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Study of Dietary Risk Factors Associated with the Onset or Worsening of Complications in Chronic Viral Hepatitis B

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Abstract **Background:** Chronic hepatitis B (HBV) infection is a major public health issue in sub-Saharan Africa, frequently leading to severe clinical complications like cirrhosis and hepatocellular carcinoma. While diet is a known modulator of liver health, its specific role in the progression of HBV in the Togolese context is poorly documented. This study aimed to identify dietary risk factors associated with the onset or worsening of clinical complications in patients with chronic hepatitis B. **Methods:** A retrospective case-control study was conducted at a specialized hepatitis care facility in Lomé, Togo. We enrolled 212 HBsAg-positive adults, comprising 106 "cases" with at least one documented HBV-related clinical complication and 106 age- and sex-matched "controls" without such complications. Dietary habits preceding the onset of complications were assessed using a standardized questionnaire. Multivariate logistic regression was used to analyze the association between food consumption frequency and clinical outcomes, adjusting for potential confounders. **Results:** The frequent consumption of several food categories was significantly associated with an increased risk of clinical complications ($p < 0.05$). These included alcoholic beverages, high-lipid foods (fried items, certain sauces), high-carbohydrate foods (fermented pastes, refined sugar), red meat, and bouillon cubes. Conversely, a regular intake of leafy green vegetable-based sauces was found to be significantly associated with a lower risk of complications. **Conclusion:** Our findings suggest that a dietary pattern characterized by the high-frequency consumption of pro-inflammatory, high-energy foods is a significant risk factor for the progression of chronic hepatitis B in the Togolese setting. These results underscore the urgent need to integrate medical nutrition therapy and patient education into the standard of care to mitigate the risk of severe liver disease.

Keywords: *Hepatitis of viral origin B, dietary determinants of risk, clinical complications,nutrition, Togo*

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1. Introduction

Chronic hepatitis B (CHB) infection represents a formidable global health challenge and stands as a leading cause of liver-related mortality worldwide [1,2]. According to the World Health Organization's 2024 Global Hepatitis Report, viral hepatitis is the second leading infectious cause of death globally, with the hepatitis B virus (HBV) responsible for a substantial portion of the 1.3 million annual fatalities [1]. While a majority of immunocompetent adults clear acute HBV infection, approximately 10% develop a chronic state, placing them at significant risk of progressing to severe clinical complications such as cirrhosis and hepatocellular carcinoma (HCC) [3].

Sub-Saharan Africa bears a disproportionate share of this burden, with regional HBV prevalence rates often exceeding 8% [4]. This high endemicity is reflected in national seroprevalence figures, such as 13% in Côte d'Ivoire and 14.7% in Mali [5]. Togo is situated within this high-risk zone, with a national HBV seroprevalence estimated at 14%, and rates in its northern regions reaching as high as 35% [6]. The 20-40 year-old demographic is most affected, likely due to a combination of high-risk behaviors and various transmission routes [5,6].

The liver, being the central organ for metabolism and detoxification, is already functionally compromised in subjects with CHB, rendering it highly susceptible to

secondary insults [3]. Among these, dietary patterns are a critical and modifiable factor known to profoundly influence hepatic health [7,8]. For instance, chronic alcohol consumption is a potent hepatotoxin that can triple the risk of fibrosis in CHB patients [7]. Similarly, diets rich in saturated fats and refined carbohydrates can promote hepatic steatosis, leading to non-alcoholic fatty liver disease (NAFLD) [8]. The coexistence of NAFLD in individuals with CHB is recognized as a "second hit" that synergistically accelerates the progression towards fibrosis, cirrhosis, and HCC [9,10].

Despite the significant burden of HBV in Togo and the well-established link between diet and the progression of liver disease, no systematic investigation has previously been conducted to assess the relationship between local dietary habits and the development of CHB-related clinical complications. This knowledge gap hinders the development of evidence-based, culturally appropriate nutritional guidelines for patient management. Therefore, this study aimed to identify specific dietary risk factors associated with the onset or worsening of clinical complications in subjects with chronic hepatitis B in Lomé, Togo.

2. Materials and Methods

2.1. Study Design and Setting

A retrospective case-control study was conducted to investigate the association between dietary factors and the presence of clinical complications in patients with chronic hepatitis B. The study took place at the *Nouvelle Formule Sanitaire-Togo* (NFS-TOGO) medical facility in Lomé, the capital of Togo. This facility was selected because it is a specialized referral center for the diagnosis and management of viral hepatitis, ensuring access to a large and relevant patient population. The data collection period extended over three months, from February 1, 2021, to April 30, 2021.

2.2. Study Population and Sampling

The study population consisted of adult patients with a confirmed diagnosis of chronic hepatitis B who were registered at the NFS-TOGO facility. A consecutive sampling technique was used to recruit participants as they attended the clinic during the study period until the required sample size was reached.

The sample size was calculated using a standard formula for case-control studies. The calculation was based on an estimated odds ratio of 2.5 for the association between high-fat diets and liver complications, a 95% confidence level, a power of 80%, and a 1:1 ratio of cases to controls. This yielded a required sample size of 106 participants per group, for a total of 212 participants.

2.3. Participant Selection Criteria

Participants were allocated into one of two groups: "cases" or "controls".

Inclusion criteria:

→ Cases: Adult patients (aged 18 and over) with a confirmed positive HBsAg test who had at least one documented clinical complication related to chronic hepatitis B (e.g., fulminant hepatitis, steatohepatitis, cirrhosis, or hepatocellular carcinoma).

→ Controls: Adult patients (aged 18 and over) with a confirmed positive HBsAg test who were chronic carriers of the virus but presented no clinical or biological signs of complications. The controls were age- and sex-matched to the cases.

Exclusion criteria:

→ Individuals with a co-infection of Hepatitis C (HCV), Hepatitis D (HDV), or Human Immunodeficiency Virus (HIV).

→ Patients with a known history of other liver pathologies, such as drug-induced, autoimmune, or metabolic liver disease, that were not attributable to HBV infection.

→ Patients with a history of alcohol-induced liver disease independent of their HBV status.

2.4. Data Collection and Variables

Data were collected by trained interviewers using a structured, pre-tested questionnaire. The questionnaire was designed to gather information across three main domains:

→ Sociodemographic and anthropometric data: Information on age, sex, and other relevant demographic characteristics was collected.

→ Clinical data: Information on the type of HBV-related complication (for cases) was extracted from patient medical records.

→ Dietary habits: This section retrospectively assessed the typical food and beverage consumption patterns in the year preceding the diagnosis of complications (for cases) or the survey date (for controls). The frequency of consumption for various local foods was categorized as: "Rarely," "2-4 days/week," or "5-7 days/week". Foods were grouped based on their primary nutrient profile (carbohydrate-rich, lipid-rich, protein-rich, fiber-rich). The questionnaire also specifically captured the intake of alcoholic beverages and the use of bouillon cubes as a culinary additive.

2.5. Statistical Analysis

The collected data were entered into Microsoft Excel 2013 and subsequently analyzed using SPSS software, version 20.0. A p-value of less than 0.05 was considered statistically significant for all tests.

- Descriptive statistics were used to summarize the sociodemographic characteristics of the participants, presented as frequencies (n) and percentages (%).
- Bivariate analysis was performed using the Chi-square (χ^2) test to assess the association between categorical variables, including dietary habits and the presence of clinical complications. Odds Ratios (OR) with 95% Confidence Intervals (CI) were calculated to estimate the strength of these associations.
- Multivariate analysis was conducted using a binary

logistic regression model to identify the independent dietary predictors of HBV-related complications after adjusting for potential confounding variables. An OR > 1 indicated an increased risk, while an OR < 1 suggested a protective effect.

2.6. Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The study protocol received formal approval from the Institutional Review Board (IRB) of NFS-TOGO (N° 008/2021/NFS/SAA). Due to the minimal-risk nature of the research, a waiver of written consent was granted; however, verbal informed consent was obtained from every participant before their inclusion in the study. Participant confidentiality was strictly maintained by de-identifying all collected data, which were stored securely.

3. Results

3.1. Sociodemographic Characteristics of the Study Population

The study enrolled a total of 212 participants, comprising 106 cases with clinical complications related to chronic hepatitis B and 106 age- and sex-matched controls without such complications. The demographic profile of the participants is detailed in Table 1.The mean age was 37.8 ± 9.6 years for the case group and 34.1 ± 9.6 years for the control group. The 31–40 year age bracket was the most represented cohort in both groups. A significant male predominance was observed, particularly in the case group, which had a male-to-female ratio of 2.8:1, compared to 1.1:1 in the control group.

Table 1. Sociodemographic characteristics of the study population

Variable	Cases (n=106)	Controls (n=106)
Age group (years)	n (%)	n (%)
≤ 20	4 (3.8)	3 (2.8)
21–30	18 (17.0)	38 (35.8)
31–40	44 (41.5)	46 (43.4)
41–50	30 (28.3)	11 (10.4)
≥ 51	10 (9.4)	8 (7.5)
Mean age ± SD	37.8 ± 9.6	34.1 ± 9.6
Gender		
Male	78 (73.6)	56 (52.8)
Female	28 (26.4)	50 (47.2)
Total	106 (100.0)	106 (100.0)

3.2. Association Between Dietary Habits and Clinical Complications

Bivariate analysis revealed that the frequency of consumption of numerous foods, beverages, and culinary additives was significantly associated with the presence of clinical complications ($p < 0.05$). Key findings from the analysis, including recalculated Odds Ratios (OR) and their 95% confidence intervals (CI), are summarized in Table 2 and detailed below.

Table 2. Bivariate analysis of key dietary factors associated with clinical complications of chronic Hepatitis B

Dietary Factor	Consumption Category	OR (95% CI)	p-value
Carbohydrates			
Fermented maize-cassava Paste (*Konm*)	Frequent vs. Rare	12.6 (5.5 – 29.0)	< 0.001
Processed pasta	Frequent vs. Rare	82.9 (33.7 – 204.3)	< 0.001
Plantain	Frequent vs. Rare	28.4 (8.4 – 96.2)	< 0.001
Lipids			
Peanut-based Sauce	Frequent vs. Rare	114.3 (14.9 – 877.9)	< 0.001
Fried tomato sauce (*Nougbagba*)	Frequent vs. Rare	191.1 (43.9 – 831.9)	< 0.001
Mayonnaise/Butter	Frequent vs. Rare	---	< 0.001
Proteins			
Fatty Meat (Mutton, Pork, Beef)	Frequent vs. Rare	17.6 (8.5 – 36.6)	< 0.001
Omelette	Frequent vs. Rare	---	< 0.001
Legumes (Cowpea, Bambara groundnut)	Frequent vs. Rare	---	< 0.001
Beverages & Additives			
Alcoholic Beverages	Frequent vs. Rare	34.7 (10.9 – 110.3)	< 0.001
Bouillon Cubes	Intensive vs. Rare/Occasional	60.1 (23.9 – 151.3)	< 0.001
Fiber-Rich Sauces			
Leafy Vegetable Sauces (*Gboma, Essrou*)	Frequent vs. Rare	0.30 (0.17 – 0.54)	< 0.001
Viscous Sauces (Okra, Baobab)	Frequent vs. Rare	4.20 (2.3 – 7.6)	< 0.001

3.2.1. Consumption of High-macronutrient Foods

A strong, statistically significant association was observed between the frequent consumption of foods rich in carbohydrates, lipids, and certain proteins and the presence of HBV-related complications.

For carbohydrates, the consumption of fermented products like maize-cassava paste (*Konm*) and processed foods such as pasta was significantly higher in the case group. Frequent intake (2-7 days/week) of *Konm* was associated with over 12 times the odds of having clinical complications compared to rare consumption (OR = 12.6,[63/5], 95% CI: 5.5–29.0; $p < 0.001$). This association was even more pronounced for processed pasta (OR = 82.9, [829/10]95% CI: 33.7–204.3; $p < 0.001$).

Regarding lipids, consumption of high-fat sauces was almost exclusive to the case group. For instance, frequent intake of fried tomato sauce (*nougbagba*) was associated with an extremely high risk of complications (OR = 191.1, [1911/10], 95% CI: 43.9–831.9; $p < 0.001$). Similarly, the odds ratio for peanut-based sauce consumption was 114.3, [1143/10] (95% CI: 14.9–877.9; $p < 0.001$).

In the protein category, frequent intake of fatty meats (mutton, pork, beef) was strongly linked to the case group (OR = 17.6,[88/5] 95% CI: 8.5–36.6; $p < 0.001$). A similar strong positive association was found for the consumption of legumes and omelettes.

3.2.2. Consumption of Beverages and Culinary Additives

Analysis of beverage intake showed that frequent consumption of alcoholic beverages was a major risk determinant. Individuals in the case group had nearly 35

times the odds of being frequent consumers of alcohol compared to the control group (OR = 34.7,[347/10], 95% CI: 10.9–110.3; $p < 0.001$).

The use of flavor-enhancing bouillon cubes also revealed a highly significant dose-dependent association. Intensive use (5–7 days/week), reported by 79.2% of cases but none of the controls, was strongly correlated with the presence of clinical complications (OR = 60.1, [601/10], 95% CI: 23.9–151.3; $p < 0.001$).

3.2.3. Consumption of Fiber-rich Sauces

The consumption of fiber-rich sauces showed divergent associations with clinical outcomes. Frequent intake of viscous sauces (made from okra, baobab leaves) was positively associated with being in the case group (OR = 4.2,[21/5], 95% CI: 2.3–7.6; $p < 0.001$).

Conversely, a statistically significant protective association was observed for the consumption of non-viscous, leafy green vegetable sauces (e.g., *gboma*, *essrou*, *moringa*). Frequent intake of these sauces was significantly more common in the control group and was associated with a 70% reduction in the odds of having clinical complications (OR = 0.30, [3/10] 95% CI: 0.17–0.54; $p < 0.001$).

4. Discussion

This study is the first systematic investigation in Togo to establish a clear association between specific local dietary patterns and the presence of clinical complications in patients with chronic hepatitis B (CHB). Our principal finding is that the frequency of consumption of pro-inflammatory, high-energy foods, rather than their intrinsic nature alone, is strongly linked to the progression of liver disease. These results provide critical, context-specific evidence highlighting the pivotal role of nutrition in the clinical management of CHB and underscore the urgent need for targeted dietary interventions in the West African setting.

The NFS-TOGO medical facility was purposefully selected for several scientifically grounded reasons. As a major referral center for hepatology in the country, it manages a high volume of patients with viral hepatitis, which ensures access to a sufficiently large and diverse patient population to achieve the required sample size. This high patient throughput is critical for a case-control study requiring the recruitment of a significant number of cases with specific clinical complications. Furthermore, the facility employs standardized protocols for the diagnosis, follow-up, and management of chronic hepatitis B. This standardization minimizes clinical variability between participants and ensures that the classification of "cases" and "controls" is based on consistent and reliable clinical criteria, thereby enhancing the internal validity of the study. Finally, its well-maintained medical records system was essential for the retrospective data collection, allowing for accurate retrieval of clinical and dietary information preceding the onset of complications.

The sociodemographic profile of our study population, characterized by a significant male predominance and a peak prevalence in the 31–40 year age bracket, aligns with findings from other hospital-based studies in Togo and the broader West African region [11]. The higher susceptibility among men is a well-documented phenomenon in HBV pathology. This may be attributed to a combination of factors, including sex-based hormonal differences, where androgens may promote viral persistence while estrogens enhance antiviral defenses [12], and a higher prevalence of behavioral risk factors such as unsterilized grooming tools and traditional scarification practices [13]. The vulnerability of this age group likely reflects the natural history of the disease in high-endemicity regions, where infections acquired in infancy or early childhood, due to an immature immune system, progress silently over decades, manifesting as severe clinical complications in adulthood [14].

Our analysis identified several dietary habits acting as potent risk factors for HBV-related complications. The strong association between frequent alcohol consumption and an increased risk of complications (OR = 34.7) confirms the well-established synergistic effect between alcohol and HBV in accelerating liver damage [15]. The metabolism of ethanol produces acetaldehyde, a highly toxic compound that inflicts direct damage on hepatocytes, triggering a cascade of oxidative stress, steatosis, and inflammation that culminates in fibrosis and cirrhosis [16,17]. In a liver already compromised by a chronic viral infection, the addition of this potent hepatotoxin logically hastens the progression to end-stage liver disease.

A central finding of this research is the strong link between a diet high in energy-dense macronutrients and the presence of clinical complications. The frequent intake of high-lipid sauces (e.g., peanut-based or fried *nougbagba*), fatty red meats, and high-glycemic carbohydrates (e.g., fermented pastes like *Konm* and processed pasta) was significantly more common in the case group. This dietary pattern is known to overwhelm the liver's metabolic capacity, promoting ectopic fat deposition and inflammation, which are hallmarks of Non-Alcoholic Fatty Liver Disease (NAFLD) [8,18]. The co-existence of NAFLD in CHB patients is increasingly recognized as a "second hit" that synergistically accelerates fibrosis progression and substantially increases the risk of hepatocellular carcinoma (HCC) [9,19,20]. Furthermore, the high consumption of red and processed meats, as observed in our cases, not only contributes to NAFLD but also introduces exogenous carcinogens like heterocyclic amines, which may further elevate HCC risk [21].

Specific to the Togolese culinary context, the intensive use of flavor-enhancing bouillon cubes emerged as a particularly strong risk factor (OR = 60.1), with consumption being almost exclusive to the case group. These cubes are typically high in sodium, monosodium glutamate (MSG), and saturated fats. While direct hepatotoxicity data is limited, high-sodium intake has been correlated with fibrosis severity in viral hepatitis [22]. Moreover, experimental studies suggest that chronic MSG consumption can induce hepatic inflammation and dyslipidemia, imposing an additional metabolic burden on an already compromised liver [23].

Conversely, this study identified a significant protective factor: the regular consumption of non-viscous, leafy green vegetable sauces (e.g., *gboma*, *essrou*). Frequent intake of these sauces was associated with a 70% reduction in the odds of having clinical complications (OR

= 0.30). This finding is biologically plausible. Such vegetables are low in calories but rich in dietary fiber, micronutrients, and bioactive compounds. They are excellent sources of inorganic nitrates, which can improve endothelial function [24]; antioxidants that mitigate the oxidative stress central to liver damage; and vitamins such as folate (B9) and K, which support hepatocyte regeneration and anti-fibrotic pathways [25]. Additionally, their high fiber content promotes a healthy gut microbiome, which plays a crucial role in modulating inflammation along the gut-liver axis [26].

A perplexing finding was the higher consumption of fatty fish among cases, which contradicts typical dietary recommendations based on their anti-inflammatory omega-3 fatty acid content. This paradox may be explained by local culinary practices. In Togo, deep-frying is a common method for preparing fish. This cooking process can destroy beneficial omega-3s while generating harmful trans-fats and advanced glycation end-products (AGEs), thereby transforming a potentially healthy food into a detrimental one [27].

This study is not without limitations. Its retrospective case-control design is inherently susceptible to recall bias, as participants' memory of past dietary habits may be imperfect [28]. Secondly, the dietary assessment was conducted using a non-validated, structured questionnaire, which could affect the accuracy of the data. Furthermore, while we matched for age and sex, other potential confounders such as viral load, HBV genotype, physical activity levels, and socioeconomic status were not accounted for and could influence both diet and disease progression [29,30]. Finally, this observational design can only establish association, not causation; it demonstrates a strong correlation but cannot definitively prove that the observed dietary patterns are the direct cause of the complications.

Despite these limitations, our study provides valuable and actionable evidence on the critical relationship between diet and CHB progression in Togo. The findings strongly advocate for the integration of medical nutrition therapy and patient education as a cornerstone of standard care for CHB patients, shifting the paradigm beyond solely virological monitoring to a more holistic management approach. Empowering patients with evidence-based, culturally appropriate nutritional guidance is an accessible and crucial strategy to slow disease progression and reduce HBV-related morbidity and mortality in this high-endemicity region.

5. Conclusion

This study provides compelling, context-specific evidence establishing a significant association between distinct dietary patterns and the prevalence of clinical complications among subjects with chronic hepatitis B in Togo. Our findings conclusively demonstrate that the progression to severe liver disease is strongly correlated with a dietary pattern characterized by the regular intake of alcohol, high-glycemic carbohydrates, saturated and fried lipids, and red meats. The pervasive use of flavor-enhancing bouillon cubes, rich in sodium and other additives, also emerged as a particularly potent risk factor. Conversely, the regular intake of leafy green vegetable sauces was found to be significantly protective, highlighting the potential of micronutrient-rich, high-fiber foods to mitigate liver damage.

These results carry profound implications for the clinical management of chronic hepatitis B in Togo and similar resource-limited settings. They underscore an urgent need to integrate medical nutrition therapy and targeted patient education as a fundamental component of standard care, moving beyond a sole focus on virological monitoring. While this retrospective study establishes strong associations, we acknowledge its limitations, including potential recall bias and the inability to definitively establish causation. Therefore, prospective cohort studies and intervention trials are warranted to corroborate these findings and to evaluate the efficacy of structured dietary modifications on clinical outcomes.

In summary, this research identifies key, modifiable dietary determinants of risk that significantly contribute to the burden of advanced liver disease in Togolese subjects with chronic hepatitis B. Empowering subjects with evidence-based nutritional guidance represents a crucial, accessible strategy to complement antiviral therapy, slow disease progression, and ultimately reduce HBV-related morbidity and mortality in this high-endemicity region.

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