

Non-Invasive Assessment of Liver Fibrosis Using the FIB-4 Score in Patients with Hepatic Steatosis at Libreville University Hospital

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Abstract

Introduction: Metabolic dysfunction-associated steatotic liver disease (MASLD) has become the leading cause of chronic liver disease worldwide, carrying a risk of progression to fibrosis, cirrhosis, and hepatocellular carcinoma. The FIB-4 score, simple and inexpensive, is recommended as a first-line non-invasive tool for fibrosis screening. This study aimed to describe the epidemiological and clinical profile of patients with hepatic steatosis and to assess fibrosis stage using the FIB-4 score at Libreville University Hospital (CHUL). **Patients and Methods:** This was a prospective, descriptive and analytical study of 124 patients followed from January 2025 to June 2026 in the Department of Hepato-Gastroenterology and Digestive Endoscopy at CHUL. Sociodemographic, clinical, biological and ultrasonographic data were collected, along with the FIB-4 score, calculated using the Sterling *et al.* formula. Comparisons used the Chi-square and Mann-Whitney tests, with correlation assessed by Spearman's coefficient (significance threshold $p < 0.05$). Given the small number of patients with a high FIB-4 score, factors associated with significant fibrosis risk were explored using unadjusted comparisons only. **Results:** Mean age was 51.6 ± 10.8 years, with a female predominance (sex ratio = 1.38). All patients presented with ultrasonographic hepatic steatosis. The main risk factors were a fat-rich diet (80.6%), sedentary lifestyle (57.3%), diabetes (46.8%) and metabolic syndrome (39.5%). Hepatitis B surface antigen carriage was noted in 17.7% of patients, and 43.5% of patients had at least one condition (chronic hepatitis B or C, cirrhosis, or portal hypertension) that could independently affect FIB-4 components. Mean FIB-4 score was 1.56 ± 0.84 ; 45.2% of patients

had a low score (<1.30), 46.8% an indeterminate score, and 8.1% a score suggestive of significant fibrosis (>2.67), positively correlated with age ($r = 0.34$; $p < 0.001$). No sociodemographic or clinical factor was significantly associated with a high FIB-4 score in exploratory unadjusted comparisons. **Conclusion:** Hepatic steatosis and its metabolic risk factors are common in this Gabonese hospital population, supporting systematic non-invasive screening with FIB-4 and wider access to confirmatory diagnostic tools.

Keywords

Hepatic Steatosis, Liver Fibrosis, FIB-4 Score, Metabolic Syndrome, Gabon

1. Introduction

Metabolic dysfunction-associated steatotic liver disease (MASLD), formerly known as non-alcoholic fatty liver disease (NAFLD), is defined by excessive intrahepatocyte fat accumulation in the absence of excessive alcohol consumption or another identified cause of liver disease [1]. Over the past two decades it has become the leading cause of chronic liver disease worldwide, with a global prevalence estimated at approximately 25% of the adult population; the African region remains the least documented but is probably underestimated [2]. In 10 to 20% of cases, steatosis progresses to steatohepatitis, which may lead to progressive liver fibrosis, cirrhosis, or even hepatocellular carcinoma [2]. Liver biopsy remains the reference standard for assessing fibrosis, but its invasive nature, cost, and risk of complications limit its use in routine practice, particularly in resource-limited settings [3].

Non-invasive scores, calculated from simple clinical and biological parameters, have therefore been developed to guide screening for significant fibrosis [4]. The FIB-4 score, initially developed in patients co-infected with HIV and hepatitis C virus and subsequently validated in metabolic hepatic steatosis, is currently used to assess fibrosis [3] [5]. A threshold below 1.30 allows advanced fibrosis to be excluded with a good negative predictive value, whereas a threshold above 2.67 is suggestive of significant fibrosis [3].

In sub-Saharan Africa, several hospital-based studies report high ultrasonographic prevalences of hepatic steatosis, particularly among subjects with metabolic syndrome: 71.1% in Burkina Faso [6] and 37.2% in Burundi [7], with elevated rates also reported among stroke patients in Douala, Cameroon [8]. In Gabon, the high endemicity of hepatitis B virus, with a seroprevalence of hepatitis B surface antigen estimated at 7.3% among blood donors, further exposes patients to a possible coexistence of viral and metabolic liver disease, which may be potentially deleterious in terms of outcome [9].

At Libreville University Hospital, the management of patients with hepatic steatosis appears to rely mainly on abdominal ultrasonography and standard laboratory work-up, as access to liver elastography and biopsy remains limited. The objective of this work was to describe the epidemiological, clinical, and paraclinical

cal profile of patients with hepatic steatosis followed in the department, and to determine the factors associated with significant liver fibrosis using the FIB-4 score.

2. Methodology

2.1. Study Design, Setting, and Duration

This was a prospective, descriptive and analytical study conducted in the Department of Hepato-Gastroenterology and Digestive Endoscopy (SHGEED) of Libreville University Hospital (CHUL), over a period of 18 months, from January 2025 to June 2026.

2.2. Study Population

The target population consisted of all patients with hepatic steatosis managed in specialized hospital settings. The source population was represented by all patients seen in consultation or hospitalized in the Department of Hepato-Gastroenterology and Digestive Endoscopy of CHUL during the study period. From this source population, all patients for whom a complete liver work-up, an abdominal ultrasound, and the parameters required to calculate the FIB-4 score (age, AST, ALT, platelet count) were available were included, giving a total of 124 patients.

The minimum sample size was calculated using Schwartz's formula: $n = Z^2 \times p(1 - p)/i^2$, with a 95% confidence level ($Z = 1.96$), an expected prevalence of hepatic steatosis of 71.1% based on available sub-regional data [6], and a precision of 8%, giving a minimum required sample size of 123 patients. Consecutive, exhaustive recruitment of all patients meeting the inclusion criteria during the study period yielded 124 patients, thus satisfying the minimum required sample size.

2.3. Non-Inclusion Criteria

Incomplete or unusable medical records (missing sociodemographic, clinical, or biological data); the absence of at least one of the parameters required to calculate the FIB-4 score (age, AST, ALT, platelet count); the absence of an abdominal ultrasound or an unavailable report; and refusal to participate or objection to the use of data for research purposes were not included.

2.4. Data Collection and Definitions

Sociodemographic data, reasons for consultation, clinical signs (general, functional, and physical), results of the hepatic and metabolic laboratory work-up, abdominal ultrasound findings, and metabolic and viral risk factors (sedentary lifestyle, diabetes, fat-rich diet, alcohol consumption, metabolic syndrome, defined according to the 2009 harmonized criteria [10], hepatitis B surface antigen carriage, anti-HCV antibodies, underlying cirrhosis, signs of portal hypertension, HIV serology) were collected using a standardized data collection form. Alcohol consumption was categorized into three mutually exclusive classes (none, ≤ 20

g/day, >20 g/day); when a patient's reported consumption varied across the recall period and both thresholds were endorsed, the higher exposure category was retained. The FIB-4 score was calculated according to the formula of Sterling *et al.*: $(\text{age [years]} \times \text{AST [IU/L]}) / (\text{platelet count [10}^9\text{/L]} \times \sqrt{\text{ALT [IU/L]}})$ [11]. Three classes were defined according to the thresholds usually applied in metabolic hepatic steatosis [3]: a low score (<1.30), suggesting the absence of advanced fibrosis; an indeterminate score (1.30 - 2.67); and a high score (>2.67), suggestive of significant fibrosis. Fibrotest and Actitest scores, when available, were reported as complementary information.

2.5. Statistical Analysis

Data were entered and analyzed using Epi Info software, version 7.2.5.0. Quantitative variables were expressed as mean $\pm$ standard deviation (or median and range in case of non-Gaussian distribution), and qualitative variables as frequencies and percentages. Comparisons of proportions used the Chi-square test or Fisher's exact test when expected frequencies were below 5, and comparisons of non-Gaussian quantitative variables used the Mann-Whitney test. Because only 10 patients had a FIB-4 score above 2.67, factors potentially associated with a high FIB-4 score were explored using unadjusted (univariate) comparisons only, calculating the crude odds ratio (OR) and its 95% confidence interval where computable; no multivariable model was fitted for this outcome, given the limited number of events relative to the number of candidate predictors. The correlation between age and the FIB-4 score was assessed using Spearman's correlation coefficient. As a sensitivity analysis, the distribution of FIB-4 classes was recalculated after excluding patients with a condition that could independently affect FIB-4 components (chronic hepatitis B or C, known cirrhosis, or signs of portal hypertension). The significance threshold retained for all analyses was $p < 0.05$.

2.6. Ethical Considerations

The protocol received institutional authorization from Libreville University Hospital prior to the start of the study (CHUL institutional ethics committee). Patient confidentiality and anonymity were guaranteed by assigning an individual identification number to each record. Informed consent was obtained from each patient. The study was conducted in accordance with good clinical practice as defined by the Declaration of Helsinki.

3. Results

3.1. Sociodemographic Characteristics

The mean age of patients was 51.6 ± 10.8 years (range: 21 - 77 years), with a peak frequency in the 50 - 59 age group (37.1%). The sex ratio was 1.38 (72 women for 52 men). Patients with no declared occupation accounted for 34.7% of the sample, and retirees for 16.1% (Table 1).

Table 1. Sociodemographic characteristics of patients (n = 124).

Characteristics	Number (n)	Percentage (%)
Age (years), mean ± SD	51.6 ± 10.8	-
<30 years	6	4.8
30 - 39 years	13	10.5
40 - 49 years	35	28.2
50 - 59 years	46	37.1
60 - 69 years	21	16.9
≥70 years	3	2.4
Female sex	72	58.1
Male sex	52	41.9
No declared occupation	43	34.7
Retirees	20	16.1

3.2. Reasons for Consultation

Incidental discovery of hepatic steatosis on ultrasound was the main reason for consultation (52.4%), followed by isolated abnormal liver function tests (25.8%) and chronic abdominal pain (18.5%). Epigastric pain and abdominal distension each accounted for 1.6% of reasons for consultation.

3.3. Clinical Data

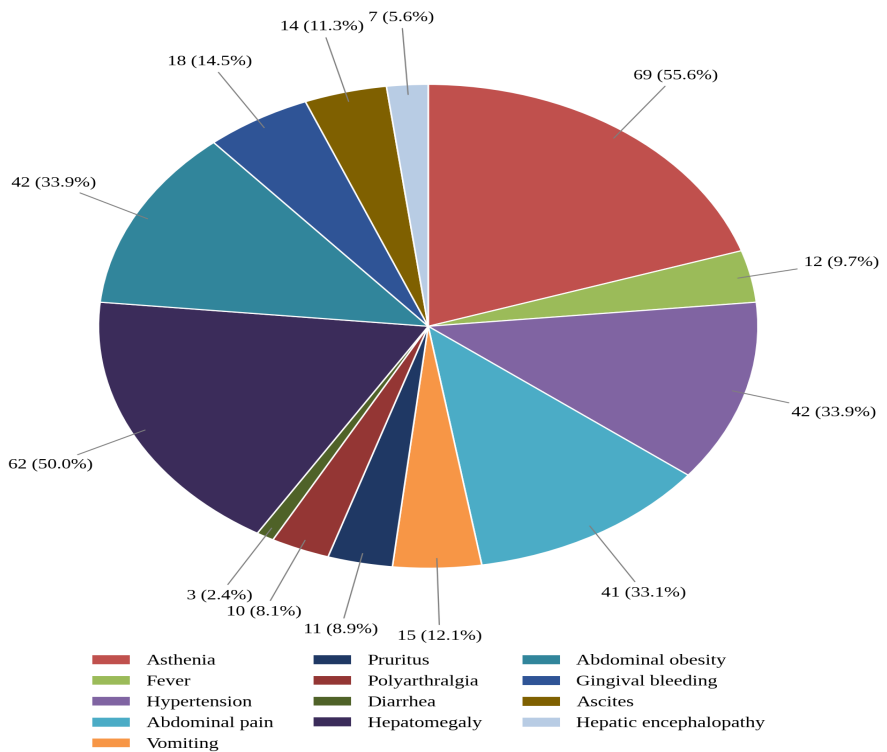


Figure 1. General, functional, and physical clinical signs (n = 124).

Figure 1 shows the distribution of general, functional, and physical clinical signs observed in the 124 patients with hepatic steatosis. Asthenia ($n = 69$, 55.6%) and hepatomegaly ($n = 62$, 50.0%) were by far the most frequent findings, together accounting for over a third of all reported signs. Hypertension and abdominal obesity were equally common, each present in 42 patients (33.9%), reflecting the strong metabolic component of the study population. Abdominal pain ($n = 41$, 33.1%) was also frequently reported. Signs suggestive of more advanced liver disease gingival bleeding ($n = 18$, 14.5%), ascites ($n = 14$, 11.3%), and hepatic encephalopathy ($n = 7$, 5.6%) were considerably less common, consistent with a predominantly compensated clinical profile. Minor or non-specific symptoms such as diarrhea ($n = 3$, 2.4%) and polyarthralgia ($n = 10$, 8.1%) were rare.

3.4. Ultrasonographic Hepatic Steatosis

All 124 patients presented with ultrasonographic hepatic steatosis, this finding being the study's inclusion criterion.

3.5. Biological Abnormalities

Among the 124 patients, for whom a complete biological work-up was available for all parameters, hypertriglyceridemia was found in 41.1% of patients, hyperglycemia in 46.0%, elevated alkaline phosphatase in 36.3%, elevated total bilirubin in 33.9%, elevated gamma-GT in 34.7%, elevated LDL-cholesterol in 32.3%, and elevated HDL-cholesterol in 24.2%. Prothrombin time was $\geq 50\%$ in 67.7% of patients. Associated acute pancreatitis was noted in 24.2% of patients (**Figure 2**).

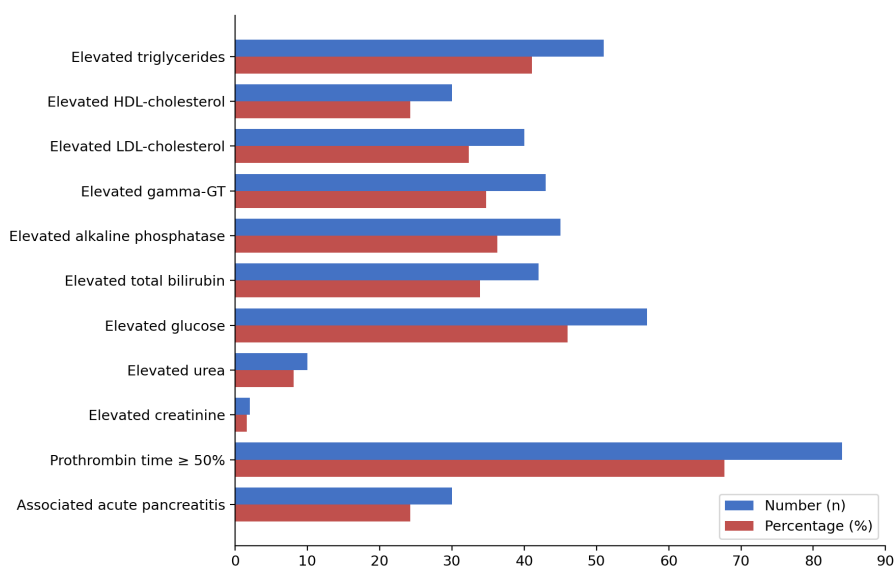


Figure 2. Biological abnormalities ($n = 124$).

3.6. Lifestyle Habits and Underlying Conditions

A fat-rich diet was the most frequent risk factor (80.6%), followed by a sedentary lifestyle (57.3%). Alcohol consumption, reclassified into three mutually exclusive

categories (see Methods), was reported as none in 3.2% of patients, ≤ 20 g/day in 46.0%, and > 20 g/day in 50.8%. Diabetes was present in 46.8% of patients and metabolic syndrome in 39.5%. Hepatitis B surface antigen carriage was found in 17.7% of patients, positive HCV serology in 4.0%, underlying cirrhosis in 11.3%, and signs of portal hypertension in 29.8%; overall, 43.5% of patients (54/124) had at least one of these four conditions potentially able to affect FIB-4 components independently of hepatic steatosis (**Table 2**).

Table 2. Distribution of lifestyle habits and underlying conditions (n = 124).

Risk Factor/Underlying Condition	Number (n)	Percentage (%)
Fat-rich diet	100	80.6
Sedentary lifestyle	71	57.3
No alcohol consumption	4	3.2
Alcohol consumption ≤ 20 g/day	57	46.0
Alcohol consumption > 20 g/day	63	50.8
Diabetes	58	46.8
Metabolic syndrome	49	39.5
Signs of portal hypertension	37	29.8
Positive HBsAg	22	17.7
Underlying cirrhosis	14	11.3
Positive anti-HCV antibodies	5	4.0
Positive HIV serology	2	1.6

3.7. FIB-4 Score and Fibrosis Stages

The mean FIB-4 score was 1.56 ± 0.84 (median: 1.38; range: 0.38 - 6.28). A low score, below 1.30, was observed in 45.2% of patients (56/124), an intermediate score, between 1.30 and 2.67, in 46.8% (58/124), and a high score, above 2.67, suggestive of significant fibrosis, in 8.1% of patients (10/124) (**Table 3**).

Table 3. Distribution of patients according to FIB-4 score (n = 124). Mean FIB-4 score: 1.56 ± 0.84 (median 1.38; range 0.38 - 6.28).

FIB-4 Score Class	Number (n)	Percentage (%)
Low risk (< 1.30)	56	45.2
Indeterminate (1.30 - 2.67)	58	46.8
Significant fibrosis (> 2.67)	10	8.1

The Fibrotest result was interpretable in 120 of the 124 patients (96.8%); it was unavailable for the remaining 4 patients. Among the 120 interpretable results, a minimal stage was found in 34 patients (28.3%), distributed between stage F0 (8 patients, 6.7%), stage F0 - F1 (12 patients, 10.0%), and stage F1 (14 patients, 11.7%). A moderate stage was observed in 69 patients (57.5%), distributed between stage

F1 - F2 (45 patients, 37.5%) and stage F2 (24 patients, 20.0%). Finally, a severe stage concerned 17 patients (14.2%), comprising stage F3 (5 patients, 4.2%), stage F3 - F4 (4 patients, 3.3%), and stage F4 (8 patients, 6.7%).

3.8. Factors Associated with a High FIB-4 Score: Exploratory Analysis

Because only 10 patients (8.1%) had a FIB-4 score above 2.67, no adjusted multi-variable model was fitted for this outcome (see Methods). In unadjusted comparisons, no sociodemographic or clinical variable examined was significantly associated with a high FIB-4 score, including sex, hypertension, abdominal obesity, diabetes, sedentary lifestyle, fat-rich diet, alcohol consumption > 20 g/day, metabolic syndrome, HBsAg carriage, anti-HCV positivity, underlying cirrhosis, or age (Table 4). This absence of association most likely reflects insufficient statistical power given the small number of high-risk patients, rather than a true absence of effect, and these exploratory findings should be interpreted with caution.

Table 4. Factors associated with a high FIB-4 score (>2.67): exploratory unadjusted comparisons (n = 124; 10 events).

Variable	High FIB-4 n/N (%)	Crude OR [95% CI]	p
Male sex	4/52 (7.7)	0.92 [0.24 - 3.44]	1.000
Hypertension	3/42 (7.1)	0.82 [0.19 - 3.44]	1.000
Abdominal obesity	4/42 (9.5)	1.33 [0.35 - 5.02]	0.733
Diabetes	3/58 (5.2)	0.46 [0.11 - 1.86]	0.334
Sedentary lifestyle	5/71 (7.0)	0.73 [0.20 - 2.66]	0.743
Fat-rich diet	8/100 (8.0)	0.96 [0.19 - 4.76]	1.000
Alcohol > 20 g/day	5/63 (7.9)	0.97 [0.27 - 3.51]	1.000
Metabolic syndrome	4/49 (8.2)	1.02 [0.27 - 3.83]	1.000
Positive HBsAg	0/22 (0.0)		0.206
Positive anti-HCV	1/5 (20.0)	3.06 [0.32 - 29.19]	0.348
Underlying cirrhosis	0/14 (0.0)	-	0.602
Age (median, years)	55.0 vs 52.0	-	0.544

As a sensitivity analysis, the FIB-4 distribution was recalculated after excluding the 54 patients (43.5%) with at least one condition potentially able to independently affect FIB-4 components (chronic hepatitis B or C, known cirrhosis, or signs of portal hypertension). Among the remaining 70 patients, the distribution was broadly similar to that of the full cohort: 47.1% low risk, 42.9% indeterminate, and 10.0% high risk, suggesting that the overall FIB-4 distribution was not primarily driven by these potentially confounding conditions.

4. Discussion

This study confirms the high frequency of hepatic steatosis and its metabolic risk

factors in a Gabonese hospital population. The ultrasonographic prevalence of steatosis found (100%, by inclusion design) cannot be directly compared to community prevalence estimates; it instead reflects a population already referred for a suspected hepatic abnormality. For context, hospital-based series in sub-Saharan Africa report high ultrasonographic prevalences among symptomatic adults or those with metabolic syndrome, notably in Burkina Faso (71.1% among patients with metabolic syndrome) and Burundi (37.2%) [6] [7], markedly higher than prevalence estimates in the general African population, generally below 15% [2]. This discrepancy is likely explained by a recruitment bias, as our sample consisted of patients referred to a specialized consultation for an already suspected hepatic abnormality, often based on an initial suggestive ultrasound.

The mean age (51.6 years) and female predominance (sex ratio 1.38) found are comparable to data in the literature, metabolic hepatic steatosis being typically diagnosed between 40 and 50 years of age, with a variable sex predominance across series [8]. The high frequency of metabolic risk factors observed, such as a fat-rich diet (80.6%), sedentary lifestyle (57.3%), diabetes (46.8%), and metabolic syndrome (39.5%), underscores the importance of nutritional transition and urban lifestyle in the occurrence of this condition in Africa, as has been shown in other African series [6] [7].

The HBsAg seroprevalence in our population (17.7%) is markedly higher than that reported in the general Gabonese population among blood donors (7.3%) [9], which may reflect a preferential recruitment, in a specialized department, of patients with chronic hepatitis B virus carriage referred for liver work-up, rather than a genuine over-representation of steatosis-hepatitis B co-infection in the general population. This coexistence nonetheless warrants particular attention, as the literature suggests it may favor a more rapid progression toward cirrhosis and hepatocellular carcinoma [12].

The mean FIB-4 score obtained in our series (1.56 ± 0.84) falls within the so-called “grey” or intermediate zone (1.30 - 2.67), reflecting a population at globally moderate and heterogeneous risk of significant fibrosis. This finding is consistent with the seminal study by Sterling *et al.*, who developed and validated the FIB-4 in patients co-infected with HIV and HCV, demonstrating its ability to exclude advanced fibrosis below a threshold of 1.45, with excellent negative predictive value [11].

The application of the 1.30 threshold as the low cut-off in steatotic liver disease has been specifically validated by Shah *et al.*, who established that this threshold optimized sensitivity for excluding advanced fibrosis in patients with NAFLD/MASLD, with a negative predictive value approaching 90% [13]. This finding directly corroborates our observation: the low proportion of high-risk patients (8.1%) in our cohort reflects a good capacity of the FIB-4 to rule out severe fibrosis in the majority of patients without recourse to an invasive method.

The positive and significant correlation between the FIB-4 score and age ($r = 0.34$; $p < 0.001$) is expected from a methodological standpoint, age being one of

the four variables integrated into the score's calculation formula, alongside transaminases and platelet count. This relationship therefore does not necessarily reflect an independent pathophysiological link, but rather an intrinsic property of the index, as was already noted at its initial validation by Sterling *et al.* [11].

In this cohort, no sociodemographic or clinical variable was significantly associated with a high FIB-4 score in exploratory, unadjusted comparisons (**Table 4**). This contrasts with several studies in the literature identifying abdominal obesity and excessive alcohol consumption as determinants of hepatic steatosis itself—for instance, the association between visceral adiposity and hepatic steatosis has been confirmed by Kim *et al.*, who reported that visceral fat area constitutes an independent risk factor for significant steatosis on multivariate analysis [14], and the involvement of alcohol, even at moderate to high doses, in the occurrence of steatosis in subjects otherwise at metabolic risk is well documented by Long *et al.* [15]. However, these studies examined factors associated with the presence of steatosis, a comparison not possible in our single-arm cohort in which all patients were steatotic by design; our own analysis instead examined factors associated with a high FIB-4 score, a markedly rarer outcome (10/124) for which this cohort was not powered to detect associations of a plausible magnitude. Obesity and hypertension, components of the metabolic syndrome, have similarly been shown to be independently and additively associated with a deleterious inflammatory and metabolic profile favoring hepatic fat accumulation, as shown by Lee *et al.* in a study of visceral obesity and hepatic steatosis [16]. Larger, adequately powered studies are needed to determine whether these factors also predict fibrosis severity, as opposed to steatosis occurrence, in this population.

5. Limitations

This study has several limitations: the absence of a non-steatotic comparison group, the small number of patients with a high FIB-4 score ($n = 10$, limiting associations to unadjusted exploratory comparisons), and the single-center design, all of which may limit the scope and generalizability of the findings. In addition, 43.5% of patients had a condition (chronic hepatitis B or C, cirrhosis, or portal hypertension) potentially affecting FIB-4 components, although a sensitivity analysis excluding these patients yielded a similar distribution. Finally, the FIB-4 score was not confirmed against liver biopsy or elastography.

6. Conclusion

This study confirms the high frequency of hepatic steatosis and its metabolic risk factors in a Gabonese hospital population. The FIB-4 score identifies a non-negligible proportion of patients (8.1%) at risk of significant fibrosis, confirming its value as a simple and accessible screening tool, consistent with current diagnostic recommendations for MASLD [17]. These results justify systematic screening, preventive measures targeting metabolic risk factors, and wider access to confirmatory diagnostic tools (elastography, targeted biopsy).

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Author Contributions

Engoang AA (Principal Investigator) conceived the study and coordinated data collection. Ziza Ngaila NP, Nzouto PD, Biloghe P, Pambo T, and Tsiouka E contributed to data collection. Itoudi Bignoumba PE performed the statistical analyses and literature review. Moussavou Kombila JB (Sponsor) supervised the study and revised the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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