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Prevalence of Liver Steatosis Among Workers in Ouagadougou and Associated Factors: A Cross-Sectional Study

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ABSTRACT

Aims: Liver steatosis prevalence is growing, linked to the current worldwide epidemics of obesity and Type 2 diabetes. In sub-Saharan Africa, data on apparent healthy workers must still be included. This study aimed to determine the prevalence of hepatic steatosis and its associated factors in the workplace.

Methods and Results: A cross-sectional study was conducted from July to October 2022 in seven selected public and private works places in Ouagadougou, Burkina Faso. Workers still in activity were enrolled by random sampling. Sociodemographic and anthropometric characteristics and blood pressure measurements were performed using standard procedures. Blood samples for fasting blood glucose, cholesterol (total, HDL, LDL), triglycerides, transaminases (AST, ALT), gamma-glutamyl-transferase, C reactive protein, uric acid, surface antigen of hepatitis B (HBsAg), antibody to hepatitis C virus (anti-HCV), and HIV antibodies have been realized. Liver steatosis was assessed by FIBROSCAN with controlled attenuation parameter (CAP). An adjusted logistic regression analysis was performed. A significance level of 5% was applied. A total of 500 workers were included in this study. Among them, 293 (58.6%) were men. The prevalence of hepatic steatosis was 18% (95% CI: 14.7–21.7). Factors associated with hepatic steatosis were age over 50 ($p = 0.038$), waist circumference ($p = 0.0001$), body mass index ($p = 0.008$), and cytolysis ($p = 0.001$).

Conclusion: Liver steatosis affects almost a fifth of working people. Health policies must step up the fight against obesity and other nutrition-related noncommunicable diseases.

1 | Introduction

Liver steatosis, the most common liver disease defined as an abnormal accumulation of triglycerides in hepatocytes, is diagnosed from triglycerides in 5% of hepatocytes [1–3]. It is a progressive complication of diseases such as Type 2 diabetes, obesity, and dyslipidaemia. Africa faces an epidemic of overweight and obesity [4–7], dyslipidaemia, and metabolic syndrome in both adults and children [8]. Liver steatosis is a risk factor for hepatocellular carcinoma, which is a serious public health issue [9, 10].

Its overall prevalence is estimated at 25% worldwide and continues to rise in parallel with the increasing rate of metabolic syndrome [2, 10, 11]. In Africa, few studies have been conducted; liver steatosis prevalence varies from 1.2% to 4.5% in Nigeria [3]

Delphine Napon-Zongo has full access to all of the study's data and is responsible for its integrity and the accuracy of the data analysis.

in sampled subjects, to 20% among volunteers in Sudan [12], 73% among diabetes subjects in Ethiopia, and 87% among overweight or obese subjects in South Africa [3], 71.13% among patients with metabolic syndrome in Burkina Faso [13]. Data on the prevalence of liver steatosis are scarce compared with infectious causes, notably viral hepatitis B, C, and Delta [14].

This prevalence also depends on the sensitivity of the detection method [10]. Current guidelines recommend noninvasive tests for the initial assessment of nonalcoholic fatter liver disease (NAFLD). New techniques for detecting steatosis have emerged in recent years. Among the available noninvasive tests, transient elastography by FIBROSCAN with controlled attenuation parameter (CAP) (Echosens, Paris, France) is a method with good sensitivity and specificity compared to the gold standard of liver biopsy. This method enables earlier diagnosis of steatosis and appropriate management [15–17]. Few studies used transient elastography to measure steatosis and correlate it with biological data [5, 15, 18, 19]. Although not always accessible, it is less operator-dependent than ultrasound.

Most studies of liver steatosis carried out in Africa were hospital-based surveys. They were most often limited to certain types of symptomatic patients, notably those with obesity or metabolic syndrome [20, 21], or case studies of patients with liver steatosis [21], or studies using ultrasound alone as a diagnostic tool [10]. There is a lack of data in the general and working populations.

Therefore, the study aimed to determine the prevalence and factors associated with liver steatosis in a working population in Ouagadougou using FIBROSCAN/CAP.

2 | Methods

2.1 | Study Design

This is a cross-sectional study conducted from July to October 2022 in seven public and private health facilities in Ouagadougou.

2.2 | Study Population

This study involved working men and women aged 18 and over attending their annual check-up visits.

2.3 | Sample Size—Sampling

The estimated prevalence of steatosis in Africa in the general population is 13.5% [2]. Considering a precision of 3%, a statistical power of 80%, and using OpenEpi version 3 [22], a 95% confidence level, the required sample size was 499 workers.

Consecutive recruitment of workers who visited the health facilities of the "Office de Santé des Travailleurs" (office of worker health) for the annual medical check-up and consented to participate was done. Workers of any gender, regardless of the sector of activity, who performed the biological sampling and FIBROSCAN/CAP examination were included.

2.4 | Data and Sample Collection

The participants are workers who had given their consent to answer a self-administered questionnaire, then to perform a FIBROSCAN/CAP examination and fasting blood samples for blood glucose, cholesterol (total, HDL, LDL), triglycerides, liver transaminases (AST and ALT), gamma glutamyl transferase (GGT), C reactive protein (CRP), uric acid, creatinine, HBsAg, anti-HCV antibodies and anti-HIV antibodies.

Sociodemographic, clinical, anthropometric, and history data were collected using semi-structured administered collection forms. Blood samples were taken on-site by a qualified biomedical technician. The device used to examine the patients was the FIBROSCAN/CAP, in its mobile version, 430 Mini, from ECHOSENS, Paris, France. This noninvasive medical device is equipped with two probes, M and XL, depending on the morphotype of the subjects. Pulse elastography was performed on the right lobe of the liver of a worker in the supine position and maximum abduction. The procedure was noninvasive and painless, requiring no anesthesia or hospitalization, and performed after a minimum of 3 h of fasting. The examination lasted 5–10 min in most cases. The device could measure from 100 to 400 dB/m for steatosis and from 2 to 75 kPa for fibrosis.

These included fasting blood glucose, cholesterol (total, HDL, LDL), triglycerides, liver transaminases (AST and ALT), GGT, CRP, uric acid, creatinine, HBsAg, anti-HCV and anti-HIV antibodies. After sampling, the samples were transported to the OST medical analysis laboratory for conditioning and then sent to the medical analysis laboratory of the Association Assaut-Hépatites in Bobo-Dioulasso for biochemical and immunological biology analyses. Biochemical analyses were performed using the CYANSmart, a semi-automatic biochemistry analyzer using spectrophotometer technology. Detection of HBsAg and anti-HCV was performed using the Rapid Diagnostic Test (RDTs) OnSite HBsAg/HCV Ab from CTK Biotech Inc. (USA), for the simultaneous detection of HBsAg and anti-HCV. Anti-HIV antibodies were tested with DETERMINETM HIV-1/2 (Abbott Diagnostics Medical Co. Ltd. Japan).

2.5 | Variables

The dependent variable was hepatic steatosis, categorized 1 for "present" and 0 for "absent." Hepatic steatosis was considered for a CAP value ≥ 275 dB/m on FIBROSCAN/CAP, according to European Association for the Study of the Liver (EASL) guidelines. So, the dependent variable was coded 0 (absent) if the participant had CAP < 275 and 1 (present) if the participant had CAP ≥ 275 dB/m [23]. There were CAP values and fibrosis values, according to the examination indications. Fibrosis is considered moderate from 8.2 kPa. The quality criteria to carry out the examination according to the median IQR are excellent quality for an IQR $< 15\%$ and good quality for an IQR between 15% and 30%. FAST score has been calculated for identifying Non Alcoholic SteatoHepatitis (NASH) among people who has a NAFLD. The FIBROSCAN-AST (FAST) score has been developed in 2020 for the noninvasive identification of patients with non-alcoholic steatohepatitis

(NASH), concomitant significant activity (NAS ≥ 4) and significant fibrosis ($F \geq 2$) as per liver biopsy [24, 25]. We applied the original cut-offs to rule-out (FAST score ≤ 0.35) and to rule-in fibrotic NASH (FAST score ≥ 0.67). FAST score > 0.35 has a sensitivity of 90% and specificity of 50% and FAST score ≥ 0.67 has a sensitivity of 50% and specificity of 90% in identifying NASH with ≥ F2 fibrosis and NAS ≥ 4.

Independent variables were sociodemographic, anthropometric, clinical, metabolic; morphological, serological, biochemical, and behavioral. Sociodemographic characteristics were gender, age, residence, level of education, occupation, and marital status. The anthropometric, clinical, and metabolic variables included the components of body mass index (BMI) and metabolic syndrome. The metabolic syndrome was diagnosed when at least three of the following criteria were present: high waist circumference, arterial hypertension (normal systolic blood pressure (SBP) < 140/normal diastolic blood pressure (DBP) < 90/SBP > 140/DBP > 90), above-normal fasting blood glucose, dyslipidemia (high triglyceride levels and low levels of high-density lipoprotein [HDL cholesterol]).

The biochemical variable was cytolysis, considered present in case of elevated liver enzymes: when ALT > 40 IU/L and/or AST > 40 and cholestasis, considered present when GGT elevated above 55 IU/L.

Behavioral variables included alcohol consumption (defined by drinking in the last 30 days and not drinking the previous 30 days), smoking (industrial cigarettes), sedentary lifestyle (was considered sedentary any worker who, on average, sits for at least 7 h a day), according to WHO criteria: "Below 150 min of moderate weekly physical activity (i.e., 30 min a day, five days a week) or 75 min of intense physical activity (25 min, three days a week), one is considered inactive…" [26].

2.6 | Statistical Analysis

The database was cleaned before being used. EPIDATA software was used for registration, and Stata version 14.1 was used for data cleaning, processing, and analysis. Variables were entered into Epi-data 4.6.0.2 (CDC Atlanta, USA) and analyzed using STATA 14.1 (Texas, USA). Quantitative variables were expressed as mean ± standard deviation and qualitative variables as percentages with their 95% confidence intervals. The Student's *t*-test was used to compare quantitative variables, and the chi^2 test and Fischer's exact test for qualitative variables.

All worker records with valid measurements of CAP (in dB/m) and elasticity (*E* in kPa) measured with FIBROSCAN/CAP were included in the analysis. The proportion of CAP ≥ 275 dB/m and its 95% confidence interval (95% CI) were calculated overall and among patients with risk factors. Crude and adjusted odds ratios (OR) and 95% CIs are presented.

Binary logistic regression was used as a multivariate analysis method to investigate factors associated with liver steatosis. Independent variables included in the model were those with a *p* of less than 0.25 in univariate analysis. A significance level of 5% was used.

2.7 | Ethics Statement

The study protocol was approved by the Institutional Ethic Committee of the Research Institute of Health Sciences (Number A041-2022/CEIRES Burkina Faso) before data collection.

3 | Results

3.1 | Sociodemographic Characteristics of the Study Population

Of the 500 workers, 293 (58.6%) were male. Most of the participants are under 40. Half of the respondents had a higher level of education (50.4%). The majority of workers were salaried, (85.0%). Nearly two-thirds of workers were living with a partner (65.2%), and almost all, (91.8%), lived in urban areas (Table 1).

3.2 | Anthropometric, Clinical, and Metabolic Characteristics

We found that more than half the workers were overweight: 180 (36.0%) were overweight and 121 (24.2%) were obese. The average waist circumference was 88.8 cm. According to the International Diabetes Federation (IDF) threshold, 212 workers (42.4%) were abdominally obese, rising to 70% according to the new threshold. Thus, 91 (31.1%) men and 121 (58.5) women were abdominally obese. Among the workers, the proportion of those with high total cholesterol levels was 35.8%.

Considering the components of metabolic syndrome, more than a third of workers had abdominal obesity (42.4%), characterized by a high waist circumference, more than a quarter had high blood pressure (27.8%), and 18.2% had blood sugar levels above the normal range. Triglyceride levels were high in most agents (410, or 82%), and almost 2/3 of workers had at least two abnormalities (see Table 1).

3.3 | Behavioral Characteristics

More than half the workers (55.2%), had consumed alcohol in the past 30 days, and 72.4% workers practiced physical activity. Regarding diet, the majority of participants (89.6%) workers, consumed less than five fresh fruits and vegetables a day, and 205 (41.0%) had a high-fat diet (Table 1).

3.4 | Morphological Characteristics

FIBROSCAN examinations were valid, with an interquartile range (IQR) below 30% in all cases. Examination quality was excellent for almost two-thirds, 65.40%, whose IQR was below 15%, and good for the remaining 34.6%, whose IQR was between 15% and 30%.

Six (1.2%) workers had liver fibrosis on FIBROSCAN/CAP, characterized by elasticity thresholds above 8.2 kPa.

TABLE 1 | Description of socio-demographic, clinical, biological, and lifestyle parameters in the study sample of workers ($N = 500$).

	Overall participants ($N = 500$)	Participants without liver steatosis ($n = 410$)	Participants with liver steatosis ($n = 90$)	
	***n* (%)**	***n* (%)**	***n* (%)**	***p***
Description of sociodemographic parameters				
Gender				0.77
Female	207 (41.4)	171 (41.7)	36 (40.0)	
Male	293 (58.6)	239 (58.3)	54 (60.0)	
Education level				0.65
No level/primary	70 (14.0)	58 (14.1)	12 (13.3)	
Secondary education	178 (35.6)	142 (34.7)	36 (40.0)	
Higher education	252 (50.4)	210 (51.2)	42 (46.7)	
Age ranges				0.0001
Under 40 years	236 (47.2)	209 (51.0)	27 (30.0)	
40–49 years old	153 (30.6)	124 (30.2)	29 (32.2)	
50 years and over	111 (22.2)	77 (18.8)	34 (37.8)	
Profession				0.25
Employee	425 (85.0)	352 (85.8)	73 (81.1)	
Self-employed	75 (15.0)	58 (14.2)	17 (18.9)	
Marital status				0.23
Living alone	107 (21.4)	92 (22.4)	15 (16.7)	
Living as a couple	393 (78.6)	318 (77.6)	75 (83.3)	
Residence				0.90
Urban area	459 (91.8)	376 (91.7)	83 (92.2)	
Peri-urban area	41 (8.2)	34 (8.3)	7 (7.8)	
Description of physical, clinical, metabolic characteristic				
Nutritional status				0.0001
Underweight	13 (2.6)	13 (3.2)	0 (0.0)	
Normal weight	186 (37.2)	181 (44.2)	5 (5.5)	
Overweight	180 (36.0)	147 (35.8)	33 (36.7)	
Obesity	121 (24.2)	69 (16.8)	52 (57.8)	
Mean (±standard deviation) body mass index	26.7 (±4.9)	25.7 (±4.5)	31.2 (±4.4)	0.0001
Abdominal obesity				0.0001
No	288 (57.6)	273 (66.6)	15 (16.7)	
Yes (waist circumference > 94/80 cm in men/women)	212 (42.4)	137 (33.4)	75 (83.3)	
Mean (±standard deviation) waist circumference	88.8 (±12.6)	86.1 (±11.6)	101.2 (±9.2)	0.0001
Blood glucose				0.43
Standard rate	409 (81.8)	338 (82.4)	71 (78.9)	

(Continues)

	Overall participants ($N=500$)	Participants without liver steatosis ($n=410$)	Participants with liver steatosis ($n=90$)	
	***n* (%)**	***n* (%)**	***n* (%)**	***p***
High rate (> 6.1 mmol/L)	91 (18.2)	72 (17.6)	19 (21.1)	
Blood pressure				0.0001
Normotensive	361 (72.2)	319 (77.8)	42 (46.7)	
High blood pressure (**> 140/90 mmHg**)	139 (27.8)	91 (22.2)	48 (53.3)	
Total cholesterol				0.16
Standard rate	321 (64.2)	269 (65.6)	52 (57.8)	
High rate (**> 5.2 mmol/L**)	179 (35.8)	141 (34.4)	38 (42.2)	
Triglycerides				0.59
Standard rate	90 (18.0)	72 (17.6)	18 (20.0)	
High rate (≥ 1.7 mmol/)	410 (82.0)	338 (82.4)	72 (80.0)	
Presence of at least three elements of metabolic syndrome				0.0001
No	352 (70.4)	314 (76.6)	38 (42.2)	
Yes	148 (29.6)	96 (23.4)	52 (57.8)	
Elevated gamma glutamyl transpeptidase (> 55/40 UI/l mmol/L in men/women)				0.003
No	422 (84.4)	356 (86.8)	66 (73.3)	
Yes	78 (15.6)	54 (13.2)	24 (26.7)	
Elevated liver enzymes (ALAT > 40 mmol/L and/or ASAT > 40 mmol/L)				0.0001
No	403 (80.6)	346 (85.9)	57 (66.0)	
Yes	97 (19.4)	64 (14.1)	33 (34.0)	
Diabetes and/or hypertension under treatment				0.0001
No	450 (90.0)	382 (93.2)	68 (75.6)	
Yes	50 (10.0)	28 (6.8)	22 (24.4)	
Description of behavioral characteristics of workers				
Alcohol consumption in the past 30 days				0.051
No	224 (44.8)	192 (46.8)	32 (35.6)	
Yes	276 (55.2)	218 (53.2)	58 (64.4)	
Current smoking				0.52
No	483 (96.6)	397 (96.8)	86 (95.6)	

(Continues)

TABLE 1 | (Continued)

	Overall participants ($N=500$)	Participants without liver steatosis ($n=410$)	Participants with liver steatosis ($n=90$)	
	***n* (%)**	***n* (%)**	***n* (%)**	***p***
Yes	17 (3.4)	13 (3.2)	4 (4.4)	
Physical activity				0.018
No	138 (27.6)	104 (25.4)	34 (37.8)	
Yes	362 (72.4)	306 (74.6)	56 (62.2)	
Consumption of fresh and vegetables				0.37
No consumption	134 (26.8)	111 (27.1)	23 (25.6)	
1–4/day	314 (62.8)	260 (63.4)	54 (60.0)	
≥ 5/day	52 (10.4)	39 (9.5)	13 (14.4)	
High-fat diet				0.33
No	295 (59.0)	246 (60.0)	49 (54.4)	
Yes	205 (41.0)	164 (40.0)	41 (45.6)	

3.5 | Serological and Biochemical Characteristics

Of the 500 workers, 7.8% were HBsAg positive, while 1.2% were positive for HCV antibodies. Elevated liver enzymes (cytolysis), with ALT and AST above 40 IU/L was observed in 19.4% of the workers, and elevated gamma-glutamyl transferase (GGT) levels in 15.6%.

3.6 | Prevalence of Hepatic Steatosis

Among the 500 workers, the prevalence of liver steatosis was 18.0% (95% CI: 14.7–21.7).

Of these 90 participants with liver steatosis, 67 (74.5%) had a FAST score of less than 0.35, 20 (22.2%) had a FAST score between 0.35 and 0.67, and 3 (3.3%) had a FAST score of 0.67 or greater.

3.7 | Factors Associated With Hepatic Steatosis

In univariate analysis, age over 40, the presence of hypertension and/or treated diabetes, BMI, waist circumference, high total cholesterol, high uric acid, a high number of metabolic syndrome elements, elevated GGT, elevated liver enzymes, alcohol consumption, and physical activity were found to be factors associated with hepatic steatosis.

In multivariate analysis, age over 50, waist circumference, BMI, and elevated liver enzymes (cytolysis), with ALT and AST above 40 IU/L were associated with the presence of fatty liver.

Workers over 50 were 2.1 times more likely to have fatty liver than those under 50 (aOR = 2.1; 95% CI [1.1–4.1], $p=0.038$), all other things being equal. Workers who had an excessive waist circumference above the normal threshold (aOR = 1.2 [95% CI: 1.1–1.3]; $p=0.0001$) were also 1.2 times more likely to have fatty liver disease than workers with a normal waist circumference, all else being equal. After adjusting for the other variables in the model, workers with a higher than normal BMI, that is, who were overweight or obese (OR = 1.2 [95% CI: 1.1–1.3]; $p=0.008$), had a 20% increased risk of developing fatty liver compared with workers of normal weight, all else being equal. Elevated liver enzymes (cytolysis), with ALT and AST above 40 IU/L, was associated with a 2.9-fold increased risk of developing hepatic steatosis (aOR = 2.9; 95% CI [1.6–5.5], $p=0.001$) (Tables 2 and 3).

4 | Discussion

The prevalence of liver steatosis was high among the workers. This is the first finding among workers in the context of epidemiological transition in West African countries.

4.1 | Strengths and Weaknesses

To our knowledge, this study is the first one on liver steatosis and its associated factors, with a large sample of asymptomatic subjects, in a non-hospital setting in Africa. In addition, anthropometric measurements and complementary blood sampling enabled us to study the metabolic syndrome and its components in a population with a wide age range (19–70 years). Another strength is using a device adapted to screening for liver steatosis, which is easy to measure and less operator-dependent than ultrasound. It has two probes whose use is indicated by the device itself [27].

However, our study has the following limitations: we did not evaluate the participants' socio-economic level or food consumption data, which could be associated with liver steatosis,

TABLE 2 | Factors associated to liver steatosis for all participants ($N = 500$).

	Univariate analysis		Multivariate analysis	
Variables	**Crude OR**	***p***	**Adjusted OR**	***p***
Age ranges (in years)				
Under 40	Ref		Ref	
40–49	1.8 (1.1–3.2)	0.041	0.9 (0.5–1.9)	0.90
50 and over	3.4 (1.9–6.03)	0.0001	2.1 (1.1–4.1)	0.038
Marital status				
Single	Ref		Ref	
In union	1.4 (0.8–2.6)	0.23	1.1 (0.5–2.4)	0.76
Personal history of hypertension and/or treated diabetes				
No	Ref		Ref	
Yes	4.4 (2.4–8.2)	0.0001	1.7 (0.8–3.8)	0.21
Waist circumference (cm) †	1.2 (1.1–1.2)	0.0001	1.2 (1.1–1.3)	0.0001
Body mass index (kg/m^2)†	1.3 (1.2–1.4)	0.0001	1.2 (1.1–1.3)	0.008
High total cholesterol				
No	Ref		Ref	
Yes	1.4 (0.9–2.2)	0.16	1.2 (0.7–2.2)	0.48
Cumulation of at least three elements of metabolic syndrome				
No	Ref		Ref	
Yes	4.5 (2.8–7.2)	0.0001	1.2 (0.7–2.2)	0.52
Cholestasis				
No	Ref		Ref	
Yes	2.4 (1.4–4.1)	0.002	1.7 (0.8–3.5)	0.14
Cytolysis				
No	Ref			
Yes	3.1 (1.9–5.2)	0.0001	2.9 (1.6–5.5)	0.001
Alcohol consumption in the past 30 days				
No	Ref		Ref	
Yes	1.6 (0.9–2.6)	0.053	1.1 (0.6–2.0)	0.74
Consumption of fruit and vegetables				
Have eaten no fresh fruit or vegetables	Ref		Ref	
Eating 1–4 fruits and vegetables	> 1.0 (0.6–1.7)	0.99	1.3 (0.6–2.5)	0.50
Eating at least five fruits or vegetables	1.6 (0.7–3.5)	0.23	1.6 (0.6–4.2)	0.36
Physical activity				
No	Ref		Ref	
Yes	0.6 (0.3–0.9)	0.018	0.7 (0.4–1.2)	0.18

†For both factors (body mass index and waist circumference), the odds ratio corresponded to a one-unit increase in the anthropometric parameter considered. These variables ("body mass index" and "waist circumference") were separately introduced in the final regression model.

TABLE 3 | Factors associated with liver steatosis (excluding the participants with hepatitis B and hepatitis C infections, $N = 457$).

	Univariate analysis		Multivariate analysis	
Variables	**Crude OR**	***p***	**Adjusted OR**	***p***
Age ranges (in years)				
Under 40	Ref		Ref	
40–49	1.5 (8.2–2.7)	0.19	0.9 (0.5–1.8)	0.81
50 and over	3.3 (1.9–6.0)	0.0001	2.8 (1.4–5.4)	0.002
Marital status				
Single	Ref		Ref	
In union	1.5 (0.8–2.8)	0.246	1.3 (0.6–2.9)	0.46
Personal history of hypertension and/or treated diabetes				
No	Ref		Ref	
Yes	3.9 (2.0–7.4)	0.0001	1.6 (0.7–3.6)	0.24
Waist circumference (cm)[a]	1.1 (1.09–1.2)	0.0001	1.1 (< 1.1–1.2)	0.0001
Body mass index (kg/m^2)[a]	1.3 (1.2–1.4)	0.0001	1.3 (1.2–1.4)	0.0001
High total cholesterol				
No	Ref		Ref	
Yes	1.3 (0.8–2.1)	0.33	1.0 (0.6–1.7)	0.89
Cumulation of at least three elements of metabolic syndrome				
No	Ref		Ref	
Yes	3.3 (2.0–5.4)	0.0001	1.10 (0.6–2.0)	0.73
Elevated gamma glutamyl transpeptidase (> 55/40 UI/l mmol/L in men/women)				
No	Ref		Ref	
Yes	2.0 (1.1–3.7)	0.016	1.8 (0.9–3.7)	0.11
Elevated lived enzymes (ALAT > 40 mmol/L and/or ASAT > 40 mmol/L)				
No	Ref		Ref	
Yes	2.9 (1.7–5.0)	0.0001	3.6 (1.9–6.7)	0.002
Alcohol consumption in the past 30 days				
No	Ref		Ref	
Yes	1.6 (0.9–2.7)	0.058	1.2 (0.7–2.1)	0.55
Consumption of fruit and vegetables				
Have eaten no fresh fruit or vegetables	Ref		Ref	
Eating 1–4 fruits and vegetables	1.1 (0.6–1.9)	0.76	1.4 (0.7–2.8)	0.32
Eating at least five fruits or vegetables	1.7 (0.8–3.9)	0.19	1.7 (0.6–4.6)	0.30
Physical activity				
No	Ref		Ref	

(Continues)

TABLE 3 | (Continued)

Variables	Univariate analysis		Multivariate analysis	
	Crude OR	*p*	Adjusted OR	*p*
Yes	0.6 (0.3–0.9)	0.02	0.7 (0.4–1.3)	0.30
Education level				
No level/primary	Ref			
Secondary education	1.1 (0.5–2.2)	0.88		
Higher education	0.9 (0.4–1.8)	0.69		
Profession				
Employee	Ref		Ref	
Self-employed	1.7 (0.9–3.1)	0.089	1.3 (0.6–3.0)	0.55
Gender				
Female	Ref			
Male	1.0 (0.6–1.6)	0.98		
Current smoker				
No	Ref			
Yes	1.1 (0.3–3.8)	0.93		
High-fat diet				
No	Ref		Ref	
Yes	1.4 (0.9–2.2)	0.19	1.0 (0.5–3.0)	0.92

Note: When including BMI but excluding the waist circumference among the explanatory variables, the significant associated factors with steatosis were age of 50 year or more (aOR = 2.8, CI 95%: 1.4–5.4, $p = 0.002$), elevated liver enzymes (aOR = 3.6, CI 95%: 1.9–6.7, $p = 0.0001$) and increased BMI (aOR = 1.3, CI 95%: 1.2–1.4, $p = 0.0001$).
[a]When including waist circumference but excluding BMI among the exploratory variables, the significant associated factors with steatosis were elevated liver enzymes (aOR = 2.0, CI 95%: 1.1–3.8, $p = 0.02$) and increased waist circumference (aOR = 1.1, CI 95%: 1.0–1.2, $p = 0.0001$).

and another limitation is the suggestive self-report of lifestyles factors. This study was carried out only in an urban setting. A study among rural workers could also make a significant contribution.

4.2 | Prevalence of Liver Steatosis

Liver steatosis affected almost one worker out of five. This very high prevalence for an active and productive population questions their health and its determinants: environment, eating habits, lifestyle, and physical activity [3]. This study was carried out in urban settings, in capital cities, where most individuals lead sedentary lifestyles associated with an excessive caloric intake of foods rich in carbohydrates, meat, and fats. As a result of urbanization and changing lifestyles, families are increasingly sedentary, spending more time in front of television screens, computers, and telephones. Similarly, a service sector worker can easily spend 7 h a day sitting in front of their workstation. This prolonged sitting is often accompanied by consuming fatty and sugary foods [4, 6, 8]. Studies conducted elsewhere in sub-Saharan Africa have reported variable prevalence rates depending on the population studied.

Low prevalence was found in West Africa, notably 1.2% and 4.5% in Nigeria, on control subjects [3]. In East Africa, Kastberg et al. [28] in Kenya, reported a prevalence of 15.9% in urban and rural populations and in Sudan, among asymptomatic people, Almobarak reported a prevalence of liver steatosis of 20% [12]. Their teams used ultrasonography, which only detects steatosis at 30%. In our study, we used FIBROSCAN/CAP, recognized as more efficient and sensitive, enabling early diagnosis.

High rates of liver steatosis have been reported concerning particular populations such as diabetic subjects in Ethiopia (73%), 87% on overweight or obese subjects in South Africa [3], and 71.13% on patients with metabolic syndrome [20] in Burkina Faso.

4.3 | Factors Associated With Liver Steatosis

Among sociodemographic factors, only those over 50 were associated with liver steatosis. Workers aged over 50 were 2.1 times more likely to have fatty liver than those under 50. This could be explained by increasing life expectancy in African populations. Several studies agree that the older a person gets, the greater their risk of developing liver steatosis. A redistribution of visceral fat is observed at advanced age, such as postmenopausal women [11, 28], with the possible consequences of abdominal obesity and insulin resistance, both risk factors for liver steatosis [29]. Sedentary lifestyles are more common in later life. At this stage of life, activity is usually reduced, either due to retirement, arthralgia, or other ailments. Other authors in Sudan [9] and Kenya [28] reported age > 50 years as a factor associated with liver steatosis.

In the present study, among anthropometric factors, above-normal waist circumference was associated with liver steatosis. Excess waist circumference is characteristic of abdominal obesity. The risk of developing fatty liver increases with waist circumference.

Similarly, a higher than-normal BMI, characteristic of overweight or obesity, is associated with liver steatosis. Previous studies have also reported the prevalence of liver steatosis increases with BMI, making obesity a risk factor [20, 30, 31]. In the meta-analysis by Paruk et al. [10], the prevalence ranged from 1.2% to 4.5% in controls to 87% in liver biopsy specimens from overweight or obese subjects.

This study highlighted the significant proportion of workers affected by these chronic pathologies, such as arterial hypertension (27.8%), diabetes, overweight/obesity (around 60% of workers), and dyslipidaemia (35.8%). Diabetes and/or hypertension under treatment was present in 10% of workers. The presence of these cardio-metabolic risk factors in an active, productive population is an indication of their state of health and its determinants: environment, eating habits, lifestyle, physical activity, and so forth. This is a source of a heavy burden of morbidity, particularly the risk of stroke and cancer, with possible mortality and high health costs for families and the country. The findings highlighted are important to consider and investigate further. Prevention programs should be implemented within professional structures in order to preserve this important human potential for development.

We found that elevated liver enzymes (cytolysis), with ALT and AST above 40 IU/L was also associated with hepatic steatosis. Zawdie's team in Ethiopia [32] reported a significant association between transaminases and liver steatosis, in a population of people with diabetes.

Although in univariate analysis, the prevalence of liver steatosis was higher among workers with diabetes on treatment and with a family history of diabetes, in multivariate analysis, there was no statistically significant association between diabetes and liver steatosis. However, this is a cross-sectional study with a single-point measurement of fasting blood glucose and not a cohort study. In the literature, the prevalence of liver steatosis is reported to be high among people with diabetes, reaching 70% [29]. NAFLD is the clinical manifestation of the metabolic syndrome. The factors associated with its presence are essentially the components of this syndrome, which is a real public health problem. The fight against NAFLD means adapting the Mediterranean diet to the possibilities available in each country and promoting good eating habits: reducing the consumption of sugar sweetened beverages, ultra-processed and fatty foods and red meat, and increasing the consumption of fruit, olive oil, nuts, legumes, seeds, whole grains, and vegetables [33].

The study did not show any link between the consumption of fresh fruit and vegetables, fatty meals, and steatosis, as reported in the literature [33]. This could be explained by shortcomings in our data collection procedure, which was based on questioning rather than analyzing of workers' food consumption. Diet, lifestyle and physical activity play an important role in both the development and management of hepatic steatosis. Healthy, balanced diets, such as the Mediterranean diet, are characterized by a low intake of fatty and sugary foods [33]. Research is needed to better assess food groups and quantities in dietary surveys. This will help to raise public awareness of the need for healthy lifestyles.

5 | Conclusion

Liver steatosis affects almost a fifth of active workers in Ouagadougou. Most of the factors identified are modifiable factors that could be acted upon to prevent the onset of liver steatosis, and, hence, some instances of cirrhosis and liver cancer. We need to target workers in particular, an active segment of the general population. This would prevent these ailments, preserve the health of professionals, and make them more productive for longer. All of which would save economic resources that could be redirected and invested in other areas, such as improving working conditions and education.

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Conflicts of Interest

The authors declare no conflicts of interest.

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