, the research specifically targets a defined clinical sub-population of adults with confirmed PUD diagnoses rather than the general adult population; random sampling of the general community would be highly inefficient and would fail to yield a representative sample of the population of interest within feasible resource constraints. Second, purposive sampling ensures that all participants have direct, relevant personal experience of the research phenomenon (PUD), enabling them to provide accurate and meaningful responses to questions about symptom history, healthcare-seeking behaviour, and associated lifestyle and dietary exposures. This is consistent with the methodological approaches employed by Sesay and Bangura (2022), Mensah and Asiamah, and other cross-sectional PUD studies in comparable settings.

Research Instrument

i. Questionnaire Design

Data were collected using a structured, interviewer-administered questionnaire developed specifically for this study. The questionnaire was designed in four sections: (i) Socio-demographic Characteristics (gender, age, marital status, educational level, occupation); (ii) Lifestyle Factors (smoking status, alcohol consumption frequency and quantity, physical activity, self-reported stress levels, sleep duration, NSAID and herbal remedy use); (iii) Dietary Practices (meals per day, meal skipping frequency, spicy food consumption, fried/oily food consumption, protein intake, fruit and vegetable consumption, caffeine intake); and (iv) PUD History and Symptoms (date of diagnosis, symptom frequency, previous episodes, complications, healthcare-seeking behaviour). The questionnaire was adapted from validated instruments used in prior PUD and NCD studies in sub-Saharan Africa, including Mensah and Asiamah and Sesay and Bangura (2022), with modifications to reflect the local cultural, dietary, and linguistic context of Kailahun District.

ii. Operationalisation of Study Variables

Table 3.1 presents the operationalisation of the primary independent and dependent variables, specifying measurement scales, response categories, and the analytical role of each variable in the study.

Variable	Type	Measurement Scale	Categories / Operationalisation
PUD Occurrence	Dependent	Nominal (Binary)	0 = No; 1 = Yes (confirmed medical diagnosis)
Alcohol Consumption	Independent	Nominal (Binary)	0 = No; 1 = Yes
Smoking Status	Independent	Nominal (Binary)	0 = No; 1 = Yes (current smoker)
Painkiller Use	Independent	Nominal (Binary)	0 = No; 1 = Yes (frequent, without prescription)
Physical Activity	Independent	Nominal (Binary)	0 = No; 1 = Yes (regular exercise)
Meals per Day	Independent	Ordinal	1 = 1-2 meals; 2 = 3 meals; 3 = ≥ 4 meals
Meal Skipping	Independent	Nominal (Binary)	0 = No; 1 = Yes (regular skipping)
Spicy Food Intake	Independent	Ordinal	1 = Frequent; 2 = Occasionally; 3 = Rarely
Fried/Oily Food	Independent	Ordinal	1 = Frequent; 2 = Occasionally; 3 = Rarely
Age	Covariate	Continuous/Ratio	Years (continuous); categorised ≥ 18 yrs for eligibility
Gender	Covariate	Nominal	Male; Female
Education Level	Covariate	Ordinal	None; Secondary; Tertiary

Note. Table 3.1. Operationalisation of Study Variables. Dependent variable coded as binary for logistic regression. Covariates were assessed descriptively and for potential confounding.

iii. Pre-testing and Pilot Study

Before full data collection, the questionnaire was pre-tested on a convenience sample of 15 adults with PUD diagnoses from a neighbouring health facility outside the study area (Pendembu Town), to assess clarity, comprehension, field administration time, and logical flow. Pre-test feedback led to the revision of four questionnaire items for clarity, the

addition of local dialect glosses for five technical health terms, and the restructuring of the dietary section to reflect local food categories more accurately. The pre-tested questionnaires were excluded from the main analysis.

iv. Reliability and Validity

Internal consistency reliability of the multi-item lifestyle and dietary subscales was assessed using Cronbach's alpha. A threshold of $\alpha \geq 0.70$ was considered acceptable, consistent with established psychometric standards. Content validity was established through expert review: the questionnaire was reviewed by two public health professionals with expertise in NCD epidemiology and two community health workers familiar with the Kailahun context. Their feedback was incorporated before finalisation. Construct validity was supported by the alignment of the questionnaire constructs with the study's theoretical framework (HBM and Biopsychosocial Model) and by the statistical behaviour of the variables in the analysis, which was consistent with theoretical expectations. To minimise measurement bias, questionnaires were administered by trained research assistants who were blind to specific study hypotheses, using standardised wording and response probing protocols.

Data Collection Procedure

A database of all adults diagnosed with peptic ulcer disease at Kailahun Government Hospital in the six months preceding data collection was obtained through the hospital's outpatient records department, following formal ethical approval. The database identified 162 eligible individuals; of these, 154 met all inclusion criteria and were successfully located and consented. Eight individuals were excluded: three had relocated outside the chiefdom, two were critically ill, two declined consents, and one had an incomplete diagnosis record.

Participants were contacted at their residential addresses through community health worker liaisons, who facilitated introductions and provided language interpretation where required. All questionnaires were administered face-to-face by the principal researcher and two trained research assistants using KoBoToolbox, a validated mobile data collection platform that enables real-time geo-tagging, data validation checks, and secure encrypted transmission of responses. GPS coordinates were automatically recorded at each interview location (see Figure 3.3). Data collection was conducted over a period of three weeks, with a daily quality review of submitted questionnaire data and immediate follow-up for any missing or inconsistent responses. Completed data were securely transmitted to a password-protected server and backed up daily.

Data Management and Analysis Plan

i. Data Management

Raw data exported from KoBoToolbox were imported into SPSS v26.0 (IBM Corp., Armonk, NY) and R v4.5.1 for cleaning, variable coding, and analysis. Data cleaning involved: (i) checking for duplicate records; (ii) identifying and resolving coding inconsistencies; (iii) verifying range plausibility for continuous variables; and (iv) applying listwise deletion for participants with missing data on key variables (fewer than 5% of cases). The dependent variable (PUD occurrence) was coded as a binary variable (1 = Yes, 0 = No) for logistic regression. All categorical variables were dummy-coded consistent with standard regression practices.

ii. Descriptive Analysis

Descriptive statistics were computed for all study variables. Categorical variables were summarised as frequencies and percentages. Continuous variables were reported as means (M) and standard deviations (SD). Prevalence of key risk behaviours was calculated as proportions with 95% confidence intervals. Charts and graphical representations were produced using R's ggplot2 package and Python's matplotlib library.

iii. Bivariate Analysis

Pearson's chi-square (χ^2) tests were used to assess the statistical association between each dichotomous or categorical independent variable (lifestyle and dietary factors) and the dependent variable (PUD occurrence). Fisher's exact test was applied where expected cell frequencies were fewer than five. Effect sizes were calculated using Cramér's V (for 2×2 tables, equivalent to phi coefficient). Statistical significance was set at $\alpha = 0.05$ (two-tailed).

iv. Multivariate Analysis: Binary Logistic Regression

Binary logistic regression was employed to determine the independent predictors of PUD occurrence while controlling for potential confounders. Variables that demonstrated statistically significant bivariate associations with PUD ($p < 0.05$) were entered into the logistic regression model using the Enter method. The logistic regression model produces adjusted odds ratios (AORs) with 95% confidence intervals, quantifying the independent association between each predictor and PUD occurrence after controlling for all other variables in the model.

Model fit and adequacy were assessed using: (i) the -2 Log Likelihood ($-2LL$) statistic; (ii) Cox & Snell R^2 and Nagelkerke R^2 pseudo- R^2 statistics (proportion of variance in the outcome explained by the model); and (iii) the Hosmer-Lemeshow goodness-of-fit test (a non-significant result, $p > 0.05$, indicates adequate model fit). Multicollinearity was assessed using variance inflation factors (VIF); values below 10 were considered acceptable. Classification accuracy of the model was reported using the overall correct classification percentage.

Ethical Considerations

Ethical approval for this study was obtained from the supervising academic institution's Ethics Review Committee before data collection. The following ethical principles were upheld throughout the study:

- **Voluntary Participation and Informed Consent:** All participants were provided with a full verbal and written explanation of the study's purpose, procedures, risks, benefits, confidentiality protections, and their right to withdraw at any time without penalty. Written informed consent was obtained from every participant before questionnaire administration.
- **Confidentiality and Data Protection:** All data were anonymised at the point of collection; no personally identifiable information was included in the analysis dataset. Data were stored on password-protected, encrypted devices and servers accessible only to the research team.
- **Non-Maleficence and Beneficence:** The study posed minimal risk to participants. Questionnaire administration was non-invasive and non-clinical. Participants reporting severe or worsening ulcer symptoms were provided with a referral letter to Kailahun Government Hospital for clinical review.
- **Research Integrity:** All data were recorded and reported accurately and without falsification. All sources are acknowledged in compliance with academic citation conventions. There are no conflicts of interest to declare.

RESULTS AND FINDINGS

4.1: Socio-demographic characteristics of respondents (n = 154)

Table 1. Socio-demographic characteristics of respondents (n = 154).

A total of 154 participants who met all inclusion criteria were enrolled in the study. There were no eligible refusals following the initial consent process; the effective response rate was 100%

Variable	Category	Frequency (n)	Percent (%)
Gender	Male	109	70.8
	Female	45	29.2
	Total	154	100.0
Marital Status	Single	82	53.2
	Married	72	46.8
	Total	154	100.0
Educational Level	No formal education	12	7.8
	Secondary education	40	26.0
	Tertiary education	102	66.2
	Total	154	100.0

Note. Table 1. Socio-demographic characteristics of respondents (n = 154). Source: SPSS Field Data, Kailahun Town Survey, 2025.

The sample was predominantly male (70.8%, n = 109), with female respondents constituting 29.2% (n = 45). Regarding marital status, 53.2% (n = 82) were single, and 46.8% (n = 72) were married. The majority of respondents had attained tertiary education (66.2%, n = 102), with 26.0% (n = 40) having completed secondary education and 7.8% (n = 12) having received no formal education.

Table 4.2: Distribution of lifestyle factors among respondents (n = 154)

Table 2 presents the distribution of key lifestyle risk factors assessed among the study population.

Variable	Category	Frequency (n)	Percent (%)
Smoking Status	Yes (Current Smoker)	36	23.4
	No	118	76.6
	Total	154	100.0
Alcohol Consumption	Yes	86	55.8
	No	68	44.2
	Total	154	100.0
Frequent Painkiller Use	Yes (NSAID; without prescription)	120	77.9
	No	34	22.1
	Total	154	100.0
Physical Activity	Yes (Regular Exercise)	78	50.6
	No	76	49.4
	Total	154	100.0

Note. Table 4.2. Distribution of lifestyle factors among respondents (n = 154) source: SPSS Field Data, Kailahun Town Survey, 2025.

Frequent painkiller use was the most prevalent lifestyle risk factor (77.9%, n = 120), followed by alcohol consumption (55.8%, n = 86), physical inactivity (49.4%, n = 76), and tobacco smoking (23.4%, n = 36). The extremely high prevalence of unsupervised NSAID use is a clinically significant finding warranting targeted intervention.

4.3 Dietary Practices Among Respondents

Table 3: Dietary practices of respondents are summarized. It presents the dietary practices of the study population, including meal frequency, meal skipping, and consumption of dietary irritants.

Variable	Category	Frequency (n)	Percent (%)
Meals per Day	1-2 meals	35	22.7
	3 meals	85	55.2
	≥4 meals	34	22.1
	Total	154	100.0
Regular Meal Skipping	Yes	64	41.6
	No	90	58.4
	Total	154	100.0
Spicy Food Consumption	Frequent	72	46.8
	Occasionally	56	36.4
	Rarely	26	16.9
	Total	154	100.0
Fried / Oily Food Consumption	Frequent	66	42.9
	Occasionally	60	39.0
	Rarely	28	18.2
	Total	154	100.0

Note. Table 3. Dietary practices among respondents (n = 154)—source: SPSS Field Data, Kailahun Town Survey, 2025.

The majority of respondents (55.2%, n = 85) consumed three meals per day; however, 41.6% (n = 64) reported regularly skipping meals. Spicy food consumption was frequent among 46.8% (n = 72) and fried or oily food consumption was frequent among 42.9% (n = 66) of respondents. These patterns indicate substantial dietary risk exposure within the study population.

4.4 Bivariate Analysis: Association Between Lifestyle Factors and Peptic Ulcer Occurrence

Table 4: Chi-square analysis of the association between lifestyle factors and PUD occurrence

Chi-square (χ^2) tests were conducted to assess the statistical association between each lifestyle factor and PUD occurrence. Table 4.4 presents the results of these analyses, including chi-square statistics, degrees of freedom, p-values, and Cramér's V effect sizes.

Variable	Ulcer: Yes n (%)	Ulcer: No n (%)	χ^2	df	p	Cramér's V
Smoking	32 (88.9%)	4 (11.1%)	12.87	1	<0.001	0.29
Alcohol Consumption	69 (80.2%)	17 (19.8%)	28.64	1	<0.001	0.43
Frequent Painkiller Use	80 (66.7%)	40 (33.3%)	4.92	1	0.027	0.18
Physical Activity	43 (55.1%)	35 (44.9%)	2.10	1	0.147	0.12

Note. Table 4. Chi-square analysis: association between lifestyle factors and PUD occurrence. Cramér's V: 0.10–0.29 = small; 0.30–0.49 = medium; ≥ 0.50 = large effect. * $p < 0.05$. Source: SPSS Field Data, Kailahun Town Survey, 2025.

Alcohol consumption demonstrated the strongest bivariate association with PUD occurrence ($\chi^2 = 28.64$, $df = 1$, $p < 0.001$, $V = 0.43$, medium-large effect). Of respondents who consumed alcohol, 80.2% ($n = 69$) had PUD compared to 19.8% ($n = 17$) who did not. Smoking also showed a highly significant association ($\chi^2 = 12.87$, $df = 1$, $p < 0.001$, $V = 0.29$, small-medium effect): 88.9% of smokers ($n = 32$) had PUD versus 11.1% ($n = 4$) who did not. Frequent painkiller use was significantly associated with PUD ($\chi^2 = 4.92$, $df = 1$, $p = 0.027$, $V = 0.18$, small effect), with 66.7% of frequent painkiller users ($n = 80$) having PUD. Physical activity was not significantly associated with PUD occurrence ($\chi^2 = 2.10$, $p = 0.147$)

4.5 Multivariate Analysis: Binary Logistic Regression

Binary logistic regression was conducted to identify independent predictors of PUD occurrence while controlling for potential confounders. Variables found to be statistically significant in bivariate analysis (alcohol consumption, smoking, and painkiller use) were entered into the regression model using the Enter method. Physical activity was excluded from the model on account of its non-significant bivariate association ($p = 0.147$).

i. Model Fit Statistics

Tables 5: Present the SPSS model summary and Hosmer-Lemeshow goodness-of-fit test results.

Model Summary Statistic	Value	Interpretation	Threshold
–2 Log Likelihood (–2LL)	178.34	Lower values indicate a better fit	Baseline
Cox & Snell R ²	0.21	21% variance explained (lower bound)	> 0.10 acceptable
Nagelkerke R ²	0.29	29% variance explained (adjusted)	> 0.20 good
Overall Model χ^2	38.47	Model significantly better than null	p < 0.001
Classification Accuracy	74.7%	Proportion correctly classified	> 70% good

Note. Table 5. SPSS Binary Logistic Regression Model Summary. Source: SPSS Field Data, Kailahun Town Survey, 2025.

Table 6: Hosmer-Lemeshow goodness-of-fit test results

Hosmer-Lemeshow Test	Chi-square (χ^2)	df	Sig. (p)
Goodness of Fit	6.12	8	0.634

Note. Table 6. Hosmer-Lemeshow Goodness-of-Fit Test. A non-significant p-value (p > 0.05) indicates that the model fits the data adequately. Source: SPSS Field Data, Kailahun Town Survey.

Table 7: Binary logistic regression analysis showing independent predictors of PUD occurrence

ii. Regression Coefficients and Odds Ratios

Table 4.7 presents the full logistic regression output including unstandardised regression coefficients (B), standard errors (S.E.), Wald chi-square statistics, significance levels, adjusted odds ratios (AOR/Exp(B)), and 95% confidence intervals.

Variable	B	S.E.	Wald χ^2	Sig.	AOR Exp(B)	95% CI for AOR
Smoking (vs. Non-smoker)	1.95	0.52	13.98	<0.001	7.03	2.54 – 19.42
Alcohol Consumption (vs. None)	2.04	0.44	21.53	<0.001	7.69	3.25 – 18.20
Frequent Painkiller Use (vs. None)	0.88	0.39	5.06	0.024	2.41	1.12 – 5.21
Constant	−0.83	0.31	7.18	0.007	0.44	—

Note. Table 7. Binary logistic regression — independent predictors of PUD occurrence. Dependent variable: PUD occurrence (1=Yes, 0=No). Method: Enter. AOR = Adjusted Odds Ratio. *Statistically significant at $p < 0.05$. Source: SPSS Field Data, Kailahun Town Survey.

Alcohol consumption was the strongest independent predictor of PUD occurrence (AOR = 7.69, 95% CI: 3.25–18.20, $p < 0.001$): respondents who consumed alcohol were approximately 7.7 times more likely to have PUD compared to non-consumers after adjusting for smoking and NSAID use. Smoking was the second strongest predictor (AOR = 7.03, 95% CI: 2.54–19.42, $p < 0.001$): smokers were approximately seven times more likely to have PUD than non-smokers. Frequent painkiller use was also a significant independent predictor (AOR = 2.41, 95% CI: 1.12–5.21, $p = 0.024$): frequent users were approximately 2.4 times more likely to have PUD than non-users. The overall model explained 29% of the variance in PUD occurrence (Nagelkerke $R^2 = 0.29$) and demonstrated adequate fit (Hosmer-Lemeshow $\chi^2 = 6.12$, $p = 0.634$), with a classification accuracy of 74.7%.

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Discussion of Findings

1. Socio-demographic Profile and Its Implications

The predominance of males in the study sample (70.8%) is consistent with epidemiological patterns documented across West African PUD studies. Nwokediuko et al. (2021) and Mensah and Asiamah (2020) similarly reported higher proportions of male PUD patients in Nigerian and Ghanaian samples respectively, attributing this pattern to the higher prevalence of male-specific risk behaviours, particularly tobacco use, alcohol consumption, and occupational NSAID use, rather than intrinsic biological sex differences in ulcer susceptibility. In Kailahun, the gendered division of labour with men disproportionately

engaged in heavy agricultural fieldwork and socially legitimised alcohol consumption likely explains the observed male predominance.

The high proportion of respondents with tertiary education (66.2%) is notable and merits interpretation. While it might be anticipated that higher education would confer protective health behaviour, the concurrent high prevalence of alcohol use (55.8%), NSAID consumption (77.9%), and smoking (23.4%) among the largely educated sample suggests that health knowledge does not automatically translate into protective behaviour in contexts where socio-cultural norms, economic pressures, and structural access barriers are powerful countervailing forces. This finding aligns with the Health Belief Model construct of "perceived barriers": even knowledgeable individuals may be unable or unwilling to modify high-risk behaviours when cultural, economic, or social costs are high (Glanz & Viswanath, 2015).

2. Alcohol Consumption: The Dominant Determinant

Alcohol consumption emerged as the strongest independent predictor of PUD occurrence in this study (AOR = 7.69, 95% CI: 3.25–18.20, $p < 0.001$; $\chi^2 = 28.64$, $V = 0.43$). This finding places the study's results at the upper end of the risk magnitude reported in the West African literature: Nwokediuko et al. (2021) reported a 2.5-fold risk in Nigeria; Mensah and Asiamah (2020) reported that 68% of Ghanaian ulcer patients consumed alcohol; and Sesay and Bangura (2022) found that 63% of Bo District ulcer patients consumed alcohol weekly. The substantially higher AOR in the present study may reflect the unique characteristics of alcohol consumption in Kailahun: the predominance of locally produced, unregulated spirits (palm wine, country gin) with high and variable ethanol concentrations, frequent empty-stomach consumption before the morning meal, and the additive effect of concurrent risk factors particularly the very high NSAID use prevalence which may synergistically amplify the gastrototoxic effect of alcohol.

Biologically, ethanol damages gastric epithelial cell membranes, disrupts the mucus-bicarbonate protective barrier, stimulates parietal cell HCl secretion, impairs mucosal angiogenesis, and elevates pro-inflammatory cytokines that delay ulcer healing (Zhu et al., 2021). When consumed on an empty stomach, a common practice in Kailahun, where palm wine is often consumed before the first meal, these effects are maximised due to the absence of the buffering and diluting effects of food. The convergence of high-risk alcohol consumption patterns with the broader risk factor profile of this population creates a compounding effect on PUD risk that substantially exceeds what would be expected from alcohol exposure alone.

3. Tobacco Smoking: A High-Magnitude Independent Predictor

Smoking was confirmed as a highly significant independent predictor of PUD occurrence (AOR = 7.03, 95% CI: 2.54–19.42, $p < 0.001$; $\chi^2 = 12.87$, $V = 0.29$). The concentration of PUD diagnoses among smokers 88.9% of the 36 smokers had PUD is striking and clinically significant. This finding is consistent with the established pathophysiological mechanisms through which tobacco potentiates ulcer formation: nicotine reduces bicarbonate secretion, impairs mucosal blood flow, stimulates HCl production, inhibits prostaglandin-mediated gastric protection, and delays mucosal repair (Sung et al., 2009; Vakil et al., 2024). The high odds ratio observed in this study likely reflects the interaction of smoking with other co-prevalent risk factors (alcohol, NSAIDs) in the study population, producing a multiplicative rather than merely additive combined risk.

4. Unsupervised NSAID Use: A Critical and Underappreciated Risk

The finding that 77.9% of study participants reported frequent unsupervised painkiller use is arguably the most alarming epidemiological observation in this study, particularly in the context of its independent predictive significance (AOR = 2.41, 95% CI: 1.12–5.21, $p = 0.024$). This rate far exceeds the 52% reported by Sesay and Bangura (2022) in Bo District itself, already a high figure. In Kailahun, NSAIDs are inexpensive, freely available at informal market stalls without prescription, and widely used to manage musculoskeletal pain from agricultural labour. Their consumption without food, without medical supervision, and often in combination with alcohol and traditional herbal remedies creates a pharmacologically toxic environment for the gastric mucosa. NSAIDs inhibit COX-1, suppressing prostaglandin synthesis and stripping the mucosal layer of its protective bicarbonate, blood flow, and mucus-secreting functions, directly ulcerogenic effects and compound the mucosal damage already caused by alcohol and tobacco (Vakil et al., 2024).

The relatively lower AOR for NSAID use compared to alcohol and smoking, despite its much higher prevalence, may reflect measurement insensitivity: the binary operationalisation of "frequent use" may have failed to adequately capture dose, duration, co-administration with food, and concurrent use with other gastrotoxic agents, all of which are known dose-response modifiers of NSAID-related ulcer risk.

5. Physical Activity: A Non-Significant Finding

Physical activity was not found to be a statistically significant predictor of PUD occurrence in either bivariate ($p = 0.147$) or multivariate analysis. This is consistent with the limited

and inconsistent evidence base regarding the direct relationship between physical activity and PUD pathogenesis. Physical activity's beneficial effects on gastrointestinal health operate through indirect pathways, such as stress reduction, improved metabolic function, and reduced obesity-related gastro-oesophageal reflux rather than through direct modulation of gastric acid secretion or mucosal integrity. In a population engaged in high levels of heavy manual agricultural labour (which may be classified as "physical activity" by respondents regardless of its recreational or therapeutic nature), the measurement of physical activity as a binary variable may lack the specificity to capture the nuanced relationship between exercise type, intensity, and gastrointestinal outcomes.

6. Dietary Practices: Compounding Risk

Whilst dietary variables were not included in the multivariate model due to their ordinal measurement scale and the study's cross-sectional design, which limits the interpretation of indirect dietary effects in a regression model dominated by stronger binary predictors the descriptive dietary findings are epidemiologically significant. The 41.6% prevalence of regular meal skipping creates structural conditions of prolonged gastric acid exposure without mucosal buffering, a mechanism directly linked to ulcer formation and recurrence (Iwai et al., 2010; Lim et al., 2013). The high prevalence of frequent spicy food (46.8%) and fried or oily food (42.9%) consumption likely exacerbates existing mucosal damage, particularly in the presence of concurrent alcohol use, NSAID consumption, and smoking. The carbohydrate-dominated, low-protein, low-diversity diet characteristic of rural Kailahun further impairs the nutritional substrate required for mucosal repair (FAO, 2021), creating a dietary environment that is systematically hostile to ulcer healing and recovery.

Conclusions

This study has generated the most comprehensive, rigorous, and locally specific quantitative evidence to date on the lifestyle and dietary determinants of peptic ulcer disease among adults in Kailahun Town, Sierra Leone. The following conclusions are drawn in direct response to the study's research objectives:

i. In response to Objective 1, the three dominant lifestyle factors associated with PUD occurrence are alcohol consumption (55.8% prevalence; AOR = 7.69), tobacco smoking (23.4% prevalence; AOR = 7.03), and frequent unsupervised NSAID use (77.9% prevalence; AOR = 2.41). All three were statistically significant in both bivariate and multivariate analyses.

ii. In response to Objective 2, the principal dietary risk practices in this population are: regular meal skipping (41.6%), frequent spicy food consumption (46.8%), and frequent fried or oily food consumption (42.9%), occurring within a dietary context characterised by carbohydrate-heavy, low-diversity, protein-deficient eating patterns.

iii. In response to Objective 3, statistically significant associations were identified between PUD occurrence and: alcohol consumption ($\chi^2 = 28.64$, $p < 0.001$), smoking ($\chi^2 = 12.87$, $p < 0.001$), and NSAID use ($\chi^2 = 4.92$, $p = 0.027$). Physical activity was not significantly associated ($p = 0.147$).

iv. In response to Objective 4, binary logistic regression confirmed alcohol consumption (AOR = 7.69), smoking (AOR = 7.03), and NSAID use (AOR = 2.41) as independent predictors of PUD occurrence after mutual adjustment. The model demonstrated good fit (Hosmer-Lemeshow $p = 0.634$) and explained 29% of variance in PUD occurrence (Nagelkerke $R^2 = 0.29$).

These findings confirm that PUD in rural Kailahun is fundamentally a disease of modifiable, co-occurring behavioural risk factors, operating within a socio-economic and cultural context that perpetuates and reinforces high-risk practices. The convergence of alcohol use, smoking, and unsupervised NSAID use in the same individuals, compounded by dietary inadequacy, produces a multiplicative risk environment that far exceeds what any single factor alone would predict. Addressing PUD in this setting, therefore, demands a comprehensive, multi-component public health response that simultaneously targets all three dominant determinants.

Recommendations

1. Policy Recommendations

The Ministry of Health and Sanitation should develop and implement a national policy framework specifically regulating the over-the-counter sale of NSAIDs in rural informal markets, including mandatory labelling requirements, pharmacist-led dispensing protocols, and restrictions on bulk sales without prescription. PUD-specific behavioural and dietary risk factors should be explicitly integrated into the next iteration of Sierra Leone's National NCD Strategic Plan (post-2024), with dedicated monitoring indicators, budget lines for community-level interventions, and district-level reporting requirements.

2. Public Health and Community-Level Recommendations

Culturally tailored community-level alcohol reduction programmes should be designed and delivered in Kailahun District, engaging community leaders, religious institutions, and agricultural cooperative networks as implementation partners. Programmes must acknowledge the cultural and economic roles of locally brewed beverages while providing evidence-based information on their gastric health consequences.

Community health workers should be trained and equipped to screen for PUD risk factors alcohol use, NSAID use, and tobacco smoking, during routine household visits and PHU consultations, with standardised referral pathways to district-level clinical care.

Dietary and Nutritional Recommendations

Nutrition education programmes delivered through schools, community health platforms, and women's groups should promote meal regularity (minimum three meals per day), increased protein intake from locally available and affordable sources (fish, legumes, groundnuts), and greater consumption of protective nutrients (fruits, vegetables). Agricultural extension services should be engaged to promote kitchen gardens and diversified smallholder farming systems that increase household access to fresh produce, reducing dietary monotony and improving nutritional status relevant to mucosal repair.

Clinical Practice Recommendations

Healthcare providers at all levels in Kailahun District should incorporate systematic screening for the three key lifestyle risk factors, alcohol use, smoking, and NSAID use into standard PUD assessment protocols, and should provide brief behavioural counselling interventions as part of routine outpatient consultations.

Research Recommendations

Future research should employ longitudinal cohort designs to establish temporality and causal inference between lifestyle/dietary exposures and PUD development and recurrence in the Sierra Leonean context.

Studies integrating biological measurement of *H. pylori* infection status (using stool antigen tests or urea breath tests, which are feasible in low-resource settings) with behavioural and dietary data are needed to fully characterise the multifactorial aetiology of PUD in this population.

Declarations

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Author contributions

The author was solely responsible for the conceptualization and design of the study. The author conducted the literature review, developed the data collection tools, and carried out data collection in the field. Data analysis, interpretation of results, and drafting of the manuscript were also undertaken by the author. The author reviewed and approved the final version of the manuscript and takes full responsibility for the content of the study.

Funding information

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request. Access to the data may be subject to ethical and confidentiality considerations to protect the privacy of the study participants.

Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from the Sierra Leone Ethics and Scientific Review Committee (SLESRC), ensuring that the research adhered to national and international ethical guidelines for human participation. Informed consent was obtained from all participants before data collection. Participants were fully informed about the purpose of the study, their right to withdraw at any time, and the measures taken to ensure the confidentiality and anonymity of their responses.

Consent for publication

Not applicable.

Competing interests

All authors declare that they have no competing interests.

Footnotes

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Author Contributions

Sullay Kalokoh (SK) conceived and designed the study, coordinated data collection, performed data analysis, interpreted the results, and drafted the manuscript.

Augustine Bob Moseray (ABM) contributed to the study design, supervised field data collection, and critically reviewed the manuscript.

Daniel Kamara (DK) assisted in data analysis and interpretation and contributed to manuscript revision.

Ibrahim S Jalloh (ISJ) participated in literature review, data collection, and manuscript editing.

Abdulai Augustus Brima (AAB) contributed to questionnaire development, data collection, and data management, and assisted in data validation, statistical review, and manuscript proofreading

Wow amazing

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Response/Clarification

The questionnaire used in this study was developed specifically for this research and has not been previously published. An English-language version of the questionnaire has been uploaded as a supplementary file and is cited in the main manuscript (see Supplementary File 1).

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Figures

map of Kailahun district



Figure 1

Figure 3.2: Map of Kailahun District, Eastern Province, Sierra Leone

Source: Google Maps; District boundary demarcated by Daniel kamara (Bsc Hon Biostatistic and Epidemiology)

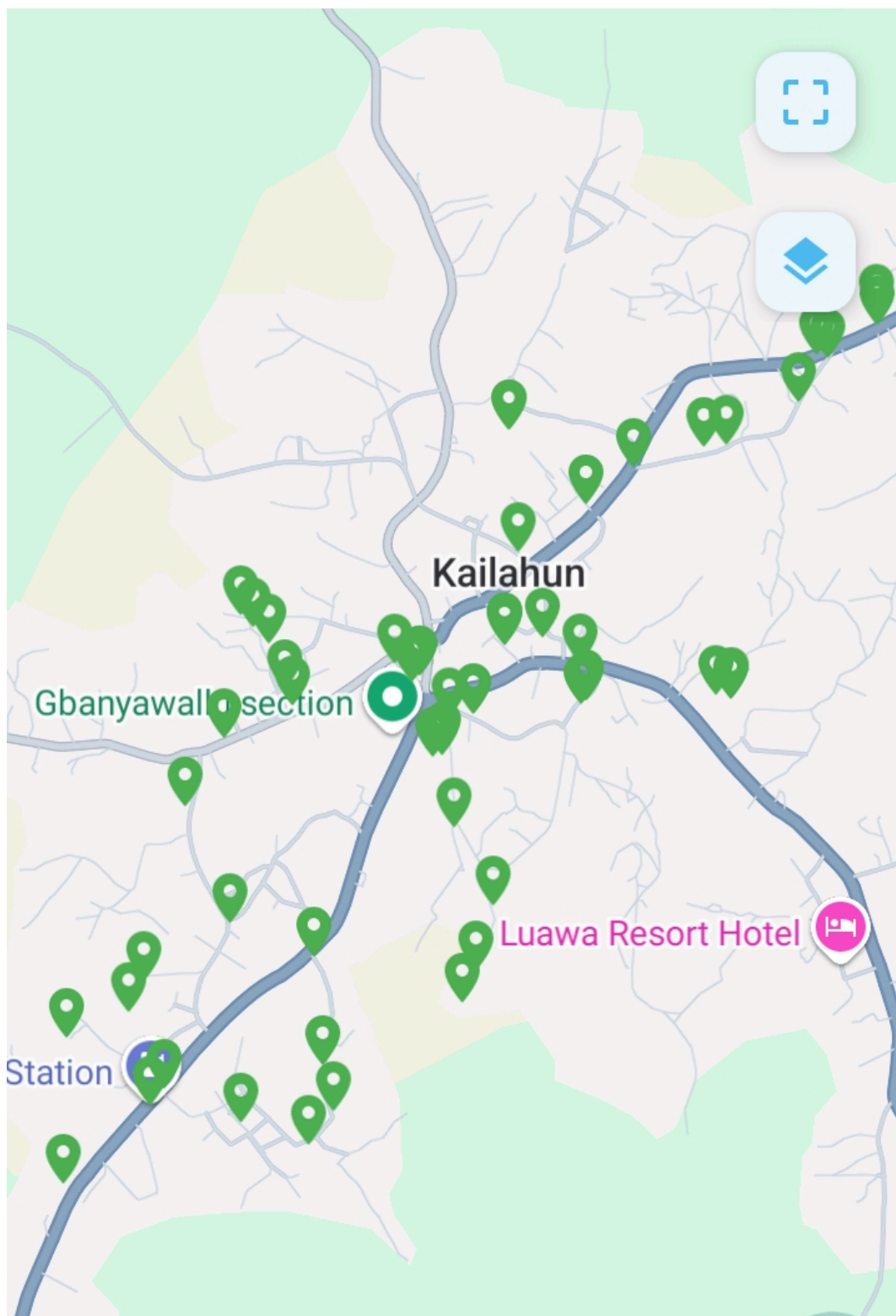


Figure 2

Figure 3.3: GPS Coordinates of Data Collection Sites, Kailahun Town

Source: Researcher's Field Data, 2025; KoBoToolbox geolocation capture

Figure 3.1: Sample Size Determination Flow

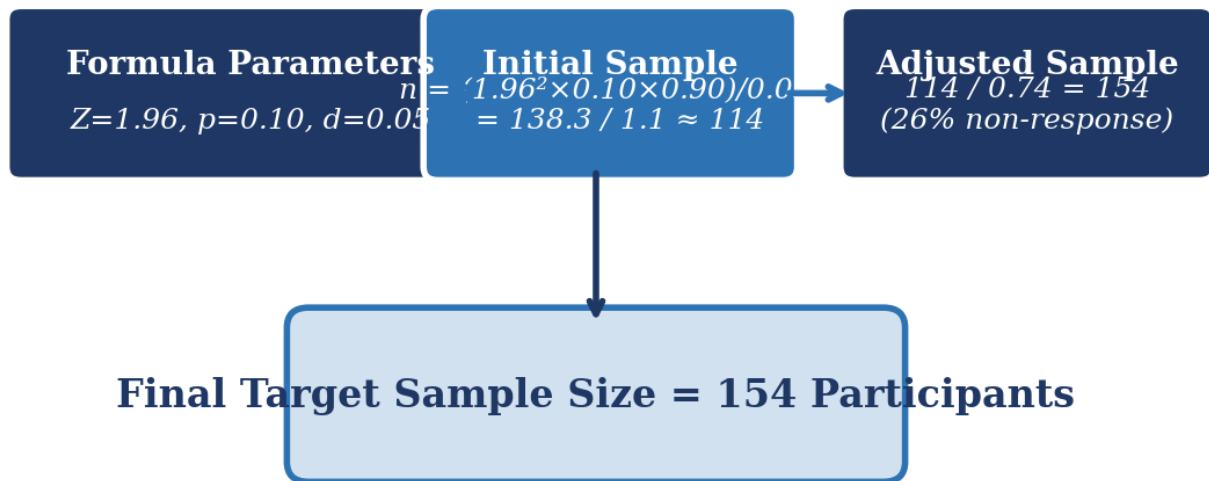


Figure 3

Figure 3.1: Sample Size Calculation Flow Diagram — Kish (1965) Formula with Non-Response Adjustme

Figure 4.1: Gender Distribution of Respondents (n = 154)

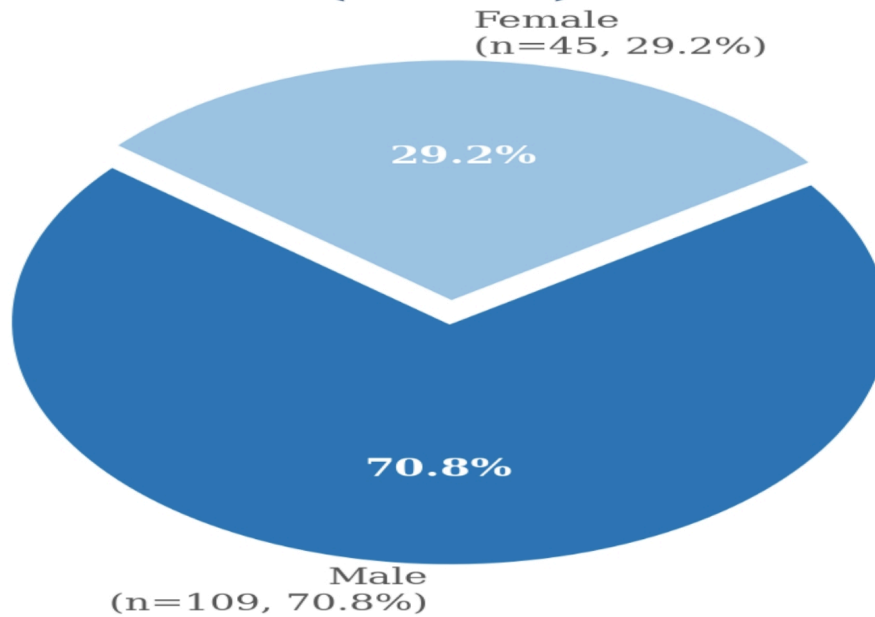


Figure 4

Figure 1: Gender Distribution of Respondents (Pie Chart; n = 154)

Figure 4.2: Educational Attainment of Respondents (n = 154)

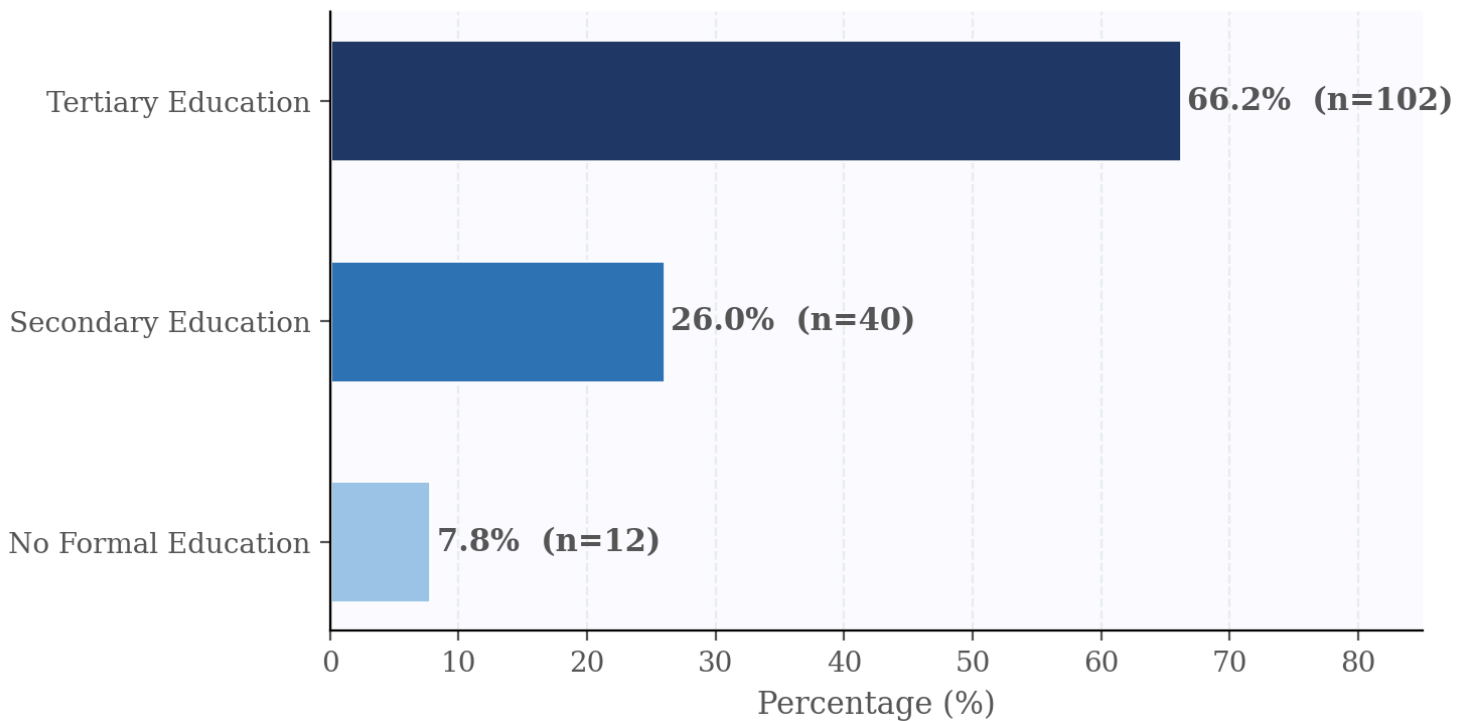


Figure 5

Figure 2: Educational Attainment of Respondents (Horizontal Bar Chart; n = 154)

**Figure 4.3: Marital Status of Respondents
(n = 154)**

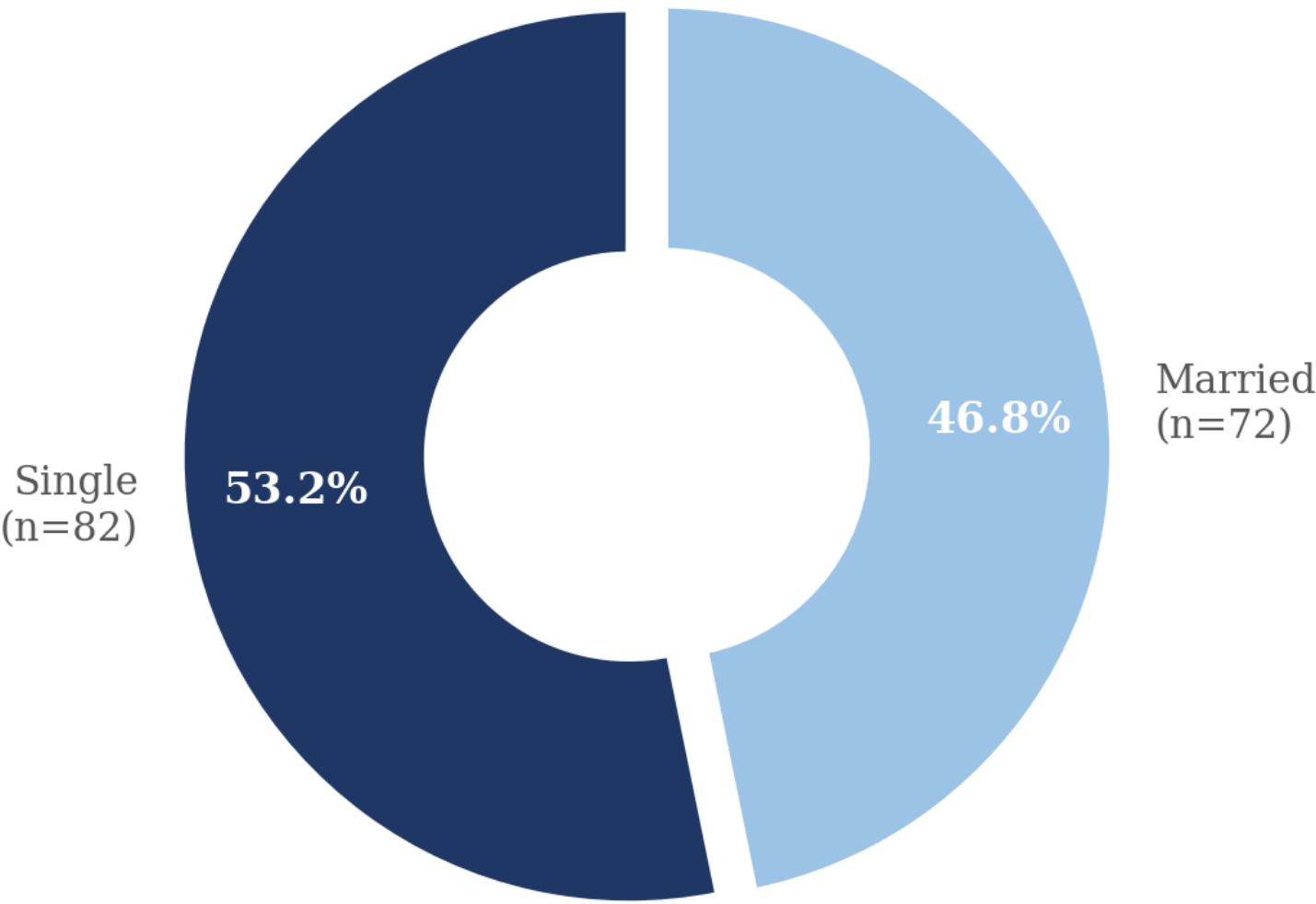


Figure 6

Figure 3: Marital Status of Respondents (Donut; n = 154)

**Figure 4.4: Distribution of Lifestyle Factors Among Respondents
(n = 154)**

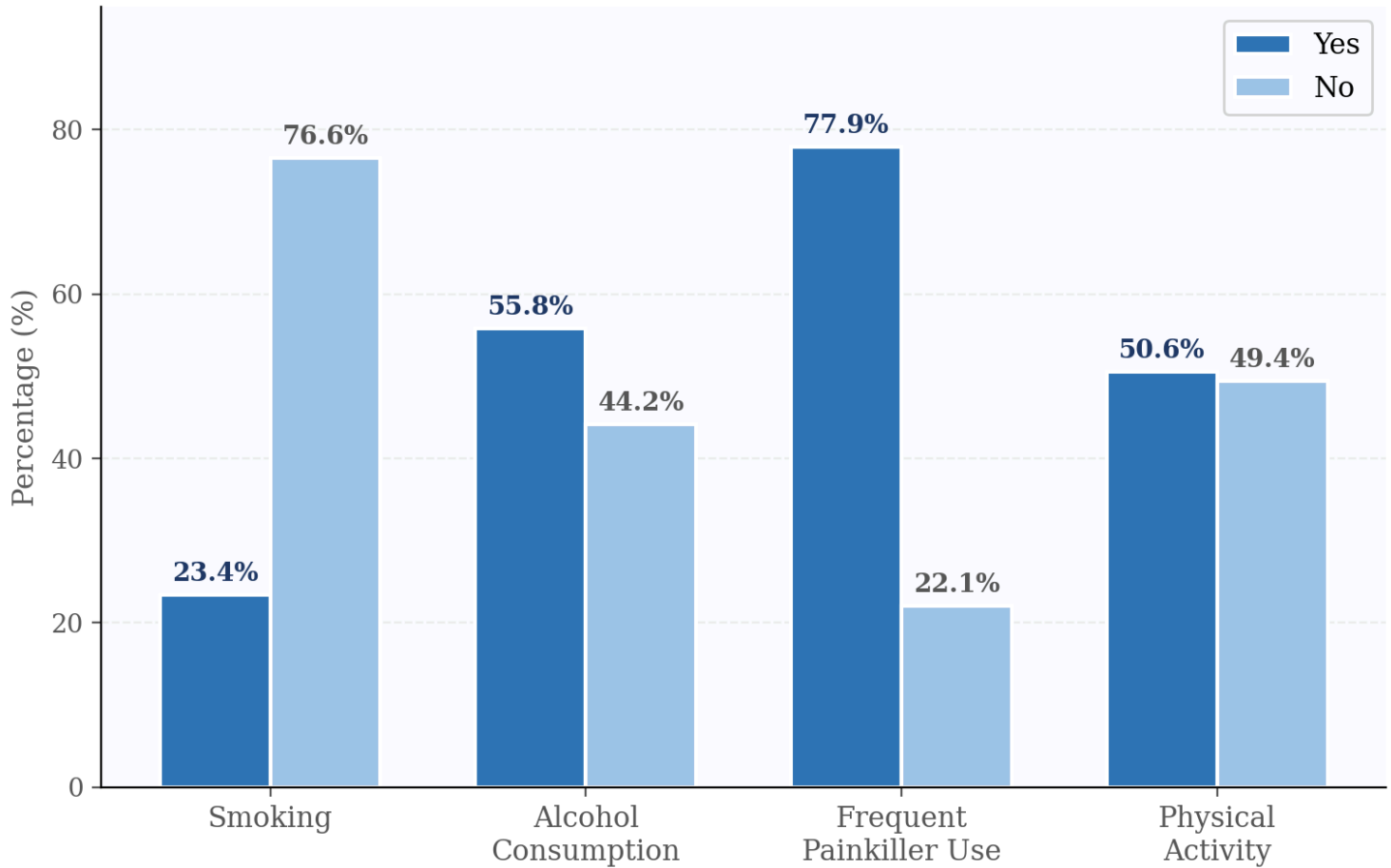


Figure 7

Figure 4: Distribution of Lifestyle Factors Among Respondents (Grouped Bar Chart; n = 154)

**Figure 4.5: Key Dietary Risk Practices Among Respondents
(n = 154)**

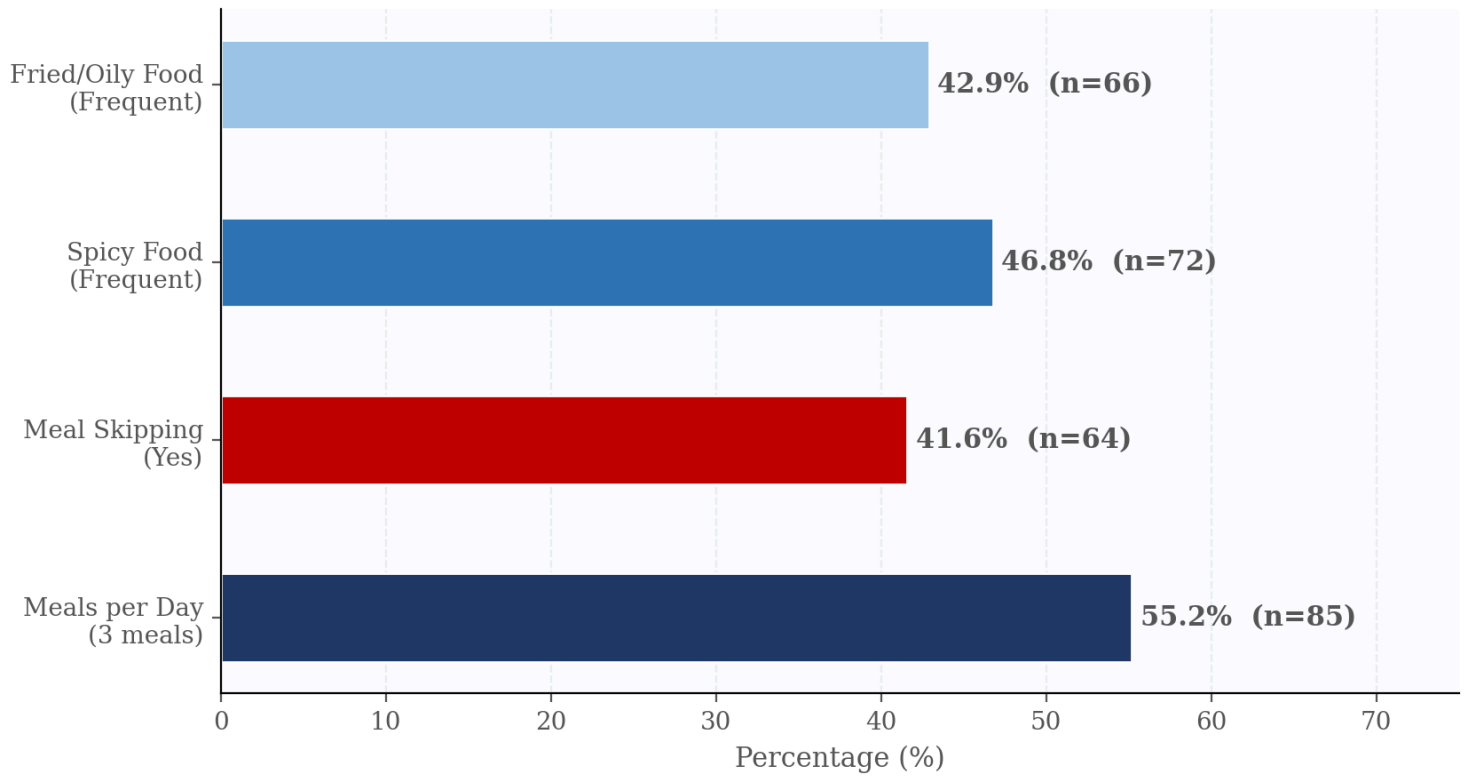


Figure 8

Figure 5: Key Dietary Risk Practices Among Respondents (n = 154)

Figure 4.6: Chi-Square Test Results — Lifestyle Factors vs. Peptic Ulcer Occurrence

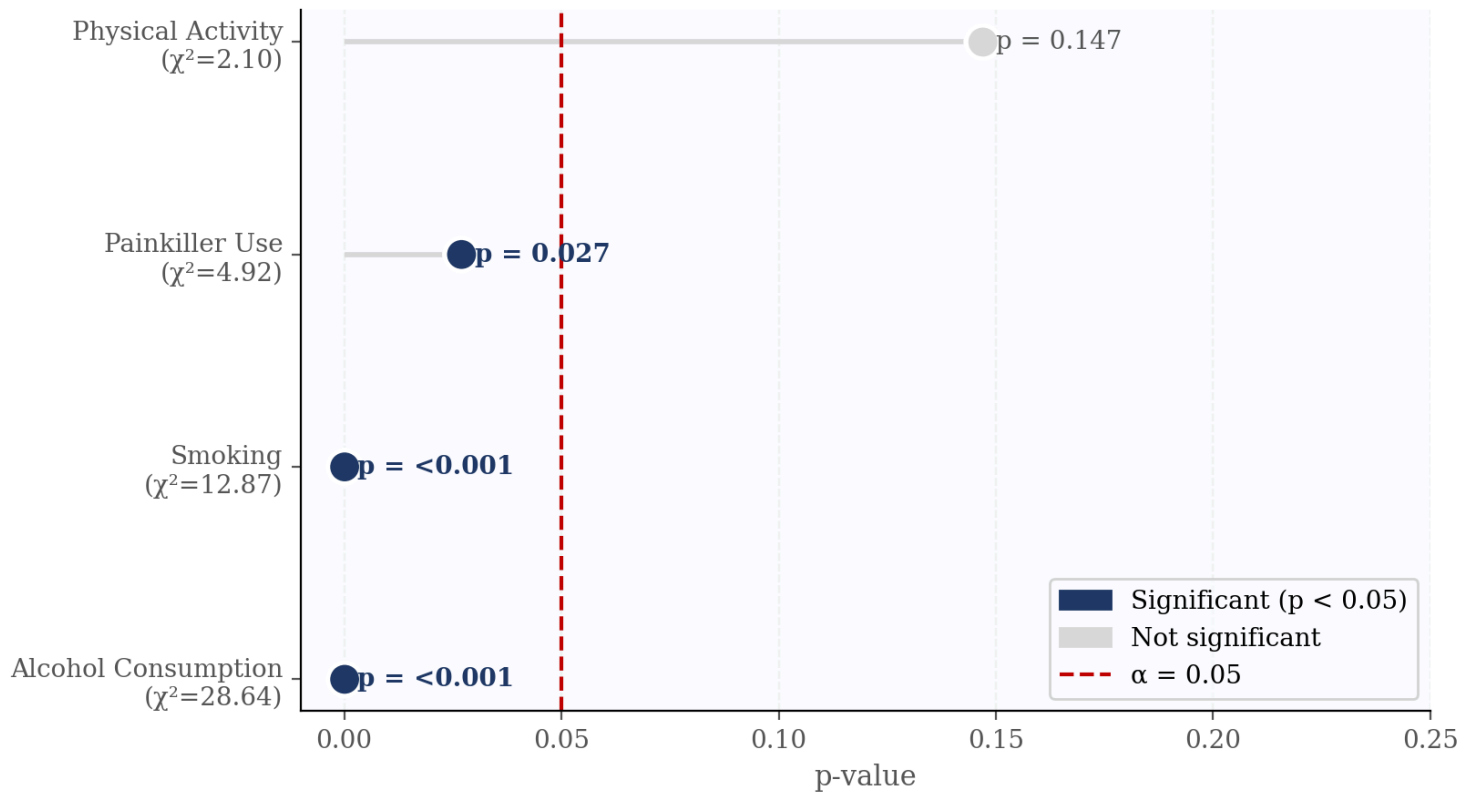


Figure 9

Figure 6: Chi-Square Test Results Significance of Association Between Lifestyle Factors and PUD Occurrence (Lollipop Plot; $\alpha = 0.05$ threshold shown in red dashed line)

**Figure 4.7: Forest Plot — Independent Predictors of Peptic Ulcer
(Binary Logistic Regression, n = 154)**

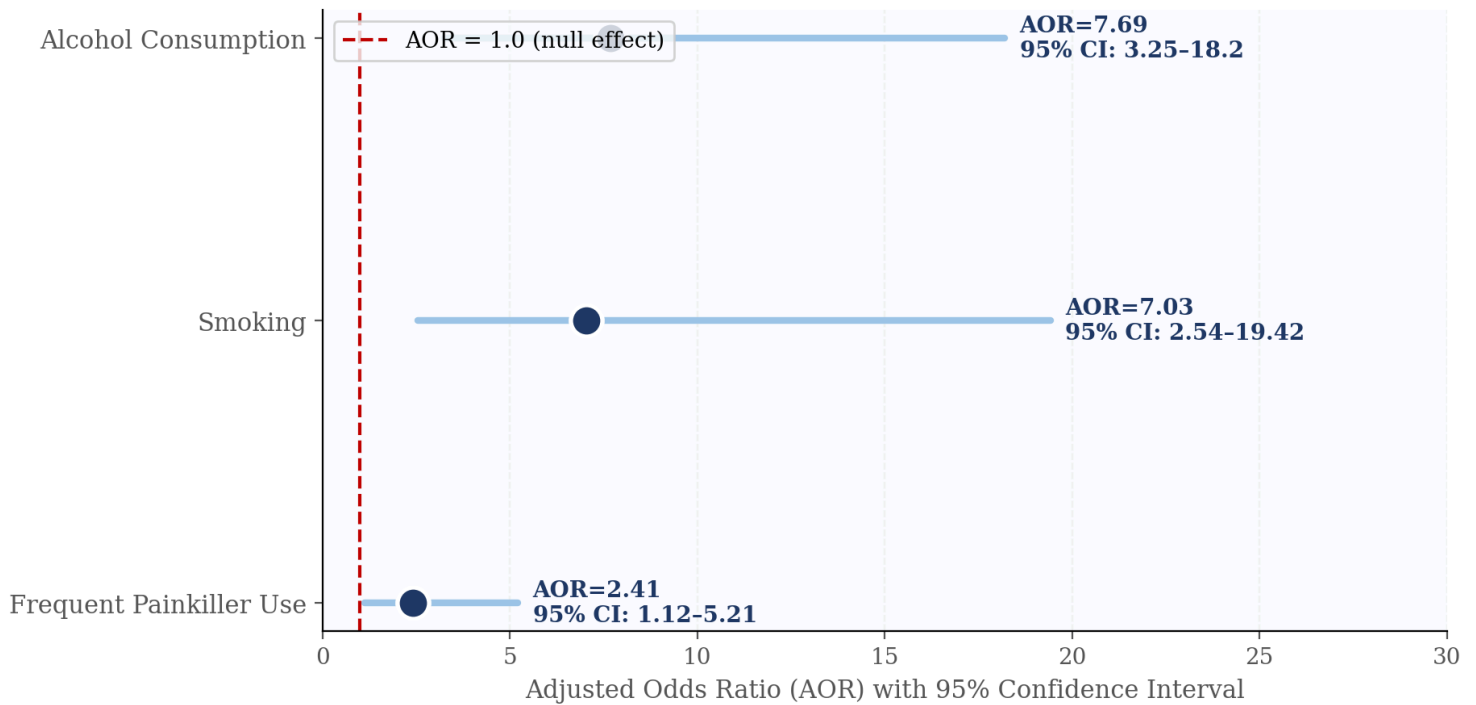


Figure 10

Figure 7: Forest Plot Adjusted Odds Ratios (AOR) with 95% Confidence Intervals for Independent Predictors of PUD Occurrence (Binary Logistic Regression; n = 154)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

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