

State of Knowledge on the Metabolic Syndrome and NASH in the Ivorian Population: Case of People Attending the Diabetology Endocrinology Service of the University Hospital Center (CHU) of Yopougon (Abidjan, Côte d'Ivoire)

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Abstract

Non-alcoholic hepatic steatosis (NASH), characterized by an excessive accumulation of lipids in the liver, is strongly associated with Metabolic Syndrome, which groups together a constellation of cardiovascular risk factors that make it an emerging public health problem on a global scale. The objective of this study was to review the state of knowledge on Metabolic Syndrome and NASH in the Ivorian population. It was a retrospective study conducted over a period of 2 months at the Diabetes Endocrinology Department of the University Hospital Centre (CHU) of Yopougon. It included all patients of any age and sex who were hospitalized or received consultation. The criteria of the Metabolic Syndrome defined by the International Diabetes Federation (IDF) were used to define and calculate the prevalence of the Metabolic Syndrome. Our study found a prevalence of 18.66% of Metabolic Syndrome according to the IDF criteria and a prevalence of 3.33% of NASH in a population of 150 patients hospitalized or received in consultation. There was a predominance of women and older subjects, so the current level of knowledge about Metabolic Syndrome and NASH was low in our study population with only 12%. Indeed, patients over 50 years of age were at higher risk of developing Metabolic Syndrome and NASH. Apart from hyperglycemia, abdominal obesity and arterial hypertension were the most common criteria.

Finally, age and body mass index (BMI) were significantly associated with the presence of metabolic syndrome and non-alcoholic fatty liver disease (NASH). However, the awareness of the population, the respect of food hygiene and the implementation of recommended strategies are essential elements in the eradication of these different pathologies.

Keywords

Metabolic Syndrome, NASH, Body Mass Index (BMI)

1. Introduction

In recent decades, diet-related chronic diseases have become more common across the world, regardless of age. One of the consequences is excessive weight gain, which increases the risk of several diseases, mainly metabolic diseases [1]. Several studies have shown that overweight and obese people can develop Metabolic Syndrome and Non-Alcoholic Hepatic Steatosis.

The prevalence of Metabolic Syndrome and Non-Alcoholic Hepatic Steatosis (NASH) is steadily increasing in industrialized countries. NASH, characterized by an excessive accumulation of lipids in the liver, is strongly associated with Metabolic Syndrome, defined by the combination of disorders such as abdominal obesity, insulin resistance with or without hyperglycemia, dyslipidemia and hypertension [2]. As for the Metabolic Syndrome, its worldwide prevalence depends on its definition, the year of the study, the age, the sex and the ethnicity of the population studied, thus complicating analyses between countries. The DESIR (Epidemiological Data on Insulin Resistance Syndrome) study conducted in France indicates a prevalence of Metabolic Syndrome of 16% in men and 11% in women [3]. While the MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) study shows a prevalence of 22.5% in men and 18.5% in women [4]. In the United States, Metabolic Syndrome affects 24% of the adult population [5]. Some studies suggest that Metabolic Syndrome is associated with a five-fold increased risk of type 2 diabetes and a two- to three-fold increased risk of cardiovascular disease, and is associated with a significant number of other complications. It is therefore considered a public health problem. Despite the growing scientific interest in Metabolic Syndrome and NASH, particularly because of the major public health problem that it raises in relation to the aging population and changing lifestyles, few studies have been devoted to this subject in Africa and particularly in Côte d'Ivoire. It is with this in mind that the present study was carried out in order to investigate the current level of knowledge on Metabolic Syndrome and NASH in the Ivorian population.

The general objective of this work is therefore to review the state of knowledge on the Metabolic Syndrome and NASH in the Ivorian population. In order to achieve this general objective, the aim is:

- to determine the prevalence of Metabolic Syndrome and NASH in the Ivorian population;
- to assess the level of knowledge of the Ivorian population on Metabolic Syndrome and NASH.

2. Materials and Methods

2.1. Presentation of the Study

The present study was carried out at the Diabetes Endocrinology Service (SED) of the University Hospital Centre (CHU) of Yopougon in the District of Abidjan, Côte d'Ivoire. This was a retrospective and cross-sectional study from August 2018 to October 2018.

This study focused on the one hand on the analysis of 150 records of patients of all ages and sexes who were hospitalized or received in consultation, and on the other hand on 100 patients who came to the consultation and answered the questions on knowledge of the Metabolic Syndrome and NASH.

2.2. Technical Equipment

The material used for the elaboration of this work consists of the survey forms, as well as the patients' files. The anthropometric and medical parameters used in the patient files were measured using an electronic scale, a vertical measuring rod, a tape measure, an electronic blood pressure meter OMRON (Japan/M3 confort HEM-7155-E) and a glucose meter Accu-c perform (French/Dimension: L94 × 152 × H21 mm).

2.3. Methods

2.3.1. Data Collection

Two survey forms were drawn up. The first provides information on the sociodemographic characteristics of the patients (age, sex, residence, ethnicity, profession, level of education, marital status), family history of diabetes, obesity and arterial hypertension, current or weaned smoking habits, reason(s) for consultation, clinical and paraclinical signs. The second provides information on the level of knowledge of the population on the Metabolic Syndrome and NASH.

2.3.2. Determination of the Prevalence of Metabolic Syndrome and NASH

1) Determination of the prevalence of the Metabolic Syndrome

a) Selection Criteria

The selection criteria were those of the International Diabetes Federation (IDF) 2005. All patients regardless of sex or age with at least three of the five IDF (2005) criteria:

- abdominal obesity with a waist circumference ≥ 94 cm (male) and ≥ 80 cm (female);
- a systolic blood pressure ≥ 130 mmHg and a diastolic blood pressure ≥ 80 mmHg;

- a fasting blood glucose level ≥ 1.00 g/l or proven type 2 diabetes;
- a triglyceride level ≥ 1.5 g/l or specific treatment for lipid abnormality;
- low high-density lipoprotein cholesterol (HDL-C) with a level 0.4 g/l (male) and 0.5 g/l (female) or specific treatment of the lipid abnormality.

b) Non-selection criteria

Not included in the study were all patients who did not present with at least three of the five International Diabetes Federation (IDF) criteria and those who had not undergone complementary examinations.

2) Determination of NASH prevalence Selection Criteria

Patients were included in the study who presented on abdominal ultrasound an appearance suggestive of focal or diffuse steatosis of the liver, without any notion of ethylism (alcohol), with a prothrombin rate (PT) $\geq 50\%$, a platelet count $\geq 50,000$ mm³ and in whom a confirmation by anatomical pathology of the liver biopsy could be performed.

a) Non-Selection Criteria

All patients who did not have an ultrasound scan suggestive of focal or diffuse steatosis of the liver and those with a history of alcohol consumption will not be included in the study.

b) Sample size

For the size of the sample, not having data on the Metabolic Syndrome and NASH within the Ivorian population, randomly, it was decided to count all the patients attending the center during the period of the study and view existing folders.

2.3.3. Statistical Analysis

Data expressed as means were analyzed by analysis of variance (ANOVA) using SPSS software version 20.0. Statistical analysis of the differences between the means was performed using the Chi-square test. Differences were considered significant if $p < 0.05$.

The graphical representation was done with Excel software (version 2007). The results are reported in the form of tables and graphs with comments.

Ethical considerations:

The prevalence of Metabolic Syndrome and Non-Alcoholic Hepatic Steatosis (NASH) is still increasing in developed and even developing countries. Metabolic Syndrome and NASH are of growing scientific interest and are considered a major public health problem.

The general objective of this study was to review the state of knowledge on Metabolic Syndrome and NASH in the Ivorian population: case of the University Hospital Centre (CHU) of Yopougon.

The study protocol was submitted to and approved by the Committee of Research Teachers of the Nutrition and Pharmacology Pedagogical and Research Unit (UPR) of the Biosciences UFR of the University of Félix Houphouët-Boigny in Abidjan. Then a letter of request for an internship and investigation was formulated by the UPR of Nutrition and Pharmacology and sent to the Head of the

Endocrinology and Diabetes Department of the University Hospital Centre (CHU) of Yopougon.

It was only after approval from the Head of the Endocrinology and Diabetes Department of the University Hospital Centre (CHU) of Yopougon that the course and surveys could begin. Before the interview with the respondents, the purpose of the study was explained to them in order to obtain their consent. Informed consent was obtained verbally from the patients. For the volunteers, the anonymity of the questionnaires during the collection of information as well as the confidentiality of the data was ensured.

3. Results

3.1. Sociodemographic Characteristics of the Study Population

The present study found a clear female predominance with 102 women (68%) and 48 men (32%) and a sex ratio of 0.47. Patients aged between 51 and 60 years were the most represented with 35, 33%. The average age of the patients was 45.6 ± 10.9 and the extremes were 20 and 76 years.

A total of 69.33% of the patients had secondary or higher education. However, 16.67% had not attended school. In terms of marital status, the majority of patients (68.67%) were married, while widows were the least represented (7.33%).

The majority of the population (49.33%) was housewives while shopkeepers were the least represented with 24%. Most of the patients (77.33%) resided in urban areas while 22.67% resided in rural areas (**Table 1**).

Table 1. Socio-demographic characteristics of the study population.

Characteristics		Total, n (%)
Gender	Male	108 (68)
	woman	48 (32)
Age	<40 years	18 (12)
	41 - 50 years	41 (27.33)
	51 - 60 years	53 (35.34)
	61 and over	38 (25.33)
Level of education	Not in school	25 (16.67)
	Primary	21 (14)
	Secondary	50 (33.33)
	Superior	54 (36)
Marital status	Married	103 (68.67)
	single	36 (24)
	widow	11 (7.33)
Socio-professional activity	Housekeeper	74 (49.33)
	Civil servant	40 (26.67)
	Trader	36 (24)
Residential areas	Urban	115 (77.33)
	Rural	34 (22.67)

3.2. Prevalence of the Different Components of the Metabolic Syndrome in the Population Studied

The mean waist circumference was 82 cm with a standard deviation of 11.13 and extremes of 74 and 108 cm, and was pathological in 31% or 20.67% of the patients according to the IDF criteria.

The mean blood pressure was 130.7/82.5 mmHg with extremes of 99.2 mmHg and 194 mmHg for systolic and 60 and 122 mmHg for diastolic. In addition, 23% of patients were hypertensive according to IDF criteria.

The mean blood glucose level was 0.89 ± 0.11 g/l with extremes of 0.52 and 1.70 g/l. In addition, 114 patients or 76% had normal blood glucose levels according to the IDF criteria. According to the IDF criterion, 25% of the patients had abnormal (low) HDL cholesterol levels compared to 75% who had normal HDL cholesterol levels. Finally, 18% (or 27) of patients had hypertriglyceridaemia according to the IDF criterion (**Table 2**).

3.3. Prevalence of Metabolic Syndrome

The present study retained 28 cases of Metabolic Syndrome according to the IDF criteria out of a total of 150 patients hospitalized or received in consultation, *i.e.* a prevalence of 18.66%. A female predominance was observed with 20 women (71.42%) and a sex-ratio of 0.4 (**Table 3**).

3.3.1. Characteristic Parameters of the Metabolic Syndrome

Hyperglycemia was the most common criterion found in patients with Metabolic Syndrome (89.28%), followed by abdominal obesity and high blood pressure with 85.71% and 82.17% respectively (**Figure 1**).

3.3.2. Family History of Patients with Metabolic Syndrome

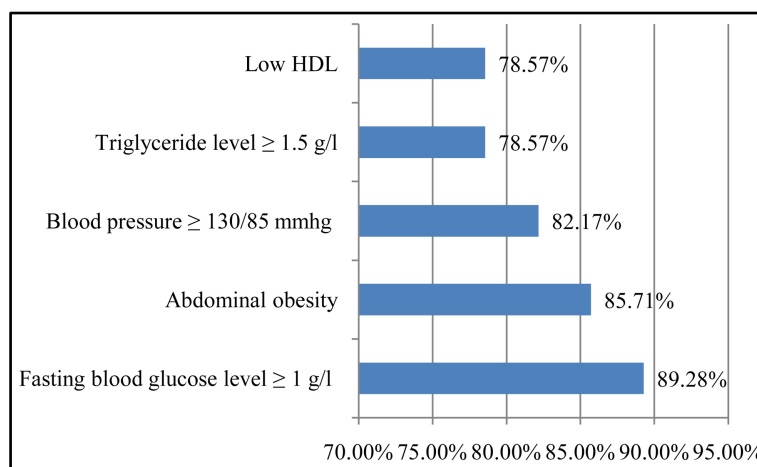
Diabetes was the most common family history in patients with Metabolic Syndrome with 82.14%, while obesity was the least common family history with

Table 2. Different components of the Metabolic Syndrome in the study population.

Characteristics		Total, n (%)
Waist size	Normal	119 (79.33)
	Abnormal	31 (20.67)
Blood pressure	Normal	35 (23)
	Abnormal	115 (77)
Blood glucose	Normal	114 (76)
	Abnormal	36 (24)
HDL-Cholesterol	Normal	112 (75)
	Abnormal	38 (25)
Triglyceride	Normal	123 (75)
	Abnormal	27 (18)

Table 3. Prevalence of Metabolic Syndrome EDS, Yopougon University Hospital.

Status	Prevalence (%)	Total, n	Woman, n (%)	Male, n (%)	Sex-ratio (M/W)
Metabolic Syndrome	18.66	28	20 (71.42)	8 (28.57)	0.4

**Figure 1.** Distribution of patients with Metabolic Syndrome according to criteria presented, EDS, University Hospital of Yopougon.

57.14% (**Table 4**).

3.3.3. Correlation between MS and Socio-Demographic Characteristics

The present study reveals that the Metabolic Syndrome predominates in subjects over 50 years old. This difference observed between these ages and the presence of the Metabolic Syndrome is significant ($p < 0.001$). The distribution of the Metabolic Syndrome according to sex showed that the Metabolic Syndrome is present in both sexes without any significant difference ($p = 0.208$). A predominance of Metabolic Syndrome was statistically significant in couples ($p < 0.05$). The majority of patients with Metabolic Syndrome resided in urban than in rural areas without any significant difference ($p = 0.467$). In terms of socio-professional activity, housewives had a higher risk of developing Metabolic Syndrome with a significant difference ($p < 0.001$). The division of the patients into two groups (educated and uneducated) reveals that the Metabolic Syndrome predominates in the educated, however the difference was not significant ($p = 0.122$) (**Table 5**).

3.3.4. Influence of BMI on the Occurrence of Metabolic Syndrome

The present study notes an increase in the prevalence of Metabolic Syndrome with BMI. The difference observed between the occurrence of the Metabolic Syndrome and the level of BMI is significant ($p < 0.001$). Indeed, all patients with Metabolic Syndrome have a BMI above normal, of which:

- 75% overweight with a BMI between 25 and 29.9 kg/m²;
- 25% obese with a BMI between 30 and 34.9 kg/m² (**Table 6**).

Table 4. Distribution of patients with Metabolic Syndrome by family history, EDS, University Hospital of Yopougon.

Family History	Total	Percentage
family obesity	16	57.14%
Family diabetes	23	82.14%
Familial hypertension	18	64.28%

Table 5. Correlation between Metabolic Syndrome and socio-demographic characteristics, SED, University Hospital of Yopougon.

Characteristics	Metabolic Syndrome		P	
	Present (%)	Absent (%)		
Age	<40 years	1 (5.6)	17 (94.4)	<0.001
	41 to 50 years	6 (14.6)	35 (85.4)	
	51 to 60 years	12 (22.7)	41 (77.3)	
	60 and over	9 (22.5)	31 (77.5)	
Gender	Male	8 (16.7)	40 (83.3)	0.208
	Female	20 (19.6)	82 (80.4)	
Status matrimonial	As a couple	16 (15.5)	87 (84.5)	0.046
	Not in couple	12 (25.5)	35 (74.4)	
Zone of residence	Urban	21 (18)	95 (82)	0.467
	Rural	7 (20.6)	27 (79.4)	
Socio-professional activity	Civil servant	10 (25)	30 (75)	<0.001
	Trader	5 (13.8)	31 (86.2)	
	Housekeeper	13 (17.6)	61 (82.4)	
Level of education	At school	17 (13.6)	108 (86.4)	0.122
	Not in school	11 (44)	14 (56)	

Table 6. Distribution of Metabolic Syndrome according to BMI, EDS, University Hospital of Yopougon.

Parameter	Metabolic Syndrome		P	
	Present, n (%)	Absent, n (%)		
Body Mass Index (BMI)	Normal	0 (0)	68 (100)	<0.001
	Overweight	21 (31.8)	45 (68.2)	
	Obesity	7 (43.8)	9 (56.2)	

3.4. Prevalence of NASH Components III.4.1-Prothrombin Levels

The majority of patients or 76% had a normal prothrombin level (<50%) while 36 patients or 24% had an abnormal prothrombin level ($\geq 50\%$) (Table 7).

Plate Rate

Patients with a normal platelet count ($<50000 \text{ mm}^3$) were the most represented with 80%, while 30 patients or 20% had an abnormal platelet count ($\geq 50000 \text{ mm}^3$) (Table 8).

3.5. Prevalence of NASH

The present study selected 5 cases of NASH out of a total 150 patients, *i.e.* a prevalence of 3.33% with a female predominance (Table 9).

3.6. Influence of BMC on the Development of NASH

There was an increase in the prevalence of NASH as BMI increased, however the difference was not significant ($p = 0.421$). Thus, 80% of NASH patients were obese with a BMI and 20% were overweight with a BMI (Table 10).

Table 7. Distribution of patients according to prothrombin level, EDS, University Hospital of Yopougon.

Parameter	Normal ($<50\%$), n (%)	Abnormal ($\geq 50\%$), n (%)	Total, n (%)
Prothrombin level	114 (76)	36 (24)	150 (100)

Table 8. Distribution of patients according to platelet count, EDS, Yopougon University Hospital.

Parameter	Normal ($<5000 \text{ mm}^3$) n (%)	Abnormal ($\geq 5000 \text{ mm}^3$) n (%)	Total, n (%)
Platelet rate	102(80)	30(20)	150(100)

Table 9. Distribution of patients according to prothrombin level, EDS, University Hospital of Yopougon.

Status	Prevalence	Total, n (%)	Woman, n (%)	Male, n (%)	Sex ratio (M/W)
Non-alcoholic hepatic steatosis		5 (3.33)	4 (80)	1 (20)	0.25

Table 10. Distribution of patients according to prothrombin level, EDS, University Hospital of Yopougon.

Parameter	NASH		P
	Present, n (%)	Absent, n (%)	
Normal	0 (0)	68 (100)	0.421
BMI Overweight	1 (1.5)	65 (98.5)	
Obesity	4 (25)	12 (75)	

BMI: Body Mass Index.

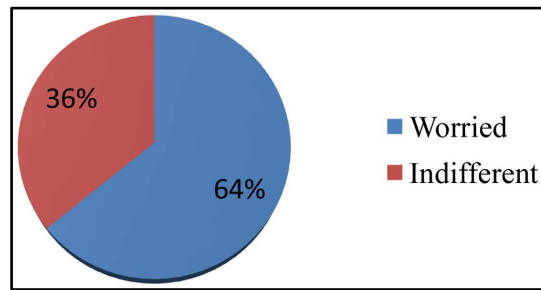


Figure 2. Distribution of patients by level of knowledge about the Metabolic Syndrome and NASH, SED, CHU of Yopougou.

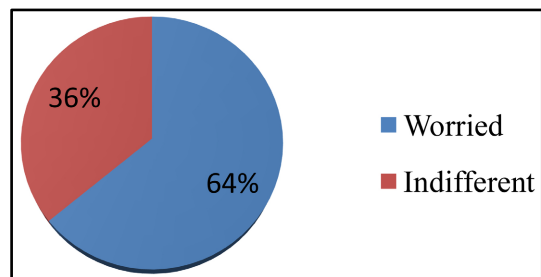


Figure 3. Distribution of patients according to psychological state, SED, Yopougou University Hospital.

3.7. Patients' Level of Knowledge about Metabolic Syndrome and NASH

A survey of 100 patients attending the clinic showed a low level of knowledge of patients about Metabolic Syndrome and NASH, only 12% had knowledge of the condition (**Figure 2**). In addition, 64% of patients were concerned about being overweight and/or obese, while 36% of patients were indifferent about their condition (**Figure 3**).

4. Discussion

A retrospective study was carried out in the Endocrinology and Diabetes Department of the Yopougou University Hospital. From this study, 28 cases of Metabolic Syndrome were found, *i.e.* a prevalence of 18.66% according to the IDF criteria and 5 cases of NASH out of a total of 150 hospitalized or consulted patients' files. In addition to this, an assessment of the current level of knowledge of patients about Metabolic Syndrome and NASH was carried out.

These results are close to those found by [6] who had 20% of patients aged 30 - 64 years out of a total of 110 patients with Metabolic Syndrome. This similarity could be explained by the use by this author of the NCEP-ATP III definition of Metabolic Syndrome.

In the present study, 32.14% of the patients were between 50 and 60 years of age, which is close to the 33.9% found by [7] in their patients in Iran in a study of the prevalence of Metabolic Syndrome in an urban population. The frequency of occurrence of Metabolic Syndrome is high in later life. This frequency is

probably related to the fact that these older people are sedentary and are exposed to complications related to diabetes and obesity. This hypothesis is supported by the DESIR study which shows an increase in the prevalence of Metabolic Syndrome with age.

In addition, Alexander [8] in their study found 44% of cases of Metabolic Syndrome in patients aged between 50 and 60. In the present study, women were the most affected by Metabolic Syndrome with 71.42%. This rate is higher than that of [9] and [6] who had 10% and 17.9% respectively using the NCEP-ATP III definition. These differences in results could be explained by the choice in the present study of the IDF definition, which proposes lower waist circumference standards (≥ 94 cm for men and ≥ 80 cm for women); thus leading to an increase in the frequency of the Metabolic Syndrome compared to the other definitions.

A history of familial obesity was found in 57.14% of patients. A rate of 82.14% of patients had a history of familial diabetes. This result is close to that of [10], who found a history of familial diabetes in 82.7% of patients.

This concordance could be explained by the fact that diabetic patients accumulate over the years the different anomalies that make up the Metabolic Syndrome.

The notion of familial hypertension was present in 64.28% of cases. This result is higher than the 10% found by [6] in his study. There was no history of cardiovascular accident among the patients. Smoking was present in 2 of the 28 patients.

The majority of the patients, 85.71% with Metabolic Syndrome, had a waist circumference of 94 cm or more in men and 80 cm or more in women. This result is close to that of the DESIR study in which 80% of patients had a waist circumference greater than 102 cm in men and greater than 88 cm in women according to NCEP-ATP III criteria. A plausible explanation for this would be the small sample size in the present study compared to the 4293 patients in this study. The measurement of waist circumference is defined as the most sensitive diagnostic criterion and is a very good screening test for Metabolic Syndrome.

A rate of 82.17% of the patients had a blood pressure greater than or equal to 130/85 mmHg of which 75% were men and 80% were women. This result is different from the 66% and 43% found in men and women respectively from data provided by [11], who also used the IDF criteria. This difference could again be explained by the small sample size of this study.

In addition, 89.28% of the patients had a fasting blood glucose level of 1 g/l or higher. Triglyceride levels of 1.5 g/l or higher were found in 78.57% of patients. Low HDL-cholesterol levels were found in 78.57% of patients, with 80% of women and 75% of men. These results are close to those found by [12] in Saudi Arabia, which were 81.8% and 74.8% for women and men respectively. This concordance could be explained by genetic predisposition, physical inactivity and dietary habits.

Furthermore, 64% of the patients were worried about being overweight or ob-

ese. This result is in line with that found by [13] in Cotonou in a study on the prevalence and determinants of obesity, which is 62.7%, which shows that patients are aware of the health complications caused by obesity, and of the diseases caused by obesity (diabetes, arterial hypertension, gallstones, hyperuricemia etc.). However, 36% of the patients were indifferent to their condition.

In the present study, NASH disease was observed in five patients out of a total of 150, representing a frequency of 3.33%.

This result is different from that found by [14] in Italy, who found a prevalence of 19.8% in 363 routine liver scans. The low rate in the present study could be explained by the financial difficulty of most patients to perform abdominal ultrasound and even some complementary tests for NASH.

Women were the most affected by Non-Alcoholic Hepatic Steatosis with 80 %, compared to men with 20%. This result is similar to that of [15] in Bamako (Mali), who obtained 75% of women with non-alcoholic hepatic steatosis. This female predominance could also be due to the fact that most of the patients were housewives living in urban areas and therefore exposed to sedentary lifestyles and lack of physical exercise.

5. Conclusions

At the end of this retrospective and cross-sectional study carried out in the Diabetes Endocrinology Department of the Yopougon University Hospital, a prevalence of 18.66% of Metabolic Syndrome according to the IDF criteria and a prevalence of 3.33% of NASH were found in a sample of 150 patients hospitalized or received in consultations.

A clear predominance is also noted in women and elderly subjects. However, the level of knowledge about Metabolic Syndrome and NASH is low (12%) in the population studied. In addition to hyperglycemia, abdominal obesity and high blood pressure were the most common criteria found. The present study had limitations such as a small sample size, and the absence of some parameters such as prothrombin and platelet count, height, waist circumference and weight in some patient records. Also, the financial difficulties for some patients to carry out the necessary complementary examinations for focal or diffuse steatosis because of their high costs, In view of these difficulties, it would be more interesting to conduct a prospective study on Metabolic Syndrome and NASH in both urban and rural areas.

Conflicts of Interest

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

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