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Research Article

Association between hyperuricemia and metabolic syndrome in a Senegalese population

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ABSTRACT

Background: Metabolic syndrome (MS) is a real public health problem in our regions. Its severity requires early detection strategies based on clinical, anthropometric and biological criteria to ensure adequate management of this condition. Hyperuricemia, although not part of these criteria, is frequently associated with MS components. Thus, we have set ourselves the goal of finding a relationship between uric acid and MS.

Methodology: We conducted a prospective study on 441 subjects received as part of an annual medical visit. The subjects included in the study benefited from a complete clinical examination and blood tests provided by this annual medical check (including blood sugar, lipid status, and uric acid). The biochemical parameters were determined using enzymatic methods adapted to the A15 automaton. The metabolic syndrome has been defined according to the criteria of NCEP-ATP III.

Results: The prevalences of metabolic syndrome and hyperuricemia were 6.57% and 6.34%, respectively. Hyperuricemia was strongly associated with MS (OR=3.87, p=0.007) and some of these components including hypoHDlemia (OR=5.09), hypertriglyceridemia (OR=3.05), and abdominal obesity (OR=2.52).

Conclusion: The positive association between hyperuricemia and MS demonstrates the interest of dosing uric acid in subjects at risk.

Keywords: Hyperuricemia, metabolic syndrome, Sénégal.

INTRODUCTION

Uric acid is the end product of purine metabolism in humans. Serum uric acid concentrations will therefore depend on the balance between intakes (endogenous and exogenous) and excretions. However, in a large number of cases, hyperuricemia results from a lack of renal elimination of uric acid associated or not with excessive food intake. Many studies have shown a relationship between high blood levels of uric acid and hypertension, obesity and hypertriglycideremia (Feig et al., 2013;Conen et al. ,2004; Keenan et al. ,2012), which are components of the MS. This syndrome associated with a risk of diabetes and cardiovascular disease (Kahn et al., 2005; NCEP-ATP III, 2001; Cameron et al., 2008; Ford et al., 2008; Woodward et al., 2009), is one of the most important public health problems in the world with a growing prevalence. The severity of this syndrome justifies early detection strategies based on the search for simple clinical, anthropometric and biological arguments in order to guarantee early management of this condition. Hyperuricemia, although not part of the criteria for defining the Metabolic Syndrome(MS), is most often associated with

its components; this is why, in this work, we set ourselves the objective of seeking a relationship between uric acid and MS.

METHODOLOGY

This is a prospective study on 441 subjects received as part of a systematic annual visit to a Senegalese company involving administrative, technical and service staff; Included in the study were all subjects who had undergone a full clinical examination and blood tests provided for by this annual medical check-up (including blood sugar, lipid balance, uric acid).

Anthropometric data were collected on survey cards designed for this purpose.

The biochemical parameters were measured using enzymatic methods adapted on the A15 analyser (Biosystems, Spain).

The SM was defined according to the criteria of (NCEP-ATP III ,2001): abdominal obesity (waist>102 cm (men) and >88 cm (women), high blood pressure (BP ≥ 130/85 mm Hg), hypertriglyceridemia (≥ 1.50 g/l), lower cholesterol HDL (<0.40 g/l (men) or <0.50 g/l (women)) and hyperglycemia (≥ 1.10 g/l) ; Subjects with at least three of these criteria were considered to have MS. Hyperuricemia has been defined as serum uric acid concentrations ≥ 72 mg/l in men and ≥ 60 mg/l in women.

All observations were entered and coded on Windows Excel 2010 (Microsoft, USA) and then analyzed using SPSS Statistics 24 (IBM, Chicago, IL, USA).

Excel software was also used to present the tables, as well as to group the modalities of certain variables before their analysis.

Descriptive statistics presented the data in the form of tables. It then summarized the qualitative variables in the form of proportions (percentages) and the quantitative variables in the form of means +/- Standard Deviation.

For the qualitative variables, the comparison of the percentages required the Pearson chi-square test with Yates correction if necessary for small samples.

The statistical inference necessary for the analytical study was used to study the associations using statistical tests for the comparison of variables (Logistic regression) and an approximation of the relative risk using the Odds Ratio (OR) with a confidence interval 95% (95% CI).

A risk value of the first kind α=0.05 was considered as a significant threshold.

RESULTS

The average age of our study population was 38.82 ± 10.35 with a sex-ratio M/F of 1.12. The prevalence of MS and hyperuricemia were 6.57% and 6.34% respectively, as shown in Table 1 below:

Table 1. Characteristics of the study population.

Variables	Results
Number of individuals	441
Age (years)	
Mean ± SD	38,82 ± 10,35
Sex-ratio M/F	1,12
Men N (%)	233 (52, 83%)
Women N (%)	208 (47, 16%)
Metabolic Syndrom N (%)	29 (6, 57%)

The prevalence of hyperuricemia was 41.38% in subjects with MS versus 23.35% in subjects without MS.

Hyperuricemia and MS were strongly associated (OR=3.87, p=0.007). Table 2 below shows this:

Table 2. Association between hyperuricemia and metabolic syndrome.

Subjects	Hyperuricemia	Normal Uricemia	OR	P value	95% CI
With MS n (%)	5 (17, 2%)	24 (82, 8%)	3,87	0,021	
Without MS n (%)	21 (5, 1%)	391 (94, 9%)			1, 34-11, 18

The study of the relationship between hyperuricemia and the other components of MS has shown a strong association with hypoHDLemia (OR=5.09), hypertriglyceridemia (OR=3.05) and abdominal obesity (OR=2.52) as shown in Table 3 below.

Table 3. Association between hyperuricemia and the various components of MS.

Componants	Hyperuricemia		OR	P
	YES	NO		
Abdominal obesity				
YES	10	92	2,52	0,04
NO	14	325		
HTA				
YES	15	171	2,14	0,09
NO	10	245		
Hypertiglyceridemia				
YES	6	41	3,05	0,04
NO	18	376		
hypoHDLemia				
YES	7	28	5,09	<0,001
NO	19	387		
Hyperglycemia				
YES	4	29	2,54	0,2
NO	21	387		

We also found a higher prevalence of hyperuricemia in subjects over 50 years with a male predominance (Figure 1and 2).

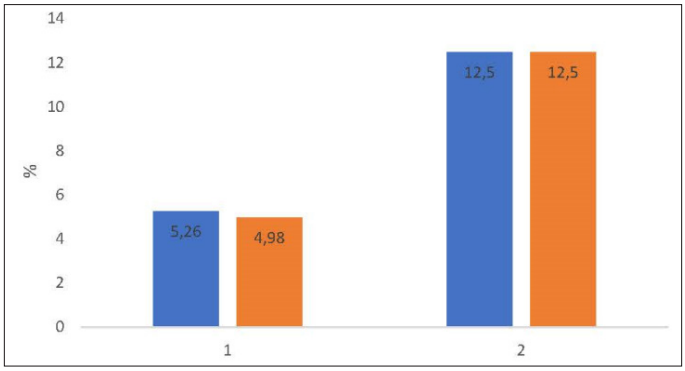

Figure 1. Percentage of subjects with MS and hyperuricemia according to age (1< 50 years; 2 ≥ 50 years)

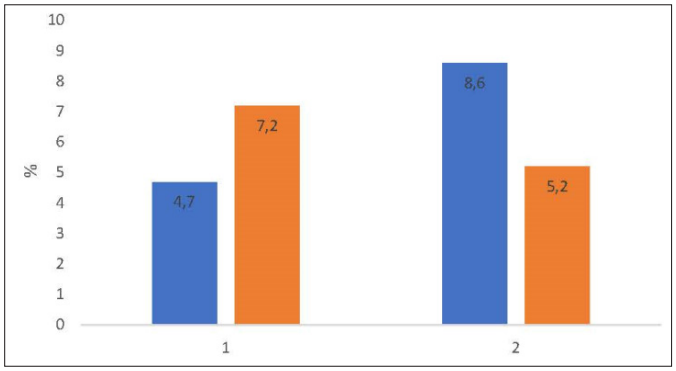

Figure 2. Percentage of subjects with MS and hyperuricemia according to gender (1:male; 2:female)

DISCUSSION

Our study found a positive association between hyperuricemia and SM (OR=2.29, p<0,05). These results corroborate those of numerous epidemiological data (Fu et al., 2017; Jung et al. , 2016; Kanbay et al.,2016;Carbone et al., 2014) and experimental (DeBosch et al, 2014). The relationship between uric acid levels and the risk of developing MS has been established by a meta-analysis of prospective studies (Yuan et al, 2015). Indeed, hyperuricemia is a risk factor for MS (Avula et al, 2016). This could be explained by its constant association with the different components of the SM. In fact, in our study, significant associations were found between hyperuricemia and hypertension, abdominal obesity and dyslipidemia (Table 2) which is in agreement with the data of the literature (Fu et al., 2017; Avula et al, 2016; Dai et al, 2016; Norvik et al, 2016). However, we have not found an association between hyperuricemia and hyperglycemia. This corroborates the study by Fu et al (Fu et al., 2017) and that of Cibikova (Cibikova et al., 2017).

These results could be linked to the inhibitory action of glucose on the reabsorption of uric acid which thus promotes its excretion. This role of glucose cannot explain the high prevalence of hyperuricemia in type 2 diabetics found by some authors. According to the latter, hyperuricemia in diabetics was favored by the existence of an MS or one of its components (Woyesa et al., 2017).

The study of the distribution of hyperuricemia according to age and sex shows on the one hand an increase in the prevalence in subjects over 50 years (Figure 1) and on the other hand higher rates in men compared women (Figure 2). The opposite being observed for the SM. These opposite trends could be linked to the biases introduced by the differences in population size in the subgroups. Increased uric acid with age has been reported by Woyesa et al (Woyesa et al., 2017). However, Fu and colleagues found no significant association between uric acid and age (Fu et al., 2017). As for the male predominance; it has been widely described in the literature (Woyesa et al., 2017; jung et al., 2018; Viazzi et al., 2017).

These variations based on age and gender has no impact on the risk of MS. In fact, studies show that subjects with high uric acid levels have a higher risk of developing MS regardless of age and sex (Chiou et al, 2010; Zhang et al.,

CONCLUSION

A positive association has been found between hyperuricemia and SM in the Senegalese population. This demonstrates the value of measuring uric acid in subjects at risk. Further work will be required to demonstrate whether hyperuricemia is a cause or a consequence of MS.

AUTHORS' CONTRIBUTION

Fatou Cissé developed the study protocol and the data collection. Fatou Cissé, Tarik Lamkinsi and Souleymane Thiam contributed to the analysis of the results and the drafting of the final document. The methodology and the statistical analyzes were performed by Tarik Lamkinsi. All authors have read and approved the final version of the manuscript.

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