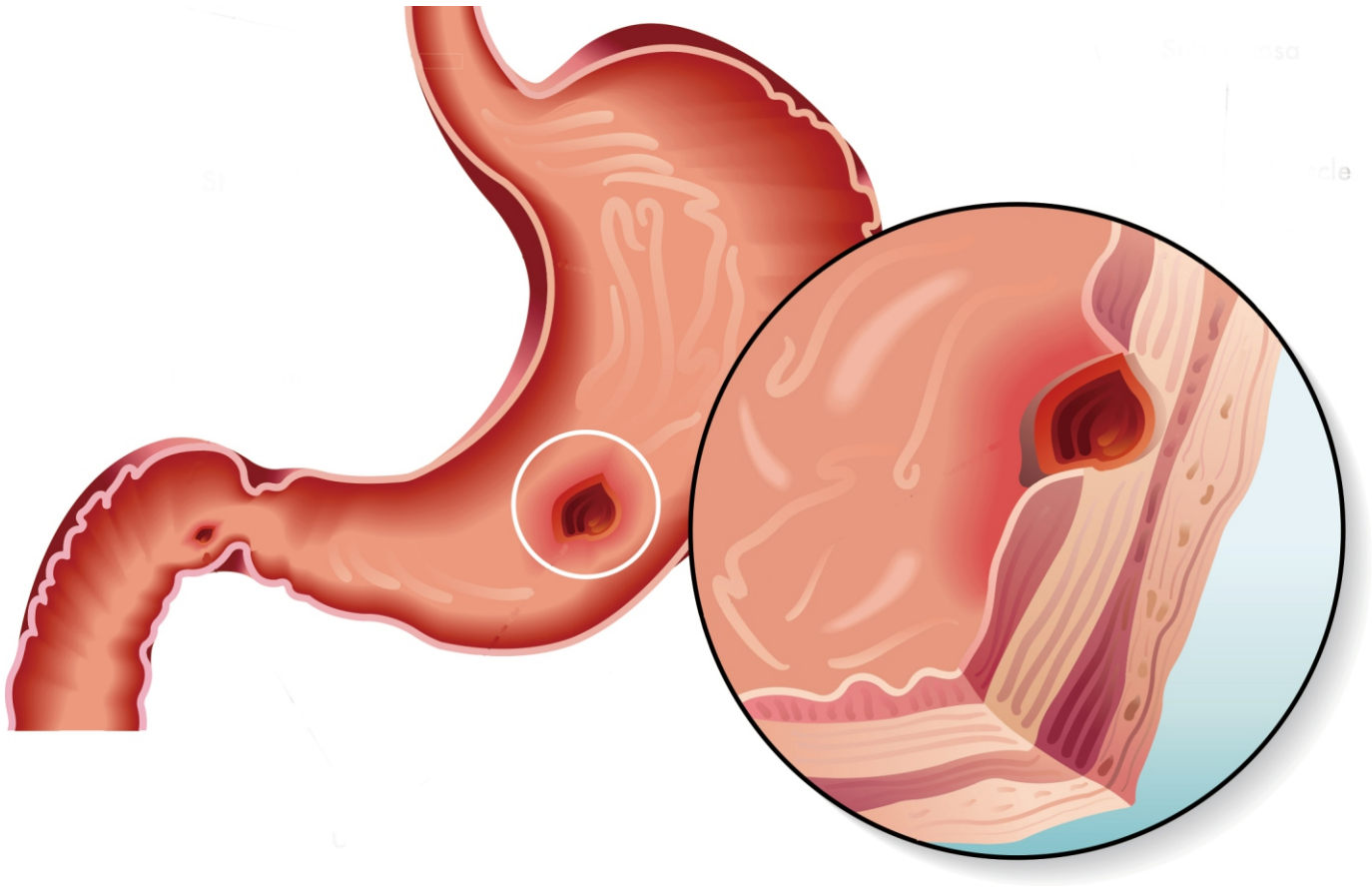
ISSN: 2163-9450 Volume 13, Number 3, March 2023

Scientific Research Publishing

Open Journal of Gastroenterology



ISSN: 2163-9450

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ISSN: 2163-9450 (Print) ISSN: 2163-9469 (Online)
https://www.scirp.org/journal/ojgas

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Scientific Research Publishing

Open Journal of Gastroenterology, 2023, 13, 99-130
https://www.scirp.org/journal/ojgas
ISSN Online: 2163-9469
ISSN Print: 2163-9450

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Volume 13 Number 3 March 2023

Open Journal of Gastroenterology (OJGas)
Journal Information

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Scientific Research Publishing

Open Journal of Gastroenterology, 2023, 13, 99-110
https://www.scirp.org/journal/ojgas
ISSN Online: 2163-9469
ISSN Print: 2163-9450

Prevalence and Factors Associated with Hepatic Steatosis in Patients with Metabolic Syndrome in Cameroon: Cases of 4 Reference Hospitals

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How to cite this paper: Nga, W.T.B., Etoa, M.C., Marina, B.G., Bagnaka, S.A.F.E., Ndam, A.W.N., Malongue, A., Kowo, M., Tzeuton, C., Noah, D.N., Njoya, O., Andoulo, F.A. and Namme, L.H. (2023) Prevalence and Factors Associated with Hepatic Steatosis in Patients with Metabolic Syndrome in Cameroon: Cases of 4 Reference Hospitals. *Open Journal of Gastroenterology*, **13**, 99-110.
https://doi.org/10.4236/ojgas.2023.133011

Received: January 26, 2023
Accepted: March 10, 2023
Published: March 13, 2023

Abstract

Introduction: Nonalcoholic fatty liver disease (NAFLD) is the leading cause of chronic liver disease worldwide and its prevalence increases with that of metabolic syndrome and its components. NAFLD is associated with complications such as cirrhosis and hepatocellular carcinoma. Diagnosis is mainly based on liver biopsy, but there are validated non-invasive methods. The purpose of the study was to assess the impact of metabolic steatopathy in patients with metabolic syndrome in Cameroon. **Methods:** This was a cross-sectional and analytical study conducted over a 6-month period from January 1st, 2019, to August 31st, 2022. Included were patients with metabolic syndrome who had consulted in endocrinology or gastroenterology at Yaoundé Central Hospital, Douala General Hospital and Douala Gyneco-obstetric and Pediatric Hospital. The diagnosis of NAFLD was made on abdominal ultrasound in front of a homogeneous or heterogeneous hyperechogenic aspect of the hepatic parenchyma compared to that of the right renal cortex called "brilliant liver" and fibrosis evaluated through non-invasive scores (Fib4 and NALFD Fibrosis score). Logistic regression by a uni- and multivariate analysis made it possible to search for the associated factors. **Results:** We included 133 pa-

tients. The female sex represented 64.7%. The mean age was 55 ± 9 years. The prevalence of NAFLD was 48.9%. At the evaluation of fibrosis was significant according to FIB-4 and NAFLD fibrosis score respectively in 6.2% and 4.6% of cases. The independently associated factors were Triglyceridemia ≤ 1.5 g/l (OR = 0.33; 95% CI [0.11 - 0.95]; p = 0.04) and LDL hypercholesterolemia (OR = 2.94; 95% CI [1.07 - 8.11]; p = 0.036). **Conclusion:** NAFLD was present in almost half of patients with metabolic syndrome. We had very few patients with significant fibrosis, but it needs to be further evaluated. The associated factors are hypertriglyceridemia and LDL hypercholesterolemia.

Keywords

Hepatic Steatosis, Metabolic Syndrome, Prevalence, Cameroon

1. Introduction

Non-alcoholic or nonalcoholic fatty liver disease (NAFLD) is defined as excessive accumulation of fat in the form of triglycerides in hepatocytes, greater than 5% in histology, apart from any context of excessive alcohol consumption, steatogenic treatment and other causes of chronic liver disease [1] [2] [3] [4].

NAFLD is the leading cause of chronic liver disease worldwide [4] [5]. Global prevalence was estimated at 32.4% in 2022 [6]. There are geographical and ethnic variations in the prevalence of NAFLD [7] [8]. In the United States, prevalence increased from 15% to 25% in the adult population between 2005 and 2010 and varied with ethnic origin [8] [9] [10]. In Asia, it is estimated at 30% [11]. In France, according to data from the CONSTANCE cohort in 2020, there was a prevalence of 18.2% [12]. In South America, the prevalence of NAFLD was 35.7% [7]. In Africa, prevalence was estimated at 13.48% [13]. In Cameroon, Mawo *et al.* in 2020 found a prevalence of 56.1% in patients with type 2 diabetes [14]. In Côte d'Ivoire, Abodo *et al.* found a prevalence of 23% [15]. In Burkina Faso in 2021, Compaoré *et al.* found fatty liver disease in 71.13% of patients and was associated with metabolic syndrome in 30.38% of patients [16]. The average age of patients is between 50 and 60 years with a clear increase in the prevalence among the older patients and there is a male predominance [4] [6] [13] [17].

NAFLD risk factors are well identified in the literature. These include high-calorie diets, physical inactivity, genetic factors [18], abdominal obesity [6] [19] [20] [21] [22] [23] and viral hepatitis [24].

NAFLD evolves in a dysmetabolic and insulin-resistance context [23] [25]. Insulin resistance observed during type 2 diabetes and present in cases of abdominal obesity leads to lipolysis and neoglucogenesis with release of free fatty acids, which go directly to the liver and constitute 60% of triglycerides. Oxidative stress and mitochondrial cytopathy are thought to play an essential role in the development of steatohepatitis lesions [25].

NAFLD encompasses a broad spectrum of liver lesions ranging from simple

steatosis to steatohepatitis (NASH), which is associated with the risk of progression to fibrosis, cirrhosis, and hepatocellular carcinoma [26] [27]. In France, about 220,000 patients with metabolic steatopathy have advanced pre-cirrhotic fibrosis or cirrhosis [12]. The diagnosis of HEPATIC steatosis and the evaluation of liver fibrosis is an important parameter in the follow-up of patients with NAFLD, to prevent the occurrence of complications. The gold standard for diagnosis of fibrosis remains liver biopsy. However, several non-invasive methods have been developed, including impulse elastometry, which is a reliable method but not always accessible in our context, and clinico-biological scores such as the FIB-4 index and the NAFLD Fibrosis Score [28] [29]. In particular, they were used in a study conducted by Bekolo *et al.* in Cameroon to evaluate fibrosis in patients with viral hepatitis C and metabolic syndrome with good negative predictive values [30]. The diagnosis of steatosis can be made through abdominal ultrasound [29].

In the context of a steady increase in obesity and type 2 diabetes cases, sedentary lifestyles are a factor in the development of NAFLD, the purpose of this study was to investigate the prevalence and factors associated with metabolic steatopathy in patients with metabolic syndrome.

2. Patients and Methods

This was a cross-sectional study from January 1st, 2019, to August 31st, 2022. It had three health facilities in the cities of Douala and Yaoundé, namely the General Hospitals of Douala and Yaoundé, and the Central Hospital of Yaoundé. These are first class hospitals each with specialized services (Endocrinology and Cardiology) where patients with metabolic syndrome are treated.

We included all patients over the age of 18 with metabolic syndrome, followed in endocrinology and/or cardiology, and having performed at least one abdominal ultrasound needed for the diagnosis of hepatic steatosis. The Metabolic Syndrome was defined according to the 2009 IDF harmonization consensus which takes into account the mandatory presence of abdominal obesity (BMI greater than or equal to 30 kg/m^2 or a waist circumference greater than 94 cm for men/greater than 80 cm for women); and 2 of the 4 following criteria, blood pressure greater than or equal to 130/85 mmHg or antihypertensive treatment, triglycerides greater than or equal to 1.5 g/l, HDL-cholesterol less than 0.4 g/l in humans or less than 0.5 g/l in women or specific ongoing treatment, fasting blood glucose greater than or equal to 1 g/l or ongoing diabetes treatment [18]. Excluded patients who were those with incomplete records, those with another cause of chronic hepatopathy (viral hepatitis B and C, autoimmune hepatitis, overload disease), taking steatogenic medications or drinking risky alcohol. The incomplete records were those not having the age and sex of the patient, the results of abdominal ultrasound and some biological examinations, namely the assay of transaminases, platelet levels.

The data collected were socio-demographic data (age, sex), comorbidities

(high blood pressure, type 2 diabetes, sedentary lifestyle, occasional alcohol use, smoking, herbal medicine), clinical parameters (weight, height, waist circumference, BMI, blood pressure, fasting blood glucose), biological data (ASAT, ALAT, lipid profile, GGT, prothrombin levels, albuminemia), ultrasound data (liver size, echostructure), evaluation of fibrosis by non-invasive methods (FIB-4, NAFLD Fibrosis Score, impulsive elastometry).

Age gathered is the age of the patient during the study period. The listed co-morbidities of high blood pressure, diabetes are those found in the medical record of each patient and whose diagnosis was made by a specialist doctor (cardiologist and endocrinologist). Regarding alcohol consumption and smoking, that's the information that's in each patient's file. Clinical and para-clinical data were obtained from the patient's last visit during the study period. The NALFD diagnosis was made in front of an ultrasound image suggestive of fatty liver disease, namely hyperechogenicity of the hepatic parenchyma compared to that of the right kidney in a diffuse or asymmetrical manner. Fibrosis was evaluated by non-invasive scores of NAFLD Fibrosis Score, FIB-4, and impulsive elastometry, which were correlated with the METAVIR score. Fibrosis was considered non-significant if <F2 and significant if F2. Although the diagnosis of cirrhosis is initially histological, we evoked it in front of a METAVIR F4 score and/or an ultrasound image showing a heteronodular liver with a granite appearance and irregular contours.

2.1. Operational Terms

- NAFLD Fibrosis Score = 1.675 + 0.037 age (years) + 0.094 BMI (kg/m^2) + 1.13 fasting glucose or diabetes (yes = 1, no = 0) + 0.99 AST/ALT ratio 0.013 platelets (10^9/L) 0.66 albumin (g/dL). Interpretation: Score < −1.455: prediction of significant fibrosis absence (F0 - F2); score > −1.455 and 0.675: undetermined score; score > 0.675: prediction of significant fibrosis (F3 - F4).
- FIB-4 = (ASAT age)/(ALAT platelets). Interpretation 1.45 (F0 - F2); >4 (F3 - F4).
- Impulsive elastometry: Interpretation: <7 kPa = absence of fibrosis or minimal fibrosis F0 - F1, 7 - 10 kPa = Moderate fibrosis (F2), 10 - 14 kPa = severe fibrosis (F3 - F4), 14 kPa = cirrhosis.
- Obesity: grade I (BMI between 30 - 35 Kg/m^2), grade II (BMI between 35 - 40 Kg/m^2).
- Morbid obesity: BMI ≥ 40 Kg/m^2.

2.2. Statistical Analysis

The data were stored on an electronic sheet designed using Epi data version 4.6 (Epi data Association, Odense, Denmark). The analyses were performed by IBM-SPSS version 26.0 software for Windows (IBM, Chicago, USA). Qualitative variables were presented as percentages, proportions, and/or frequencies. The quantitative variables were represented by their mean and median. To compare

the different frequencies, we used the Chi Square test. The student test was used to compare averages. For the statistical analyses, we considered an error threshold of 5%. Mean values were expressed with their 95% confidence intervals. Property values $p < 0.05$ were considered statistically significant. The uni- and multivariate regressions made it possible to look for the associated factors depending on whether they are protective or of exposure.

2.3. Ethical Considerations

A recruitment authorization has been obtained from the ethics committee of each of the health facilities where the study took place, to allow the collection of our data. The anonymity and confidentiality of each patient's data was respected.

3. Results

We collected 419 records from patients with metabolic syndrome, of which 133 were included in our study, for an inclusion rate of 31.7%. The average age was 55 ± 9 years and the median 57 ± 12 year, with a minimum age of 19 and a maximum age of 85. The study population consisted of 64.7% (n = 86) female patients, a sex ratio of 0.55 (Table 1). Hypertension and type 2 diabetes were found in 46.6% (62 patients) and 42.1% (56 patients) respectively (Table 1). There was a sedentary lifestyle in 75.3% or 100 patients and occasional alcohol use in 40.6% or 54 patients. Clinically, 57.1% had grade I obesity, 28.6% grade II obesity and 14.3% morbid obesity (Table 1). Biologically, hyperglycemia, hypertriglyceridemia, total hypercholesterolemia, elevated HDL-cholesterolemia, and elevated LDL-cholesterolemia were present in 51.1%, 63.9%, 55.6%, 60.2% and

Table 1. General characteristics of population.

	N (%)	Mean ± SD
Mean Age (years)		55 ± 9
Sex		
Female	86 (64.7)	
Male	47 (35.3)	
Comorbities and lifestyle		
Diabetes	56 (46.6)	
Hypertension	62 (42.1)	
Sedentarity	100 (75.3)	
Occasional alcohol consumption	54 (40.6)	
Obesity		
Grade I	76 (57.1)	
Grade II	38 (28.6)	
Morbid obesity	19 (14.3)	

Table 2. Biological characteristics of population.

	N (%)	Mean ± SD	Median ± IQR
Glycemia (g/l) (n = 133)			
<1	65 (48.9)		
≥1	68 (51.1)		
Total Cholesterol (g/l) (n = 133)			
>2	74 (55.6)	1.9 ± 0.7	1.9 ± 0.8
≤2	59 (44.4)		
LDL cholesterol (g/l) (n = 82)			
≥1	42 (51.2)	1.3 ± 0.8	1.2 ± 0,8
<1	40 (48.8)		
HDL cholesterol (g/l) (n = 133)			
≤0.4	43 (39.8)	0.4 ± 0.2	0.4 ± 0,2
>0.4	80 (60.2)		
Triglycerides (g/l) (n = 133)			
>1.5	85 (63.9)	1.4 ± 0.6	1.3 ± 0.6
≤1.5	48 (36.1)		
ASAT (UI/l) (n = 65)			
<2N	57 (87.7)	43.3 ± 14.6	42.3 ± 13.6
≥2N	8 (12.3)		
ALAT (UI/l) (n = 65)			
<2N	55 (84.6)	48.2 ± 11.8	46.2 ± 12.8
≥2N	10 (15.4)		

51.2% respectively (Table 2). Hepatic cytolysis greater than twice normal was present in 7.5% and 6% of patients on ALAT and ASAT, respectively. At imaging the prevalence of fatty liver disease was 48.9% or 65 patients (Figure 1). On abdominal ultrasound, 03 patients (2.6%) had a liver with irregular liver contours. There was significant fibrosis according to FB-4, NAFLD fibrosis score and impulsive elastometry in 6.2%, 4.6% and 1.5% of patients, respectively (Table 3). Six patients performed impulsive elastometry. The independent factors associated with fatty liver disease were Triglyceridemia ≤ 1.5 g/l (OR = 0.33; 95% CI [0.11 - 0.95]; p = 0.04); and LDL hypercholesterolemia (OR = 2.94; 95% CI [1.07 - 8.11]; p = 0.036) (Table 4).

4. Discussion

The profile of patients included in the study is that of a female patient over the age of 50 with obesity and is like that found in some studies in Africa [31] [32]

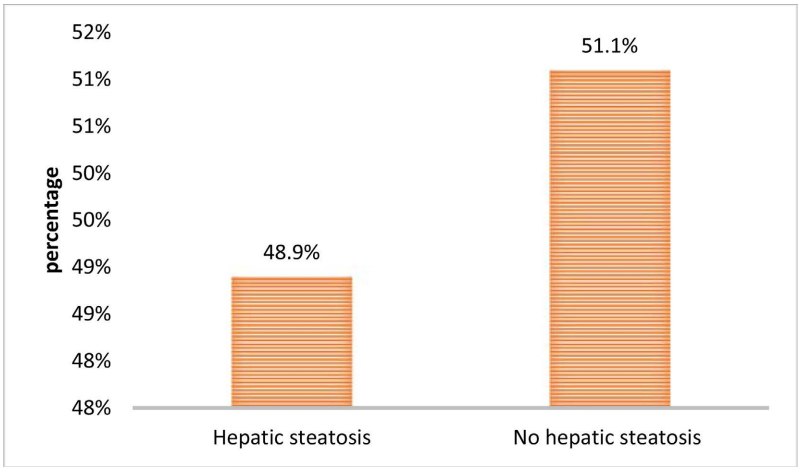

Figure 1. Prevalence of hepatic steatosis.

Table 3. Evaluation of hepatic fibrosis.

	Hepatic steatosis		p	OR (IC à 95%)
	Yes n = 65 (%)	No n = 68 (%)		
NAFLD fibrosis score (n = 13)			0.767	2 (0.07 - 5.15)
≤1.455 (F0 - F2)	1 (1.5)	2 (2.9)		
>0.675 (F3 - F4)	3 (4.6)	2 (2.9)		
Indeterminate interval	1 (1.5)	4 (5.9)		
FIB-4 (n = 65)			0.896	1.05 (0.5 - 2.2)
1.45 (No Fibrosis)	7 (10.7)	12 (18.5)		
>4 (presence of fibrosis)	4 (6.2)	3 (4.4)		
Indeterminate interval	20 (30.8)	22 (32.4)		
Fibroscan (n = 6)			0.600	3 (0.08 - 10.7)
<10 kPa	3 (4.6)	1 (1.5)		
≥10 kPa	1 (1.5)	1 (1.5)		

Table 4. Factors associated to hepatic steatosis.

	aOR	CI 95%	p
Age > 57 years	3.027	0.90 - 10.12	0.072
Hypertension	0.64	0.19 - 2.10	0.465
LDL cholesterol ≥ 1 g/l	2.94	1.07 - 8.11	0.036
HDL cholesterol ≤ 0.4 g/l	1.08	0.38 - 3.03	0.88
Triglyceridemia < 1.5 g/l	0.33	0.11 - 0.95	0.04

[33] [34]. There is, however, a difference in age, particularly in the studies of Compaoré *et al.* and Ntagirabiri *et al.*, whose patients were younger [16] [34].

A small number of patients had completed the morphological and/or biological assessments necessary for the diagnosis of metabolic liver disease. This contradicts the recommendations of learned societies that strongly advocate the diagnosis of metabolic steatosis in at-risk populations, namely diabetic patients, and those with metabolic syndrome [28] [29].

Almost half of the patients had fatty liver disease, which confirms the important place of hepatic steatosis in patients with metabolic syndrome as found in several studies worldwide, notably in Africa [14] [16] [20] [34] [35] [36] [37]. the prevalence found in our study is much higher than that of Ntagirabiri *et al.* in Burundi or Asabamaka *et al.* in Nigeria which had prevalences of 37.2% and 9% respectively [34] [35]. This difference is explained by the patient profile included in the study, notably that of Asabamaka *et al.*, who worked mainly in diabetic patients with a small proportion of patients with metabolic syndrome. Our prevalence is close to those of the Western series, whose up than 50% in patients with metabolic syndrome [19] [20]. Changes in eating habits, sedentary lifestyles, increased obesity, and metabolic diseases such as type 2 diabetes observed in countries with limited and intermediate resources strongly contribute to the increase in cases of fatty liver disease.

Hepatic fibrosis was very poorly evaluated. Although it is recommended, the evaluation of fibrosis in patients with metabolic syndrome is not a common practice in many practitioners even gastroenterologists and those despite the existence of non-invasive scores easily usable like FIB-4 or NAFLD fibrosis score. This assessment is more important because the progression to cirrhosis is much faster in case of fatty liver disease with the cancer risk known [19] [27] [28] [37] [38]. The prevalence of fibrosis ranged from 6.2% to 1.5% depending on the assessment method. However, the fact that it is underestimated makes this prevalence hard to interpret. Only three patients had a liver with irregular contours on the abdominal ultrasound.

The factors significantly associated with NAFLD were abnormalities in the lipid profile, namely hypertriglyceridemia and elevated LDL cholesterol. These are the factors traditionally found to be associated with the occurrence of NAFLD in patient with metabolic [4] [13] [35] [38] [39]. Dyslipidemia found in patients with metabolic syndrome especially those with obesity as is the case in our patients, results in accumulation of triglycerides in hepatocytes and contributes to changes in lipid metabolism in the liver [40].

The main limitation of the study is the lack of biological and morphological data necessary for the diagnosis of NAFLD in patients with metabolic syndrome. Only one third in patients could be included in the study as having performed at least one abdominal ultrasound for the diagnosis of fatty liver disease.

5. Conclusion

Patients with metabolic syndrome are female patients in the 5th decade. The prevalence of fatty liver disease was 49.8%. Fibrosis was assessed very little de-

spite the existence of non-invasive scores. Fibrosis when assessed was significant in 6.2% according to FIB4. The factors associated with fatty liver disease were hypertriglyceridemia and elevated LDL cholesterol.

Contribution of the Authors

Data Collection: Marina Bidjogo Gwet and Winnie Bekolo; Writing and Corrections: Winnie Bekolo; Proofreading and Corrections: Bidjogo, Gwet Marina, Ndjitoyap Antonin, Kowo Mathurin, Eloumou Baganka Servais, Noah Noah Dominique, Ankouane Andoulo Firmin, Njoya Oudou.

Conflicts of Interest

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

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Scientific Research Publishing

Open Journal of Gastroenterology, 2023, 13, 111-116
https://www.scirp.org/journal/ojgas
ISSN Online: 2163-9469
ISSN Print: 2163-9450

Clinical and Anatomo-Pathological Study of Digestive Polyps at Point G Teaching Hospital

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How to cite this paper: Sanogo, S.D., Tayue, M.P., Soumaré, G., Mallé, O., Maiga, A., Sidibé, L., Sow, H., Samaké, K., Dicko, M.Y., Diarra, A., Guindo, I., Kamaté, B. and Traoré, C.B. (2023) Clinical and Anatomo-Pathological Study of Digestive Polyps at Point G Teaching Hospital. *Open Journal of Gastroenterology*, **13**, 111-116.
https://doi.org/10.4236/ojgas.2023.133012

Received: January 13, 2023
Accepted: March 17, 2023
Published: March 20, 2023

Abstract

Introduction: The aim of our study was to describe the aspects clinical and pathology of digestive polyps. **Methods:** This was a descriptive and analytical study with retrospective and prospective collection from January 2014 to September 2020, *i.e.* a duration of 72 months. Our study focused on all cases of non-cancerous digestive pathologies. The data were collected from registers, medical files and reports from the anatomy and pathological cytology department of the Point G University Hospital. All of this data was entered on an individual survey form. This sheet includes demographic data, qualitative and quantitative variables. **Results:** We conducted a study of 131 cases of digestive polyps. The frequency of digestive polyps was 3.65%. The mean age of our patients was 44.6 ± 21 years with extremes of 2 years and 79 years, with a male predominance and a sex ratio of 1.01. The biopsy was the type of sample most represented in 77.1%. The digestive polyps were located in stomach in 37.4%; the colon in 27.5% then the rectum 21.4%. The polyp sessile accounted for 65.6%. Histological examination revealed that adenomatous polyps were predominant in 77% of cases, followed by juvenile polyps in 9.2%, then hyperplastic polyps in 6.2%. Low grade dysplasia was found in adenomatous polyps in 61.53% and high grade found in 38.4%. Gastritis due to *Helicobacter pylori* (Hp) was found in 16% of cases. **Conclusion:** Digestive polyps are common in the general population. The prognosis is linked to the risk of neoplastic degeneration of adenomas.

Keywords

Digestive Polyps, Clinical, Anatomopathology

1. Introduction

The first cases of polyps of the digestive tract were described by Slotz in 1814 [1]. In Western countries, polyps are among the common conditions that arouse considerable enthusiasm among gastroenterologists and pathologists. The prevalence and relative frequency of different polyps vary across regions of the world and populations.

Thus, in a recent series of gastric endoscopy in the USA; 8000 polyps were biopsied or resected in 7500 patients; prevalence was 3.75% [2]. The prevalence of adenomatous polyps increases with age, it is lower in Third World countries than in the West.

In France it is estimated at 7% between the ages of 45% and 49% and 20% to 33% after the age of 65 [3].

In Africa, however, this pathology is rare, often even unknown [4]. Indeed, several studies have highlighted the low incidence In Burkinabe hospitals, recto-colic polyps accounted for 2.34% of the conditions encountered during colonoscopies performed [5].

In Mali, to our knowledge, there has been no study on digestive polyps. With this in mind, it seemed appropriate to us to devote a study to better situate the place of digestive polyps in digestive pathology in our country and to analyze them in their sociodemographic, topographical and pathological aspects.

2. Methods

This was a descriptive and analytical study with a retro-prospective collection of data extending from January 1, 2014 to September 31, 2020, a duration of 72 months, our study focused on all cases of non-cancerous digestive pathologies. All cases of histologically confirmed digestive polyps during the study period were included. Polypectomy parts and biopsy fragments of the digestive tract were fixed with 10% formalin. The data were collected from registers, medical records and reports of the Pathological Anatomy and Cytology Department of the Point G University Hospital. Data were entered and analyzed using SPSS software version 21.0.

3. Results

During the study period, 131 cases of polyps/3588 parts of the digestive tract were recorded in the anatomy and pathological cytology department of the G-point hospital, a frequency of 3.65%. A male predominance was observed with 50.40% of cases or a sex ratio of 1.01 (**Figure 1**). The age group 60 years and older was in the majority with 32.1% of cases (**Table 1**). The mean age of our patients was 44.6 ± 21 years with extremes of 2 and 79 years. Officials were the most represented with 22.1% (**Table 2**). Endoscopic biopsy was the most common type of specimen, accounting for 77.1% of cases (**Table 3**). The most common location was stomach, accounting for 37.4% of cases (**Figure 2**). Adenomatous polyps were the most represented (77%); Among these polyps were found 61.53%

of low-grade dysplasia and 38.47% of high-grade dysplasia (Figure 3).

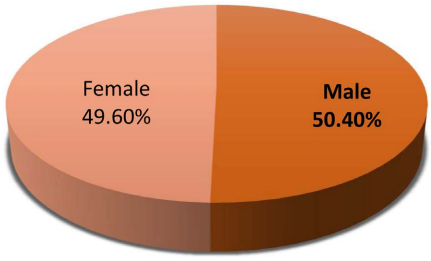

Figure 1. Patients by sex.

Table 1. Patients by age group.

AGE GROUPS	FREQUENCY	PERCENTAGE
Less than 10 years	12	9.2
10 to 19 years	7	5.3
20 à 29 years	10	7.6
30 à 39 years	16	12.2
40 à 49 years	20	15.3
50 à 59 years	24	18.3
Over 60 years	42	32.1
TOTAL	**131**	**100**

Table 2. Patients by profession.

PATIENTS BY PROFESSION	FREQUENCY	PERCENTAGE
Officials	29	22.1
Housewife	27	20.6
Student	22	16.8
Unemployed	19	14.5
Other	15	13.1
Merchant	10	7.6
Farmer	7	5.3
TOTAL	**131**	**100**

Table 3. Type of withdrawal.

TYPES OF WITHDRAWALS	FREQUENCY	PERCENTAGE (%)
Endoscopic biopsies	**101**	**77.1**
Surgical samples	22	16.8
Excision biopsies	4	3.1
Not specified	4	3.1
TOTAL	**131**	**100**

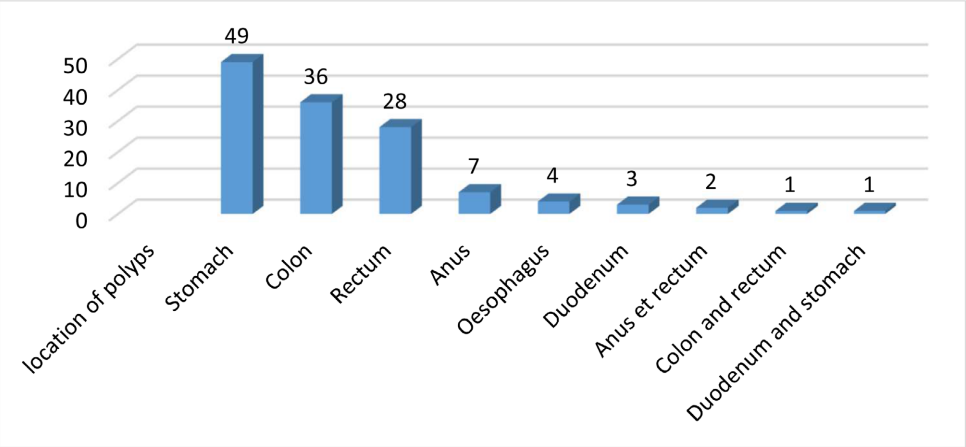

Figure 2. Location of polyps.

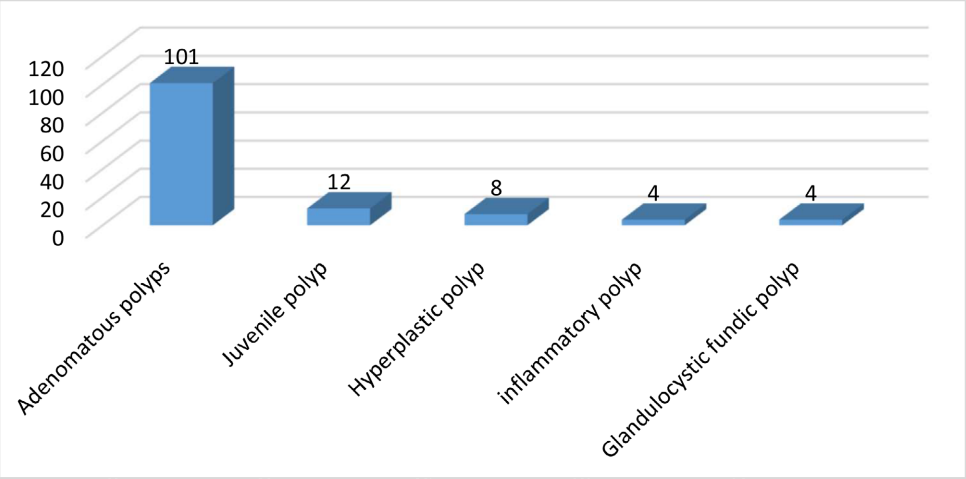

Figure 3. Distribution by histological type.

4. Discussion

In our study, the age group over 60 years was the most common, at 32.1% of cases. The mean age was 44.6 years ± 21 years with extremes of 2 years and 79 years. This result is close to that of Draoui I [6] who found in his study 12.5% of 60 to 64 years with an average age of 40 years with extremes of 2 and 80 years. In our context the diagnosis of digestive polyps is late because systematic screening is not yet applied in our health structures.

We found a slight male predominance at 50.4% of cases. This result is close to that of Draoui I [6] which found 53.3% of men and Cherrafi F [7] which also found a slight male predominance with 57.1% of cases and women 42.9%.

The most common location of polyps was the stomach (37.4%). This result is different from that of Draoui I who found the rectum (41.7%) and Cherrafi F in Morocco who that the colon was the most frequent location (51.4%). This could be explained by the fact that the majority of samples were gastric biopsies in our study. The most performed endoscopies in our context are upper GI endoscopy.

Endoscopic biopsy was the most frequent type of sample or 77.1% of cases this

result is similar to that of Cherrafi F who found 83.50% endoscopic biopsy; also similar to that of Bassene *et al.* in Dakar [8]. This could be explained by the fact that digestive polyps are most often accidentally discovered during an upper GI endoscopy.

Adenomatous polyp was the most represented histological type in 77% of cases, followed by juvenile polyp with 9.2% and hyperplastic polyp with 6.1%.

This result is different from that of Draoui I who found hyperplastic polyps (35%), adenomas (2.7%), and juvenile polyps (20%); It is higher than that found by Cherrafi F in 2020 or 59.30% of adenomatous polyps followed by hyperplastic polyps (17.9%).

This could be explained by the fact that this study was done in a single clinical department unlike our study site which receives samples from several health facilities in Mali.

Given the retrospective nature of our study, the major difficulty encountered was the absence of certain sociodemographic information in the logs of consultation and pathological examinations. Patients having been retrospectively recruited in the pathological anatomy department their evolution could not be reported in our study.

5. Conclusion

Digestive polyps are common in the general population. This is a real public health problem. Digestive endoscopy and pathology make the diagnosis. The prognosis is related to the risk of neoplastic degeneration of adenomas. The histopathological study of polyps is very important to determine the type of polyp which conditions therapeutic management and monitoring. There are different types of polyps dominated by adenomas, common in the elderly.

Conflicts of Interest

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

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Scientific Research Publishing

Open Journal of Gastroenterology, 2023, 13, 117-130
https://www.scirp.org/journal/ojgas
ISSN Online: 2163-9469
ISSN Print: 2163-9450

Irritable Bowel Syndrome in General Population of Cotonou: Prevalence and Associated Factors

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How to cite this paper: Sokpon, C.N.M., Kpossou, A.R., Aden-Henri, S.L.K., Vignon, R.K., de Tove, J.L.S., Adossou, A.C.G., Azandjèmè, C.S. and Séhonou, J. (2023) Irritable Bowel Syndrome in General Population of Cotonou: Prevalence and Associated Factors. *Open Journal of Gastroenterology*, **13**, 117-130.
https://doi.org/10.4236/ojgas.2023.133013

Received: March 2, 2023
Accepted: March 26, 2023
Published: March 29, 2023

Abstract

Introduction: Irritable bowel syndrome (IBS) is a known public health burden in western countries while only a few studies have been published on this disease in Africa. The objective of this study was to determine the prevalence of IBS in the general adult population of Cotonou (Benin), its associated risk factors and its impact on patients' daily life. **Method:** This was a descriptive and analytical cross-sectional study conducted over one month. Data was collected via a questionnaire. IBS was defined by the Rome IV criteria. **Results:** A total of 768 participants were included, with a male predominance (sex ratio 1.8). The mean age of the participants was 30.6 years, with extremes of 15 to 76 years. The prevalence of IBS in our study was 4.2%. IBS-D was the most common subtype (34.4%). IBS symptoms were influenced by diet (46.9%), stress (31.3%) and lack of sleep (15.6%). In the univariate analysis, the risk factors associated with IBS were: Dendi and Otamari ethnicity ($p = 0.015$), low level of education ($p = 0.047$), family history of IBS ($p = 0.026$), smoking ($p < 0.001$), high-salt diet ($p = 0.001$), high-fat diet ($p = 0.044$), stress ($p < 0.001$) and anxiety ($p < 0.001$). In the multivariate analysis, male gender ($p = 0.047$), regular physical activity and good sleep quality were protective factors. IBS led to daily gurgling (31.3%), absenteeism (25%) and impacted the subjects' professional life in 28.1% of the cases. **Conclusion:** Despite IBS frequency, patients with IBS rarely seek medical attention. The public should therefore be informed about this condition to reduce its impact on their daily life.

Keywords

IBS, Rome IV Criteria, Associated Factors, Cotonou, Benin

1. Introduction

Irritable bowel syndrome (IBS) is a functional bowel disorder in which abdominal pain or digestive discomfort is associated with a change in the frequency or appearance of bowel movements. Bloating, abdominal distension, and abnormal bowel movements are also frequently associated [1]. Formerly known as "spastic colitis", or "colonic neurosis", "mucosal colitis" or also "muco-membranous colitis" and more recently as "functional colopathy", the term "irritable bowel syndrome" has become more appropriate today [2]. Irritable bowel syndrome is the most common functional bowel disorder with an average prevalence of 10% in the general population [3]. To standardize its diagnosis, several clinical criteria have been developed, including Manning's criteria in 1976, Rome I in 1990, Rome II in 1999 and Rome III in 2006. The latest version, Rome IV criteria, dates from May 2016 [4] [5].

IBS is a major cause of consultation with general practitioners, gastroenterologists, and internists [6]. It accounts for one third of gastroenterology consultations [7]. Initially considered as a purely motor disorder, IBS is now recognized as a multifactorial condition [3].

Several factors have been incriminated in its occurrence. These include a diet rich in oligosaccharides, disaccharides, monosaccharides, and polyols fermentable by the gut microbiota (FODMAPs) [8], alcohol and tobacco consumption [9], physical inactivity, sleep disorders [10], obesity [11], psychological factors such as stress [3], and a family history of IBS [12].

Because of the poor quality of life in developing countries, their population is theoretically considered at high risk of IBS. However, no general population study on this condition has been conducted in the Republic of Benin. For this reason, we deemed it appropriate to conduct this study on the prevalence of IBS, its associated risk factors in the general population of Cotonou, as well as the impact on the daily life of affected subjects.

2. Methods

2.1. Study Setting

The town of Cotonou is located on the coastline, hence the name of the Littoral Department. The later was created in the last administrative division of Benin on 15 January 1999. Initially, the Littoral Department was a sub-prefecture of the former Atlantic Department, which itself came from the 1958 territorial division; time during which the country of Benin had six provinces resulting from the French colonial division. With an area of 79 km^2 (0.07% of Benin's area), the Littoral department is the smallest of the twelve departments currently in Benin.

Located at the intersection of the 6˚20 North parallel and 2˚20 East meridians, this department is bordered by Lake Nokoué to the north, the Atlantic Ocean to the south, the commune of Sèmè-Kpodji (of the department of Ouémé) to the east and the commune of Abomey-Calavi (of the department of Atlantique) to the west. It is the only department in the country that has a single municipality, with 13 districts and 143 neighborhoods. Cotonou is the economic capital of Benin and concentrates almost all the administrative and political functions of the country.

2.2. Type and Period of Study

It was a descriptive and analytical cross-sectional study. It was conducted over a period of one-month from July 8 to August 8, 2019.

2.3. Study Population

2.3.1. Inclusion Criteria

This study concerned subjects from a sample of the population of the city of Cotonou who met the following criteria:

- Residents living in Cotonou for 6 months at least.
- Be 15 years of age or older.
- No alarm signs (altered general condition, gastrointestinal bleed, nocturnal symptoms).
- Give their consent to participate in the study.

2.3.2. Non-Inclusion Criteria

People who were not included in this study:

- Any admitted subjects during the inclusion period.
- Subjects who were unable to speak.
- Subjects with a mental disability.
- Subjects with alarm signs: rectal bleed, melena, anemia, significant and unexplained weight loss.

2.4. Sampling

The minimum size of our sample was 768 persons.

This size was calculated using the Schawrtz formula: $N = \frac{\varepsilon Z\alpha^2 pq}{i^2}$

Recruitment was done using a 2-stage probabilistic cluster sampling method. In the first stage, 69 clusters representing 69 neighborhoods of Cotonou were randomly selected. In the second stage, the so-called secondary units named individuals were selected according to a simple random design using the lottery method without replacement.

2.5. Study Variables

The data collection was done via a questionnaire essentially composed of the followings:

- **dependent variable:** IBS defined by Rome IV criteria:

- chronic abdominal pain at least 1 day per week in the last 3 months associated with at least two of the points below;

- pain in connection with defecation;
- pain associated with a change in stool frequency;
- pain associated with changes in stool appearance;
- all evolving for at least 6 months.

- **independent variables**: subtype of IBS (by Bristol stool scale), socio-demographic data, medical history, diagnostic criteria, clinical signs, influencing factors, onset of disorders and consultations made, paraclinical examinations performed, treatments received, lifestyle, eating habits and finally psychological disturbances.

To assess the subjects' psychological state, we used two scales: the "Hospital Anxiety and Depression scale" (HADs) and the Cungi brief stress assessment scale. It is a standardized self-questionnaire, with a valid and reliable rating scale. It consists of 14 items rated from 0 to 3 each: seven for anxiety (HADS-anxiety) and seven for depression as follows: 0 - 7 = normal; 8 - 10 = moderate; 11 - 14 = medium; 15 - 21 = severe.

Stress was assessed using Cungi's brief stress assessment scale. It is a self-assessment scale with few items, easy to understand and to fill in by patients, easy to analyze by professionals and which explores how a patient perceives his stress reaction. It consists of 11 items rated from 0 to 6 each. The interpretation of the scale is as follows: 11 - 19 = Very low stress; 19 - 30 = Low stress; 30 - 45 = high stress; ≥45 = very high stress.

2.6. Analysis

Our analysis consisted first in making a simple description (frequency tables, average, standard deviation, median, graphs) of the various variables considered in our study. Then we looked for possible statistical associations between the dependent variables and several other variables by means of the Chi^2 Pearson test or the Fischer exact test according to the case of an ANOVA model. The data were entered into a mask designed on Epi data 3.1. Analysis was performed with SPSS 25 statistical software. The accepted threshold of statistical significance was 5%. When required, the student's t test, the odds ratio were used with an interval of 95%.

3. Results

3.1. Characteristics of the Study Population

Our study included 768 people living in Cotonou, recruited from 69 different districts of the city. The average age in our study was 30.6 years with extremes from 15 to 76 years. The modal age range was 15 to 30 years and represented (56.6%) of the study population.

Our study population was predominantly male with a sex ratio of 1.8. There were 498 males, *i.e.* 64.8% of our sample. The Fon ethnic group was the most represented (n = 309; 40.2%) and the majority of the subjects surveyed had

grown up in the Littoral department (n = 509; 66.3%). Regarding psychological disturbances, more than half of the population (n = 452; 58.9%) had a low level of stress. Stress was high in 174 subjects (22.7%) and very high in 3 subjects (0.4%). A moderate level of anxiety was found in 17.2% of the cases (n = 132), and severe in 1.4% (n = 11). The prevalence of mild depression in our study was 9.9% (n = 76), 1.7% (n = 45) for moderate depression. Only one subject had severe depression.

3.2. Prevalence of IBS According to the Rome IV Criteria and Subtypes

The prevalence of IBS in our study was 4.2% (32 subjects out of 768 included). IBS-D was the most frequent subtype (n = 11; 34.4%), followed by IBS-C (n = 10; 31.3%) (Table 1).

3.3. Epidemiological Aspects of IBS Patients

IBS was more frequent in subjects aged 30 to 44 years (4.8%) followed by subjects aged 15 to 30 years (4.4%). There was a female predominance, with a sex ratio of 0.60.

3.4. Clinical Aspects of IBS Patients

The gastrointestinal (GI) symptoms were distributed as follows: abdominal pain (n = 27; 84.4%), diarrhea (n = 21; 65.6%), constipation (n = 20; 62.5%), abdominal discomfort (n = 17; 53.1%), frequent gas emission (n = 12; 37.5%), abdominal bloating (n = 8; 25%), borborygmi rumbling (n = 4; 12.5%). The extra-digestive symptoms found were asthenia (n = 19; 59.4%), migraine (n = 18; 56.3%), pollakiuria (n = 10; 31.3%), chronic lumbago (n = 8; 25%). Regarding exoneration, it was considered easy (46.9%), laborious (34.4%), imperative (18.8%), satisfactory (53.1%) or unsatisfactory (46.9%). Nineteen (59.4%) subjects meeting the Rome IV criteria reported food as a factor aggravating the symptoms in 46.9% (n = 15) of cases. Stress and lack of sleep were reported in 31.3% and 15.6% of cases respectively.

3.5. Factors Associated with IBS

In the univariate analysis, epidemiologically, the factors associated with IBS

Table 1. Distribution of sick subjects according to IBS subtype.

	Sample	Percentage (%)
IBS-D	11	34.4
IBSC	10	31.3
IBS-M	9	28.1
IBS not specified	2	6.3
Total	32	100

were: Dendi and Otamari ethnicities (p = 0.015), origin from Alibori (OR [IC 95%] = 23.71 [1.45 - 387.95]; p = 0.043), low level of education (p = 0.047) (Table 2), family history of IBS (OR [IC 95%] = 4.09 [1.47 - 4.34]; p = 0.026) (Table 3). Considering lifestyle, there was no relationship between IBS and physical activity, sleep time and alcohol consumption. Only smoking was associated with IBS (OR [IC 95%] = 7.08 [2.82 - 16.83]; p < 0.001) (Table 4). Regarding dietary habits, high-salt diet (OR [IC 95%] = 5.26 [1.83 - 6.23]; p = 0.001) and high-fat

Table 2. Study in univariate analysis of the socio-demographic characteristics associated with IBS.

	IBS		Univariate analysis		
	Yes	No	OR	IC (95%)	p-value
Department of origin					0.043*
Littoral	22 (4.3%)	487(95.7%)	1	-	
Collines	2 (14.3%)	12 (85.7%)	3.68	0.78 - 2.18	
Atacora	1 (25.0%)	3 (75.0%)	7.38	0.74 - 2.09	
Zou	1 (3.1%)	31 (96.9%)	0.57	0.07 - 1.08	
Atlantique	1(2.6%)	38 (97.4%)	0.58	0.08 - 1.08	
Mono	1 (6.7%)	14 (93.3%)	1.58	0.19 - 1.22	
Alibori	1 (50.0%)	1 (50.0%)	**23.71**	**1.45 - 387.95**	
Foreign	1 (2.4%)	40 (97.6%)	0.55	0.07 - 1.07	
Plateau	0 (0.0%)	17 (100%)	-	-	
Borgou	0 (0.0%)	9 (100.0%)	-	-	
Couffo	0 (0.0%)	17 (100%)	-	-	
Donga	0 (0.0%)	2 (100%)	-	-	
Ethnic group					0.015*
Fon and related	16 (5.2%)	293 (94.8%)	1		
Yorouba and related	2 (2.2%)	89 (97.8%)	0.41	0.09 - 1.09	
Goun and related	4 (2.2%)	175 (97.8%)	0.42	0.13 - 1.14	
Mina	3 (7.0%)	40 (93.0%)	1.37	0.38 - 1.47	
Adja	2 (3.5%)	55 (96.5%)	1.09	0.14 - 1.16	
Dendi and related	2 (28.6%)	5 (71.4%)	**9.74**	**1.74 - 52.29**	
Otamari and related	2 (22.2%)	7 (77.8%)	**6.94**	**1.38 - 34.85**	
Haoussa	1 (12.5%)	7 (87.5%)	2.61	0.30 - 1.35	
Bariba and related	0 (0.0%)	3 (100%)	-	-	
Xwla	0 (0.0%)	36 (100%)	-	-	
Foreigners	0 (0.0%)	26 (100%)	-	-	

(*) Reflects a statistically significant link.

Table 3. Univariate analysis study of the family history associated with IBS.

	IBS		Univariate analysis		
	Yes	No	OR	IC (95%)	p-value
Family history of IBS					0.026*
Yes	5 (13.9%)	31 (86.1%)	**4.09**	**1.47 - 4.34**	
No	25 (3.8%)	635 (96.2%)	1	-	
Do not know	2 (2.8%)	70 (97.2%)	0.725	0.17 - 1.18	
Family history of colon cancer					0.262
Yes	1 (25.0%)	3 (75.0%)	8.06	0.81 - 2.25	
No	27 (4.0%)	653 (96.0%)	1		
Do not know	4 (4.8%)	80 (95.2%)	1.21	0.41 - 1.51	

(*) Reflects a statistically significant link.

diet (OR [IC 95%] = 2.37 [1.05 - 2.86]; p = 0.044) were associated with IBS (Table 4). As for psychological disturbances, stress and anxiety were associated with IBS with respectively p < 0.001 each (Table 5).

In the multivariate analysis, male gender (p = 0.047), regular physical activity (p < 0.001), and sleep time greater than 6 hours (p < 0.001) were protective factors. In addition, the older the age, the less exposed the subjects were. Dendi and Otamari ethnicity and smoking were the most significant predictive factors, with risks estimated at 11.081 and 12.732 respectively (Table 6 and Table 7).

3.6. Impact on Daily Life

IBS symptoms were most often associated with daily life disturbances such as gurgling (31.3%), impact on professional life (28.1%) and absenteeism (25%).

4. Discussion

Through a questionnaire, including the ROME IV diagnostic criteria, the Bristol scale, and two psychic evaluation scales, we were able to describe the epidemiological profile of IBS in Cotonou population. We also determined its associated factors and its impact on the daily life of affected subjects. In our study, IBS prevalence was estimated at 4.2%. This result was close to the ones found by Makharia *et al.* [13] in 2011 (4%), by Zhao *et al.* [14] in 2010 (4.6%) and by Dapoigny *et al.* [15] in 2004 in France (4.7%). However, many other authors found a higher prevalence: Van den Houte *et al.* [6] 5.5% in 2018, Boucekkine *et al.* [16] 5.8% in 2011, Meharich *et al.* [17] 33.6% in 2014. This difference could be explained by the difference in the studies' methods as well as the types of population considered. This variation could also be due to the effect of socioeconomic, nutritional and psychological factors on the onset and development of IBS.

The exposed subjects were of young age. Similar results were reported by Chatila *et al.* [9] in Lebanon, Okeke *et al.* [18] in Nigeria and Guo *et al.* [10] in

Table 4. Study in univariate analysis of the link between lifestyle and IBS.

	IBS		Univariate analysis		
	Yes	**No**	**OR**	**IC (95%)**	**p-value**
Physical activity					0.0523
None	12 (4.9%)	234 (95.1%)	1	-	
Occasionally	11 (4.8%)	218 (95.2%)	0.98	0.42 - 1.53	
One time	5 (5.2%)	92 (94.8%)	1.05	0.36 - 1.46	
Over three times	3 (3.6%)	80 (96.4%)	0.73	0.20 - 1.22	
Three times	1 (2.0%)	48 (98.0%)	0.41	0.05 - 1.05	
Two times	0 (0.0%)	64 (100.0%)	-	-	
Sleeping time					0.850
More than 6 h	20 (4.0%)	478 (96.0%)	0.89	0.43 - 1.54	
Less than 6 h	12 (4.4%)	258 (95.6%)	1	-	
Alcohol					0.572
Yes	19 (3.8%)	478 (96.2%)	0.78	0.38 - 1.46	
No	13 (4.8%)	258 (95.2%)	1	-	
Tabac					<0.001*
Yes	7 (20.0%)	28 (80.0%)	**7.08**	**2.82 - 16.83**	
No	25 (3.4%)	708 (96.6%)	1	-	
Salty foods					0.001*
Regularly	28 (6.3%)	420 (93.8%)	**5.26**	**1.83 - 6.23**	
Irregularly	4 (1.3%)	316 (98.8%)	1	-	
Sweet foods					0.100
Regularly	23 (5.3%)	411 (94.7%)	2.02	0.92 - 2.51	
Irregularly	9 (2.7%)	325 (97.3%)	1	-	
Fatty foods					0.044*
Regularly	24 (5.5%)	411 (94.5%)	**2.37**	**1.05 - 2.86**	
Irregularly	8 (2.4%)	325 (97.6%)	1	-	
Cereals					1.000
Regularly	31 (4.2%)	707 (95.8%)	1.27	0.16 - 1.18	
Irregularly	1 (3.3%)	29 (96.7%)	1	-	
Fruits					0.672
Regularly	23 (3.9%)	561 (96.1%)	0.80	0.36 - 1.44	
Irregularly	9 (4.9%)	175 (95.1%)	1	-	
Dairy products					0.589
Regularly	15 (3.7%)	388 (96.3%)	0.79	0.39 - 1.47	

Continued

Irregularly	17 (4.7%)	348 (95.3%)	1		
Tea or coffee					0.588
Regularly	13 (3.6%)	346 (96.4%)	0.77	0.38 - 1.46	
Irregularly	19 (4.6%)	390 (95.4%)	1	-	
Soft drinks					0.467
Regularly	11 (3.5%)	306 (96.5%)	0.73	0.35 - 1.41	
Irregularly	21 (4.7%)	430 (95.3%)	1	-	
Vegetables					0.150
Regularly	11 (3.0%)	353 (97.0%)	0.57	0.27 - 1.31	
Irregularly	21 (5.2%)	383 (94.8%)	1	-	

(*) Reflects a statistically significant link.

Table 5. Study in univariate analysis of the link between psychological disturbances and IBS.

	IBS		Univariate analysis		
	Yes	**No**	**OR**	**IC (95%)**	**p-value**
Stress level					<0.001*
Very low	1 (0.7%)	138 (99.3%)	1	-	
Low	10 (2.2%)	442 (97.8%)	3.12	0.40 - 1.49	
Raised	20 (11.5%)	154 (88.5%)	**6.29**	**3.01 - 13.16**	
Very high	1 (33.3%)	2 (66.7%)	**11.83**	**1.04 - 134.10**	
Anxiety level					<0.001*
Normal	4 (1.3%)	299 (98.7%)	1	-	
Moderate	13 (4.0%)	309 (96.0 %)	0.945	0.46 - 1.94	
Average	14 (10.6%)	118 (89.4%)	**4.07**	**1.97 - 8.41**	
Strict	1 (9.1%)	10 (90.9%)	**2.34**	**1.29 - 18.87**	
Depression level					0.375
Normal	27 (4%)	651 (96%)	1	-	
Moderate	4 (5.3%)	72 (94.7%)	1.33	0.46 - 1.58	
Average	1 (7.7%)	12 (92.3%)	2.01	0.25 - 1.29	
Strict	0 (0%)	1 (100%)	-	-	

(*) Reflects a statistically significant link.

China. A female predominance was observed in our study as previously reported by several authors including Chatila *et al.* [9] in Lebanon, Van den Houte *et al.* [6] in Belgium and Assogba [19] in Benin. Few studies noted a male predominance of IBS; 53.66% of male predominance with Shah *et al.* [20] in India in 2001

Table 6. Study in multivariate analysis of the socio-demographic factors associated with IBS.

	Coef	Multivariate analysis			
		T-Wald	p-value	OR ajusté	IC (95%)
Dendi and relatives	2.405	6.409	0.011*	**11.081**	**1.721 - 71.331**
Otamari and relatives	2.544	8.410	0.004*	**12.732**	**2.281 - 71.058**
Unschooled	0.809	2.947	0.086	0.086	0.892 - 5.655
Age	−0.090	29.578	<0.001*	0.914	0.885 - 0.944
Male gender	−0.617	3.928	0.047*	0.540	0.293 - 0.993

(*) Reflects a statistically significant link.

Table 7. Study in multivariate analysis of the link between lifestyle and IBS.

	Coef	Multivariate analysis			
		T-Wald	p-value	OR ajusté	IC (95%)
Frequency of physical activity High	−2.362	95.969	<0.001*	0.094	0.059 - 0.151
Sleep time ≥ 6 h	−2.180	82.762	<0.001*	0.113	0.071 - 0.181
Tobacco use	0.739	1.816	0.008*	**2.093**	**1.715 - 6.131**

(*) Reflects a statistically significant link.

and 52.9% with Okeke *et al.* [18] in 2009 in Nigeria. The Dendi and Otamari ethnic groups and the origin of Alibori were associated with irritable bowel syndrome with p = 0.015 and p = 0.043 respectively. This could be explained by the fact that the Dendi and Otamari are usually found in the north of Benin and therefore have a similar lifestyle. Their relocation to the south of Cotonou with the lifestyle changes and the stress resulting from those could have favored the occurrence of IBS. Similarly, dietary habits specific to these ethnic groups and regions could be involved and deserve to be documented. Furthermore, the lower the level of education, the higher the risk of developing IBS. In Benin, the education level of the head of the household strongly influences the living conditions of the household. Low living conditions could therefore be a source of stress and permanent anxiety that could promote the occurrence of this disease.

In our study, a family history of IBS was associated with its occurrence. Here again, lifestyle, familial environment and stress during childhood could play a role. A similar result was reported by Ibrahim *et al.* [21] in Saudi Arabia. Furthermore, Zucchelli *et al.* [22] had shown in two independent cohorts from Sweden and the USA that the rs4263839 G allele of the TNFSF15 gene associated with the risk of Crohn's disease was also significantly associated with an increased risk of IBS (p = 0.00022; OR = 1.37) and more pronounced in IBS-C (p = 0.0000087; OR = 1.79). Immunologic and generic factors were not addressed in this study.

Clinically, abdominal pain was the predominant GI symptom followed by bowel movement disorders, abdominal discomfort and abdominal bloating. Similar findings have been reported elsewhere by Van den Houte *et al.* [6] in Belgium, Koussoube [23] in Mali and Assogba [19] in Benin. Migraine and asthenia found as predominant extra-digestive signs in our study are quite characteristic as they have also been reported by several studies as dominant extra-digestive signs [16] [19] [24]. The GI dysfunctions found in our study are also reported by several authors including Boucekkine *et al.* [16], Assogba [19], Sehonou *et al.* [24]. These disorders allowed us to declare IBS with predominant diarrhea as the most frequent subtype with a proportion of 34.4%. Van den Houte *et al.* [6] found a similar result in Belgium. However, the mixed subtype was predominant in the study of Ibrahim *et al.* [21] in Saudi Arabia and the predominantly constipated subtype in the study of Boucekkine *et al.* [16] in Algeria. It is therefore difficult to state the predominance of one subtype over another one. Nineteen subjects (59.4%) meeting the Rome IV criteria reported factors that aggravated the symptoms. Diet was reported as an aggravating factor in 46.9% of cases (n = 15). Stress and lack of sleep were reported in 31.3% and 15.6% of cases, respectively. The incriminated foods were: glutinous sauces (40%), meat (26.7%), vegetable sauce (26.7%), oilseeds (13.3%), cassava flour (13.3%), alcohol (6.67%). Sehonou *et al.* [24] in Benin and Koussoube [23] in Mali reported similar results in their studies.

Regarding the patients' lifestyle, regular physical activity, and sleep time greater than 6 hours were protective factors while smoking was a risk factor for the disease. Similar results were reported by Guo *et al.* [10] in China and by Chatila *et al.* [9] in Lebanon. Tobacco use, although primarily a fashion and environmental effect, could also be the result of psychological disturbances or be maintained by them. These disturbances could cause IBS. However, this finding in our study may be due to the link between IBS and ethnicity. Indeed, IBS was related to certain northern ethnic groups in Benin in which tobacco could be frequently consumed because of the tropical climate of their region, which is colder than the equatorial climate of the South. Further studies could therefore investigate possible links between these ethnic groups and tobacco consumption.

Also, in our study there was a statistically significant association between IBS and high-salt and high-fat diet. Similar results have been reported by several authors including Song *et al.* [25] in Korea, Sehonou *et al.* [24] in Benin and Adeniyi *et al.* [26] in Nigeria. Food hypersensitivity was identified as a risk factor for IBS by several authors [17] [21] [26]. Our results are in line with this, as food was identified as the primary factor aggravating IBS symptoms in our study. This only confirms the role of diet in the occurrence of IBS. Moreover, the fact that a diet low in FODMAPs, fats and gluten can significantly reduce symptoms, proves that their involvement in the occurrence of IBS symptoms is not negligible.

Finally, psychological disturbances were also present in our study. Thus, subjects with a high to very high level of stress were the most exposed, as well as those with a moderate to severe level of anxiety. However, there was no link be-

tween IBS and depression. Similar results were reported by Baniasadi *et al.* [27] in Iran and Assogba [19] in Benin. We did not find any studies that reported no association between IBS and psychological disturbances. Our study therefore confirms the significant role of psychological disturbances in the occurrence of IBS. It is important to highlight that the symptomatology of depression in black Africans is different from that of Westerners: somatic symptoms dominate the picture, and the inhibition syndrome is not very marked. The Hospital Anxiety and Depression Scale (HADs) is a scale created based on Western realities and is not adapted to the Black African context. This raises concerns about the appropriate depression diagnostic tools for black Africans. A practical and reliable diagnostic scale should therefore be developed to truly evaluate the role of depression in IBS in Benin.

5. Conclusion

IBS is a common disease in Cotonou and the predominant diarrheic form was the most frequent. IBS is a disease of young women who grew up in the north of Benin and/or have psychological disorders. The modifiable risk factors identified were smoking, high-fat or high-salt diet, stress, and anxiety. Protective factors such as a high level of sleep and regular physical activity were found. Taking these protective factors into account and avoiding risk factors could lead to a considerable reduction in IBS symptoms.

Authors' Contributions

All authors participated in the active writing and editing of the article. All authors read and approved the final version of the manuscript.

Conflicts of Interest

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

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