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Epidemiology of gout and hyperuricemia in New Caledonia

Thomas Bardin[a,*], Elodie Magnat[b], Pierre Clerson[c], Pascal Richette[a], Bernard Rouchon[b]

[a] Department of Rheumatology, Lariboisière hospital APHP Paris Nord, and Université de Paris, INSERM U1132, Paris, France
[b] Agence Sanitaire et Sociale, Nouméa, New Caledonia
[c] Soladis Clinical Studies, Roubaix, France

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ABSTRACT

Objectives: New Caledonia is a Pacific island of 270,000 inhabitants with mixed ethnicities, including Polynesians (10.2%), people from European ancestry (27.2%), and Melanesians (39.1%),. This study aimed at determining the prevalence of gout and hyperuricemia in the general population and the various ethnicities of New Caledonia.
Methods: A 3-degree random sample of the population aged 18 to 60 years was adjusted according to the 2014 New Caledonia census. Face-to-face planned interviews and physical measurements were performed by trained nurses. All consenting participants underwent capillary measurement of creatinine; all consenting men and only women older than 40 years underwent point-of-care uricemia testing. Gout was defined by a validated algorithm. Two definitions of hyperuricemia were used: capillary level equivalent to plasma uric acid level > 360 μmol/l (6 mg/dl) and > 420 μmol/l (7 mg/dl) and/or urate-lowering drug treatment for both thresholds.
Results: We included 1144 participants (adjusted mean age 37.7 ± 12.0 years; adjusted sex ratio 50.4% men). The adjusted prevalence of gout was 3.3% (95% confidence interval 2.2–4.9). Prevalence was 6.7% (2.5–16.8), 4.1% (1.8–8.9), and 2.6% (1.4–4.7) for Polynesians, Europeans and Melanesians, respectively, and 1.9% (0.5–6.6) for other ethnicities. Prevalence of hyperuricemia, determined in 658 participants, was 67.0% (61.9–71.6) and 37.0% (32.3–42.0) for the 360- and 420-μmol/l thresholds, respectively, and was significantly greater for Polynesians and Melanesians than Europeans for both thresholds.
Conclusions: The prevalence of gout and hyperuricemia in New Caledonia was high, including in patients of European descent.

1. Introduction

The prevalence of gout varies across geographic areas [1], which suggests that genetic differences across ethnicities could play a role in the pathophysiology. The prevalence has been found particularly high in Pacific islanders [2].

New Caledonia is a multi-ethnic Pacific island of 270,000 inhabitants, including Polynesians (10.2%), people from European ancestry (27.2%), and Melanesians (39.1%), so this island is suitable for studying variations in prevalence across these ethnicities. We took advantage of a cross-sectional epidemiological study of several aspects of New Caledonians' health by the *Agence Sanitaire et Sociale de Nouvelle Calédonie* (an official body of the government of New Caledonia), to estimate the prevalence of gout and hyperuricemia in the general population and the various ethnic groups.

2. Methods

A large epidemiological study was conducted in New Caledonia by the *Agence Sanitaire et Sociale de Nouvelle Calédonie* between August 2015 and January 2016, aiming at describing health characteristics, treatment habits, addictions, and diet of the adult population [3]. Participating adults were visited by health professionals and asked to answer an extensive questionnaire. Some questions, physical examination items and capillary blood measurements were added, related to gout, hyperuricemia, consumption of urate-lowering drugs (ULDs), and factors potentially associated with hyperuricemia. We specifically present here the results related to gout and hyperuricemia.

* Corresponding author at: Institut Mutualiste Montsouris, Service de Médecine, 46, boulevard Jourdan, 75674 Paris Cedex 14, France.
E-mail address: thomas.bardin@imm.fr (T. Bardin).

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2.1. Ethics

The study was approved by the New Caledonian ethics board (*Comité Consultatif d'Ethique de la Nouvelle-Calédonie pour les sciences de la vie et de la santé*), the French Medical Research Data Processing Advisory Committee (*Comité Consultatif sur le Traitement de l'Information en matière de recherche dans le domaine de la Santé*; approval no.: 15.486) and the French Information Technology and Privacy Commission (*Commission Nationale de l'Informatique et des Libertés*; approval no.: 1973228). All participants gave their informed consent before participating in the survey.

2.2. Sample

The sampling method was extensively reported elsewhere [3]. Briefly, this cross-sectional study involved a random sample of adults aged 18 to 60 years who were living in New Caledonia in a home identified at the last population census (2014). A sampling frame of all main homes and residences housing at least one adult aged 18 to 60 years was developed. Secondary residencies, vacant homes, mobile homes and hostels used as main residencies were excluded. We excluded people who were not physically, intellectually or legally able to answer the interviewers. The sample size was calculated to allow for estimating any proportion of 50% with sufficient precision of ±5% in each of the 3 provinces of New Caledonia (North, South [which includes the capital Nouméa] and the Loyauté Islands), which led to planning the inclusion of at least 384 people in each province and globally 1200 people. A refusal rate of 40% was anticipated, and the sampling frame counted 2006 people representing about 1.25% of the population aged 18 to 60 years in New Caledonia. The sample was drawn using a three-stage cluster sample of households. The 3 provinces (corresponding to 3 strata) were divided into a total of 425 areas (according to the division of the Institute of Statistics and Economic Studies of New Caledonia), and a first sample of 140 areas was drawn. In each area, a sample of households was then drawn (unequal probabilities depending on the number of people living in the household). Finally, the rank of the person to be interviewed in each household was drawn (equal probabilities).

2.3. Data collection

Data were collected by trained nurses during face-to-face interviews. The questionnaire was completed during the interview and included several modules: socio-demographic data, level of interest and knowledge in health-related topics, interviewee's health, access to the health care system, hygiene, diet, physical activity, addictions, and sexual activity. Depression was assessed with the Mini-International Neuropsychiatric Interview [4]. Nurses recorded height, weight, waist circumference and blood pressure. Capillary creatinine level was extemporaneously measured in all consenting participants by using StatSensor Creatinine Xpress. Capillary uricemia measurement was obtained in consenting men and in women ≥ 40 years old by using the HumanSens Plus sensor (Human Diagnostics Worldwide). As a whole, the visit lasted about 1 h.

2.4. Classification criteria for gout and hyperuricemia

Gout was defined according to an algorithm that was previously validated in France [5]. Briefly this algorithm allows for calculating the probability of gout given 4 individual characteristics obtained by interview: self-knowledge of the diagnosis of gout; self-knowledge of the diagnosis of hyperuricemia; history of acute pain (< 15 days) and intense pain (visual analogue scale score ≥ 9) in the big toe, foot or ankle outside of any traumatic context; and history of cardiac disease apart from hypertension. In contrast with the European algorithm, the New Caledonia algorithm excluded from recalled cardiac diseases rheumatic fever, which is quite frequent in New Caledonia and has no known association with gout. Participants with a calculated probability of gout > 0.5 were classified as gouty. We also evaluated the prevalence of gout as defined by self-knowledge of gout because this definition is often used in the literature.

To allow for comparison with the published literature, 2 thresholds of capillary urate levels were considered for the definition of hyperuricemia: > 330 μmol/l (5.5 mg/dl) equivalent to plasma uric acid > 360 μmol/l (6 mg/dl) and > 402 μmol/l (6.7 mg/dl) for plasma uric acid > 420 μmol/l (7 mg/dl) [6]. Participants taking urate-lowering drugs were considered as hyperuricemic for both thresholds.

2.5. Statistical methods

The sample was adjusted so that it was representative of the target population according to the data collected during the 2014 New Caledonia census. This adjustment was needed because one of the provinces (Loyauté Isles) was overweighted in the framing sample in order to estimate proportions with sufficient power in this province that was less populated than the other 2 and because the rates of non-response slightly differed across provinces. Each individual was assigned a weight that was calibrated so that the estimated counts corresponded to known characteristics of the New Caledonian population on province, age and sex.

Results are expressed as mean ± standard deviation (SD) or number (percentage). Glomerular filtration rate (GFR) was estimated by the Modification of Diet in Renal Disease (MDRD) formula [7]. Proportions were estimated with two-sided 95% confidence intervals (95% CIs) assuming a binomial distribution. Odds ratios (ORs) for predictors of gout and hyperuricemia were calculated in logistic regression models. The statistical analysis was performed with R v1.2.5033 (packages "survey" and "sampling"). $P < 0.05$ was considered statistically significant.

3. Results

Among the 2006 individuals of the initial sample, 1147 were interviewed by the study nurses. Three questionnaires were excluded from the analysis because of very poor-quality responses. Therefore, the analysis involved 1144 people.

3.1. Characteristics of the studied population

The characteristics of the 1144 people from the adjusted sample are in Table 1. Mean age was 37.7 ± 12.0 years and 50.4% were male. Prevalence of diabetes, hypertension, hypercholesterolemia and cardiovascular diseases ranged from 1.0% to 5.5%. Overall, 7.7% of participants had an estimated glomerular filtration rate of < 60 ml/min. Mean body mass index (BMI) was 28.8 ± 6.6 kg/m^2. Polynesians, Europeans and Melanesians accounted for 10.6%, 24.3% and 45.9% of ethnicities, respectively. Mean BMI was 32.3 kg/m^2 (30.7–34.0), 26.5 kg/m^2 (95% CI: 25.5–27.5), 29.4 kg/m^2 (28.6–30.1) for Polynesians, Europeans, and Melanesians, respectively, and 28.8 kg/m^2 (27.5–30.1) for the other ethnicities.

3.2. Prevalence of gout in New Caledonia

According to the algorithm, the prevalence of gout in New Caledonia was estimated at 3.3% (95% CI: 2.2–4.9) (Table 2). The estimated prevalence was higher in men than women (5.5% [3.5–8.5] vs 1.0% [0.4–2.9], $P < 0.01$) and increased with age ($P < 0001$), to reach 9.4% (5.5–15.6) for men aged 50 to 60 years

Table 1
Features of the studied population.

	Missing data	Raw sample $n = 1144$	Adjusted sample $n = 1144$
Males	0	482 (42.1)	50.4
Females	0	662 (57.9)	49.6
Age, mean + SD	0	39.3 ± 12.1	37.7 ± 12.0
BMI, mean + SD	171	29.4 ± 6.7	28.8 ± 6.6
Waist circumference, mean ± SD	28	99.5 ± 16.1	98.6 ± 16.7
Ethnicity			
Europeans	0	169 (14.8)	24.3
Melanesians	0	722 (63.1)	45.9
Polynesians	0	74 (6.5)	10.6
Others	0	179 (15.6)	19.1
Educational level			
Primary school level	0	161 (14.1)	10.7
Secondary school level	0	834 (72.9)	71.4
Post-secondary education	0	149 (13.0)	18.0
Housing			
Rural	0	748 (65.4)	44.3
Urban	0	396 (34.6)	55.7
Pathological conditions			
Diabetes	0	64 (5.6)	4.5
Hypertension	0	86 (7.5)	5.5
Cardiovascular diseases	0	26 (2.3)	1.7
Hypercholesterolemia	0	12 (1.0)	1.0
Creatinine (μmol/L), mean ± SD	106	82.7 ± 27.5	84.3 ± 31.8
eGFR < 60 ml/min	106	93 (9.0)	7.7
Alcohol consumption (units/day), mean ± SD	22	1.7 ± 5.0	1.8 ± 4.6

eGFR: estimated glomerular filtration rate (Modification of Diet in Renal Disease formula). Data are *n* (%) unless indicated.

Table 2
Prevalence of gout defined according to the used algorithm * and to self-declaration of gout in adults New Caledonians aged 18–60 years, by ethnicity.

Ethnicity	Gout defined by the algorithm	Self-knowledge of gout
Europeans		
Males ($n = 88$)	7.0% (3.1–15)	7% (3.1–15)
Females ($n = 81$)	0% (0–0)	0% (0–0)
Total ($n = 169$)	4.1% (1.8–8.9)	4.1% (1.8–8.9)
Melanesians		
Males ($n = 294$)	5.3% (2.8–9.6)	4.9% (2.7–8.8)
Females ($n = 428$)	0.2% (0–0.9)	0.3% (0.1–0.9)
Total ($n = 722$)	2.6% (1.4–4.7)	2.5% (1.4–4.4)
Polynesians		
Males ($n = 31$)	7.5% (1.8–27.1)	7.5% (1.8–27.1)
Females ($n = 43$)	5.9% (1.4–21.6)	5.9% (1.4–21.6)
Total ($n = 74$)	6.7% (2.5–16.8)	6.7% (2.5–16.8)
Others		
Males ($n = 69$)	2.5% (0.5–12.7)	2.5% (0.5–12.7)
Females ($n = 109$)	1.3% (0.2–8.9)	1.3% (0.2–8.9)
Total ($n = 179$)	1.9% (0.5–6.6)	1.9% (0.5–6.6)
Overall		
Males ($n = 482$)	5.5% (3.5–8.5)	5.3% (3.4–8.3)
Females ($n = 661$)	1.0% (0.4–2.9)	1.1% (0.4–2.9)
Total ($n = 1144$)	3.3% (2.2–4.9)	3.2% (2.1–4.8)

Data are percentage (95% confidence interval).
* Richette et al. Identification of patients with gout: elaboration of a questionnaire for epidemiological studies. Ann Rheum Dis. 2015;74:1684–90.

(Fig. 1). The estimated prevalence also differed by ethnicity: 6.7% (2.5–16.8), 4.1% (1.8–8.9), and 2.6% (1.4–4.7) for Polynesians, Europeans and Melanesians and 1.9% (0.5–6.6) for other ethnicities (Table 2 and fig. 1S) [See the supplementary material associated with this article online]. Estimates using self-reported gout showed similar figures (Table 2).

Less than half (45.9% [95% CI: 26.2–67.1]) of patients classified as gouty by the algorithm were taking ULDs, and among them, 29.6% (11–58.9) reached the SUA target < 360 μmol/L (6 mg d/l).

3.3. Prevalence of hyperuricemia in New Caledonia

Uricemia was measured in 658 people (373 men aged 18–60 years, and 285 women aged 41–60 years). The overall prevalence of hyperuricemia defined as plasma uric acid level > 360 μmol/L (6 mg/dl) or ULD intake was 67% (95% CI: 61.9–71.6), whereas the prevalence defined as plasma uric acid level > 420 μmol/L (7 mg/dl) or ULD intake was 37% (32.3–42.0) (Table 3). Prevalence varied by ethnicity, the highest prevalence was observed in Polynesians: 86.3% (72.3–93.8) and 52.5% (36.5–68.1) for plasma uric acid level > 360 μmol/L (6 mg/dl) and > 420 μmol/L (7 mg/dl), respectively. Whatever the definition used for hyperuricemia, the overall prevalence was higher in men than women ($P < 0001$). However, Polynesian women had a strikingly high prevalence of hyperuricemia.

3.4. Factors associated with gout and hyperuricemia

Gout was associated with BMI (age and sex-adjusted OR [aOR] 1.15 [95% CI: 1.08–1.23 per kg/m^2), waist circumference (aOR

Table 3
Prevalence of hyperuricemia defined as uricemia > 360 or 420 μmol/l and/or urate-lowering drug intake by ethnicity and sex.

Ethnicity	Uricemia > 360 μmol/l	Uricemia > 420 μmol/l
Europeans		
Males (*n* = 68)	62.5% (48.4–74.8)	25.8% (16.1–38.7)
Females (*n* = 36)	16.6% (7.3–33.8)	0.0% (0–0)
Total (*n* = 104)	49.3% (38.8–60.0)	18.4% (11.5–28.2)
Melanesians		
Males (*n* = 225)	81.9% (72.6–88.5)	50.6% (41.3–60)
Females (*n* = 180)	60.1% (49.4–69.9)	27.3% (19.2–37.1)
Total (*n* = 405)	74.7% (67.8–80.6)	42.9% (36.0–50.1)
Polynesians		
Males (*n* = 25)	91.6% (70.1–98)	58.7% (36.4–78)
Females (*n* = 21)	76.9% (52.5–91)	41.5% (21.5–64.8)
Total (*n* = 46)	86.3% (72.3–93.8)	52.5% (36.5–68.1)
Others		
Males (*n* = 55)	66.9% (49.9–80.4)	45.4% (30.2–61.6)
Females (*n* = 48)	52.4% (35.8–68.4)	28.3% (15.6–45.9)
Total (*n* = 103)	61.6% (49.5–72.4)	39.2% (28.2–51.3)
Overall		
Males (*n* = 373)	74.9% (68.3–80.5)	43.8% (37.4–50.4)
Females (*n* = 285)	50.8% (43.3–58.3)	23.2% (17.6–30.0)
Total (*n* = 658)	67.0% (61.9–71.6)	37.0% (32.3–42.0)

Data are % (95% confidence interval).

Table 4
Factors associated with gout and hyperuricemia (plasma uric acid level > 360 μmol/l [6 mg/dl] and/or under urate-lowering drug treatment).

	Gout *n* = 36	No gout *n* = 1108	aOR (95%CI)	Hyperuricemia *n* = 463	No Hyperuricemia *n* = 195	aOR (95%CI)
BMI (kg/m^2)	36.2 ± 6.1	28.6 ± 6.5	1.15 (1.08–1.23)***	30.9 ± 6.4	27.3 ± 6.1	1.12 (1.06–1.17) ***
Waist circumference (cm)	116 ± 13.6	98.0 ± 16.4	1.05 (1.03–1.07)***	104 ± 17.3	94.2 ± 14.2	1.05 (1.03–1.07) ***
Hypertension	39.1%	4.4%	9.11 (3.35–24.73)***	9.8%	4.9%	2.81 (1.18–6.72) *
Diabetes	18.4%	4.0%	2.31 (0.75–7.09)	5.4%	5.9%	1.09 (0.42–2.79)
Hypercholesterolemia	5.2%	0.9%	1.80 (0.19–16.65)	2.0%	0.4%	3.75 (0.94–14.93)
Cardiovascular diseases	12%	1.3%	4.30 (1.05–17.58)*	2.9%	0.2%	18.52 (2.14–160.34)**
History of cancer	5.2%	0.8%	3.03 (0.31–29.98)	1.3%	0.1%	24.94 (2.65–234.94)**
Renal failure	5.2%	0.6%	2.50 (0.28–22.25)	1.5%	0.9%	1.39 (0.11–17.01)
eGFR < 60 ml/min	28.0%	7.0%	2.70 (1.09–6.68)*	10.5%	9.7%	1.15 (0.56–2.35)
Depression	23.8%	8.0%	6.28 (1.99–19.75)**	6.3%	10.7%	0.93 (0.45–1.93)
Rural housing	41.3%	44.4%	0.78 (0.33–1.83)	48.8%	46.0%	1.19 (0.75–1.88)
Born in NC	77.5%	79.3%	1.36 (0.46–4.06)	84.2%	74.8%	1.95 (1.08–3.50) *
Educational level						
Primary school	22.8%	10.3%	Ref	15.0%	15.7%	Ref
Secondary school	70.8%	71.4%	1.28 (0.48–3.39)	74.0%	65.8%	0.99 (0.53–1.86)
Post-secondary education	6.4%	18.3%	0.40 (0.06–2.71)	11.0%	18.5%	0.42 (0.18–1.01)
Ethnicity						
Europeans	30.4%	24.1%%	Ref	18.9%	39.4%	Ref
Melanesians	36.8%	46.2%	1.42 (0.47–4.33)	47.9%	32.9%	4.02 (2.24–7.19) ***
Polynesians	21.8%	10.3%	4.57 (1.26–16.66)*	15.1%	4.9%	9.17 (3.19–26.36) ***
Others	11.0%	19.4%	0.94 (0.19–4.66)	18.1%	22.9%	2.18 (1.05–4.53) *

NC: New Caledonia; aOR: adjusted odds ratio; 95% CI: 95% confidence interval; eGFR: estimated glomerular filtration rate (Modification of Diet in Renal Disease formula).
[a] Age- and sex-adjusted.
* $P < 0.05$.
** $P < 0.01$.
*** $P < 0.001$.

1.05 [1.03–1.07] per cm), hypertension (aOR 9.11 [3.25–24.73]), eGFR < 60 ml/mn (aOR 2.70 [1.09–6.68]), cardiovascular diseases (aOR 4.30 [1.05–17.58]) and depression (aOR 6.28 [1.99–19.75]) (Table 4). As compared with Europeans, Polynesians had increased age and sex-adjusted risk of gout (aOR 4.57 [1.26–16.66]), which became non-significant when further adjusted on BMI.

Hyperuricemia (plasma uric acid level > 360 μmol/L [6 mg/dl]) was associated with gout and shared same risk factors with those of gout, except for depression and renal insufficiency (Table 4). Being born in New Caledonia was associated with hyperuricemia. Melanesians and Polynesians showed increased age-, sex- and BMI-adjusted risk of hyperuricemia as compared with Europeans. Analysis of factors associated with plasma uric acid level > 420 μmol/L (7 mg/dl) yielded similar results (table S1).

We found no association between gout and dietary factors. However, consumption of dairy products (> 1/week) was associated with reduced risk of hyperuricemia (SUA level > 6 mg/dl): aOR 0.52 (95% CI: 0.27–1.0).

3.5. Association of gout with hyperuricemia

Gout significantly associated with hyperuricemia > 360 μmol/l ($P < 0.05$) and even more with hyperuricemia > 420 μmol/l ($P < 0.0001$). 6.1% of the 463 subjects with uricemia > 360 μmol/l (6 mg/dl), and 10.1% of the 268 subjects with uricemia > 420 μmol/l (7 mg/dl) were classified as gouty. The proportion of gout in hyperuricemic people was nominally higher in Europeans than in the other communities for both uricemia thresholds (Fig. 2). However, ORs adjusted for age and sex were non-significant.

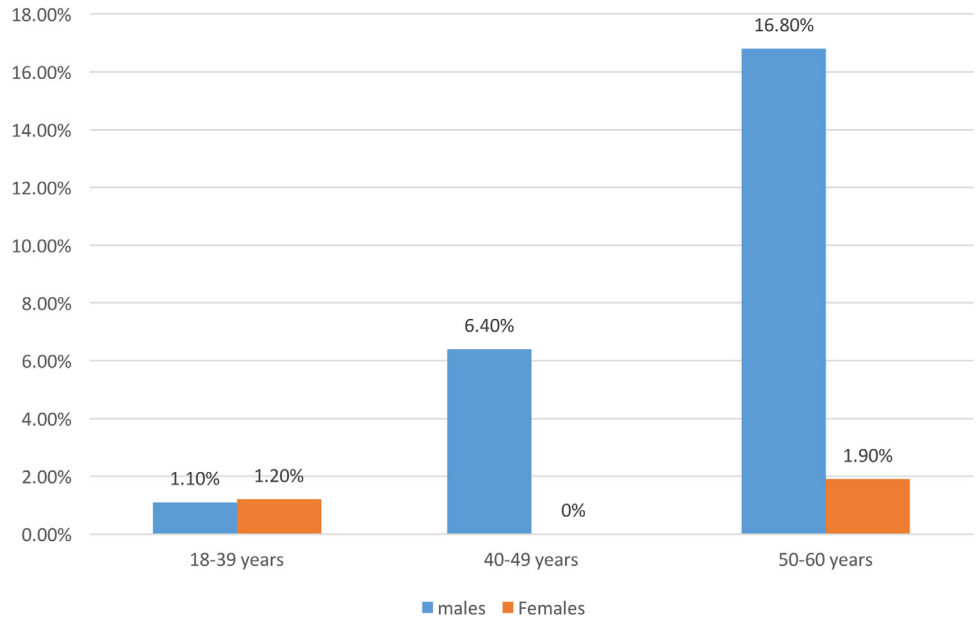

Fig. 1. Prevalence of gout defined by the algorithm, by sex and age.

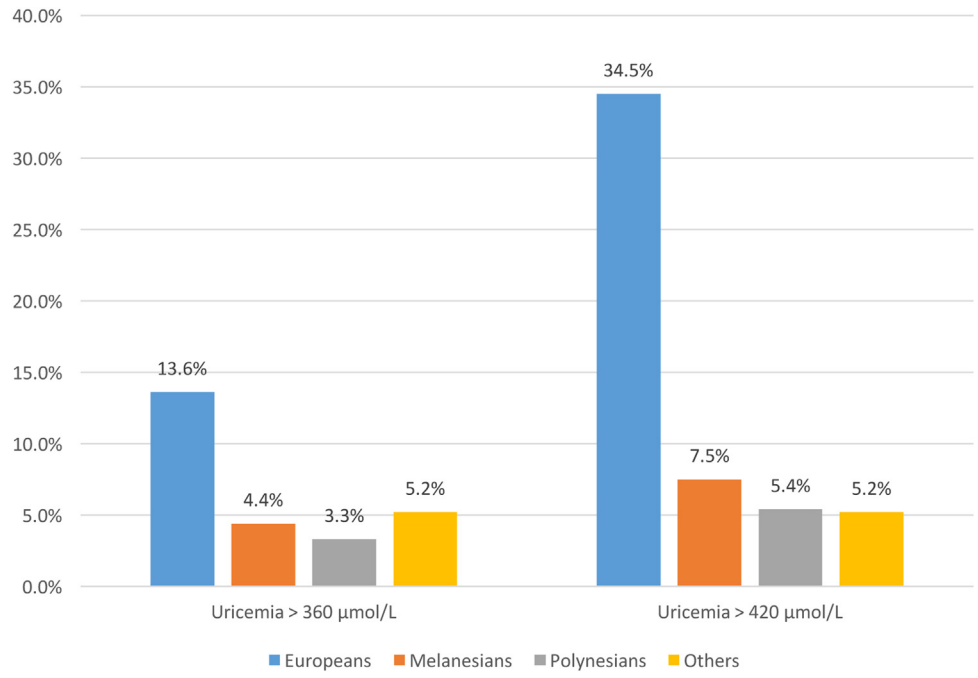

Fig. 2. Proportion of gouty patients in subjects with uricemia > 360 and 420 micromoles/l by ethnicity.

4. Discussion

This study estimated the overall prevalence of gout in New Caledonia at 3.3% (95%CI: 2.2–4.9), with variations across ethnicities: 6.7% (2.5–16.8), 4.1% (1.8–8.9), 2.6% (1.4–4.7), for Polynesians, Europeans, and Melanesians respectively, and 1.9% (0.5–6.6%) for other ethnicities.

4.1. Comparison with other studies

Comparison of our data with other studies is difficult because of variations in how gout was diagnosed across studies, which can largely influence their results. One of the challenges of epidemiologic studies of gout indeed relies on the method of gout diagnosis [8,9]. In our study, people were classified as gouty or non-gouty by an algorithm previously validated in a case-control study using synovial fluid crystal examination as a gold standard, in which sensitivity and specificity of the algorithm to classify subjects as gouty were 87.5 and 89.8% respectively [5]. We previously used this algorithm to evaluate the prevalence of gout in metropolitan France [10]. The question about participants' histories of cardiovascular diseases was slightly modified in a way that should not impair prevalence estimates. We excluded rheumatic fever from recalled disease history because rheumatic fever is frequent in New Caledonia, has no known association with gout, and could therefore have been misleading. Of note, prevalence estimates by using this

questionnaire for gout diagnosis only slightly differed from those obtained by using self-knowledge of gout, in contrast to the overestimation of prevalence by self-knowledge of gout we observed in our study of metropolitan France [9]. Self-assessment to diagnose gout in epidemiological studies has been diversely appreciated: performance was poorly rated in one report [11] but found satisfactory in another [12]. Patients' knowledge of gout may depend on the frequency of gout in the studied population and could be better in New Caledonia, where gout is frequent and severe.

4.2. Variations of gout prevalence across ethnicities

Our study showed variations of gout prevalence across ethnicities. Polynesians, who principally included individuals from the Wallis and Tahiti islands, had the highest prevalence of gout, in line with previous studies in various Pacific islands [2,13–15] and high rate of metabolic syndrome and obesity that largely developed since the introduction of western diet [16]. In our study, Polynesians had the largest BMI, and adjustment for age, sex and BMI resulted in a non-significant ORs for gout as compared with participants from European ethnicity. Gout appeared very prevalent in Polynesian men (7.5) but also women (5.9%) (Table 2), whose fractional clearance of urate has been found low [17]. In a report from New Zealand [14], with a different mode of gout diagnosis, the age-standardized prevalence of gout in Maori women was estimated at 4.1%. Few studies have been published on the epidemiology of gout in Melanesians. Gout has been found the reason for hospitalization of 8% of Melanesians in 3 hospitals in Papua New Guinea [18]. Surprisingly, the estimate of gout prevalence in New Caledonia people of European descent was much higher than in metropolitan France (4.1% [95% CI: 1.8–8.9] vs 0.95% [0.77–1.16]) in a study that used the same diagnostic method [9]. A similarly high gout prevalence (3.2%) was reported in New Zealand Europeans [14], which suggests, together with the association of hyperuricemia with birth in New Caledonia, a role for environmental factors or a founder effect.

4.3. Factors associated with gout

In all ethnicities, gout prevalence was associated with age, BMI and waist circumference. However, we could not show an association with dietary factors, which were thoroughly investigated in our study. These factors were previously identified in large longitudinal cohorts [19–21], whereas our study was cross-sectional and dealt with few gouty patients ($n = 36$), which probably resulted in a lack of statistical power. Cardiac diseases, hypertension and decreased renal function were associated with gout, but self-declaration of diabetes and dyslipidemia were not, in contrast to previous work [22–24]. Again, the small number of patients with gout led to low statistical power, which probably explains this discrepancy. We found an association of depression with gout but not hyperuricemia, which confirms previous work revealing an association of depression with gout and that determinants of depression in gouty patients were related to gout severity [25].

4.4. Prevalence of hyperuricemia

The definition of hyperuricemia varies in the literature, so comparison across studies is difficult [26]. In our study, we estimated the prevalence of hyperuricemia for two different thresholds, > 360 and > 420 μmol/l, which had been investigated in recent studies. Overall, the 2015 hyperuricemia prevalence in New Caledonia seemed very high for both thresholds: 67.0% for plasma uric acid > 360 μmol/l as compared with 11.94% found in 2009 in Italy [27] and 37% for plasma uric acid levels > 420 μmol/l as compared with 11.9% in a 2007–2016 US study [28]. Prevalence was particularly high for Polynesians of both sexes, which confirms previous reports [17]. For people of European ancestry, the prevalence of plasma uric acid level > 420 μmol/l was lower (18.4%) than other ethnicities and closer to the prevalence reported in the United States for non-Hispanic whites (12.7%) [27]. In New Caledonia, hyperuricemic people from European ancestry had a nominally higher proportion of gout, which might suggest the role of ethnic or genetic factors in the transition from hyperuricemia to gout. However, age- and sex-adjusted ORs were not significant, and a larger study appears to be needed to test this hypothesis.

4.5. Strengths and weaknesses of the study

The limitations include a slightly different distribution of ethnicities in our sample from the 2014 New Caledonia census; the use of self-declared ethnicity, which may have led to some misclassification; and the few number of people classified as having gout, which impaired the recognition of gout-associated factors. Strengths are the whole New Caledonia population-based approach; the face-to-face interview methodology, which allowed for collecting a large number of items; the use of validated point-of-care measurement of uricemia and mode of gout diagnosis. Findings are overall consistent with the published literature and bring interesting data on the little-investigated epidemiology of gout in Melanesians.

Ethics and consent to participate

This work was approved by the adequate Ethics committee and patients signed an informal consent to participate in the study.

Consent for publication

Not applicable.

Availability of data and materials

Source data are available from the *Agence Sanitaire et Sociale*, Nouméa, New Caledonia, on request.

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Authors' contribution

TB, PC, PR and BR contributed to the conception and design of the work; EM and PC to the analysis of data; TB, PR to the interpretation of data; TB and PC drafted the manuscript; all authors contributed to revision of the work, approved the submitted manuscript, and have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

Disclosure of interest

The authors declare that they have no competing interest.

Appendix A. Supplementary data

Supplementary data (Table S1, Figure S1) associated with this article can be found, in the online version, at https://doi.org/10.1016/j.jbspin.2021.105286.

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