Central African Journal of Public Health
2026, Vol. 12, No. 3, pp. 182–192
https://doi.org/10.11648/j.cajph.20261203.17

Research Article

Epidemiological Aspects of Male Infertility in the City of Ngaoundere, Cameroon

Didiane Mefokou Yemele[1, 2, *], Jessica Hermine Kamga Kiessu Moguem[1], Albert Gakou[1], Phelix Bruno Telefo[3]

[1]Department of Biomedical Sciences, University of Ngaoundere, Ngaoundere, Cameroon
[2]Ngaoundere Sunshine Diagnostics Research Laboratory, Ngaoundere, Cameroon
[3]Department of Biochemistry, University of Dschang, Dschang, Cameroon

Abstract

Infertility is a growing public health concern worldwide. While the investigative burden has historically been placed on women, male factors are implicated in nearly half of all infertility cases. Male infertility is defined as the inability of a male of reproductive age to achieve a pregnancy with a fertile female partner. Sub-Saharan Africa bears a disproportionate share of this burden, yet data from northern Cameroon remain largely absent from the scientific literature. This study aimed to describe the epidemiological and clinical features of male infertility among patients consulting three healthcare facilities in Ngaoundere, Cameroon. A mixed-design study combining a retrospective review of medical records (January 2020 – June 2023, n=72) and a prospective cross-sectional survey (June 14 – August 31, 2023, n=46) was conducted at the Ngaoundere Regional Hospital, the Cabinet Sanitaire La Reference, and the Sunshine Diagnostics Laboratory. Semen analysis was performed in accordance with WHO 2021 guidelines. Lifestyle and clinical data were collected via standardised questionnaire for the prospective cohort only. Hormonal assays (testosterone, FSH, LH) were performed on clinically indicated sub-groups. A total of 118 patients were included (mean age: 35.78 ±9 years). Civil servants predominantly teachers constituted the largest occupational group (43.2%). Pathological semen profiles were identified in 78.0% (92/118) of patients. The leading quantitative anomaly was oligozoospermia (30.5%; 36/118), followed by azoospermia (12.7%; 15/118). Asthenozoospermia was the predominant qualitative defect (22.9%; 27/118). Among the 46 prospectively interviewed patients, primary infertility was most prevalent (56.5%). Stimulant consumption was reported by 32.6% of patients with abnormal profiles. Hormonal evaluation revealed elevated FSH in 13.6% and elevated LH in 21.2% of patients with pathological semen, exclusively from the abnormal-profile group for FSH. Male infertility is a significant public health concern in Ngaoundere, predominantly affecting men in their thirties. Semen abnormalities are highly prevalent (78.0%), with oligozoospermia as the leading defect. Elevated gonadotropins (FSH and LH) point to primary testicular impairment. Stimulant consumption and psychosocial stress represent modifiable contributing factors that warrant targeted public health intervention.

Keywords

Male Infertility, Risk Factors, Semen Analysis, Spermogram, Hormonal Profile, Ngaoundere, Cameroon

*Correspondence: Didiane Mefokou Yemele (didianeyemele@gmail.com)

Received: 26 April 2026; **Accepted:** 7 May 2026; **Published:** 21 May 2026

1. Introduction

The World Health Organization (WHO) defines infertility as a disease of the reproductive system characterised by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse [1]. Long stigmatised as an exclusively female affliction, male infertility the inability of a reproductive-age male to induce gestation in a fertile female partner [2] has now been firmly established as a major contributor to the global infertility burden. Current estimates indicate that approximately 15% of reproductive-age couples worldwide are affected by infertility, with a male factor identified as the sole or contributing cause in nearly 50% of cases [3].

In sub-Saharan Africa, a region characterised by what demographers have termed the "infertility belt," the prevalence of couple infertility is particularly alarming, ranging between 20% and 40% depending on the geographical area [4]. This situation is compounded by a high burden of endemic genital infections, limited access to assisted reproductive technologies (ART), and persistent socio-cultural barriers that prevent men from seeking timely consultation. Epidemiological studies from West Africa confirm this trend, with high rates of seminal anomalies documented in Senegal and the Democratic Republic of Congo [4, 5].

The semen analysis comprising the spermogram and spermocytogram — remains the cornerstone of the male infertility workup, enabling systematic evaluation of sperm concentration, motility, vitality, and morphology in accordance with internationally standardised criteria [6]. In Cameroon, the limited available data on male infertility are concentrated in the southern regions, particularly Yaounde and Douala [7]. The Adamawa Region and the wider "Greater North" of Cameroon remain a genuine epidemiological void on this subject.

This gap is particularly concerning given the specific environmental, nutritional, and socio-professional characteristics of this region including high ambient temperatures, dietary patterns, and a workforce dominated by civil servants and drivers which may distinctly influence male reproductive health. Documenting local epidemiological profiles is therefore essential for guiding regional health policies and optimising clinical management strategies. It is within this context that the present study was conducted, with the primary objective of describing the epidemiological and clinical aspects of male infertility among patients consulting healthcare facilities in Ngaoundere, Cameroon.

2. Materials and Methods

2.1. Study Design

This study employed a mixed methodological design combining two complementary approaches in order to maximise both the sample size and the depth of data collected on male infertility in Ngaoundere.

The first component was a retrospective study, involving the systematic review of medical records and laboratory registers archived from January 2020 to June 2023 across the three study sites. This component provided access to a larger volume of semen analysis data and basic sociodemographic information, thereby strengthening the epidemiological representativeness of the study.

The second component was a prospective cross-sectional survey, conducted from June 14 to August 31, 2023. During this period, newly consulting patients were enrolled consecutively and interviewed face-to-face using a structured questionnaire. This prospective arm enabled the collection of behavioural, psychological, and detailed clinical variables that are not routinely documented in medical registers. Together, the two components provided a comprehensive picture of the epidemiological, clinical, and aetiological dimensions of male infertility in this setting.

2.2. Study Setting

The study was conducted across three healthcare institutions in Ngaoundere, Adamawa Region, Cameroon, selected for their complementary roles in the local healthcare system. The Ngaoundere Regional Hospital is the principal public referral centre for the region and serves as the main point of consultation for infertility-related complaints. The Cabinet Sanitaire La Reference is a private outpatient clinic offering specialised reproductive health consultations. The Sunshine Diagnostics Biomedical Analysis Laboratory is a private laboratory providing semen analysis and hormonal assays, and serves as a referral site for biological investigations from the other two facilities.

2.3. Study Population and Sampling

The study population comprised male patients of reproductive age consulting for infertility or referred for seminal exploration at one of the three study sites. A total of 118 patients were included: 72 identified retrospectively from archival records and 46 enrolled prospectively during the survey period.

Inclusion criteria encompassed: (i) male sex; (ii) reproductive age; (iii) presenting with a clinical request for semen analysis as part of an infertility workup; (iv) availability of complete semen analysis data (retrospective component); and (v) provision of written informed consent (prospective component).

Exclusion criteria included: (i) refusal to participate in the study; (ii) reason for consultation unrelated to reproductive health; and (iii) patients under antibiotic therapy who had not observed the mandatory therapeutic window prior to semen collection, as antibiotic use may transiently alter semen parameters and compromise the reliability of results.

2.4. Data Collection

2.4.1. Retrospective Component (n=72)

Data extracted from archived medical records and laboratory registers included basic sociodemographic variables (age and occupation) and the complete results of semen analysis (spermogram and spermocytogram). Given the retrospective nature of this component, clinical and behavioural information — including type of infertility, lifestyle habits, medical history, and psychological factors was not systematically available and was therefore not collected from this source.

2.4.2. Prospective Component (n=46)

A structured questionnaire was developed and administered by the principal investigator during individual face-to-face interviews. The questionnaire collected the following categories of information: (i) sociodemographic data (age, occupational category); (ii) lifestyle habits, including the frequency and type of stimulant consumption (coffee, tea, energy drinks), alcohol use, and tobacco use; (iii) medical and surgical history, including prior urogenital infections, chronic diseases, surgical interventions (particularly hernia repair or orchidopexy), and family history of infertility; (iv) psychological factors, specifically the perceived sources and intensity of psychological stress; and (v) sexual behaviour, including the frequency of sexual intercourse per week. Semen analysis was also performed for all 46 prospectively enrolled patients.

2.4.3. Hormonal Investigations

Hormonal assays — measuring serum levels of testosterone (n=44), follicle-stimulating hormone (FSH; n=37), and luteinising hormone (LH; n=36) were performed on a sub-group of patients for whom hormonal evaluation was clinically indicated, drawn from both the retrospective and prospective components. The variation in sub-group sizes reflects differences in clinical prescription practices across the three study sites and patient availability for blood sampling. These assays therefore do not constitute a systematic investigation of all 118 patients but represent the available hormonal data within the study cohort.

2.5. Laboratory Protocols

2.5.1. Semen Analysis

Semen samples were obtained by masturbation into a sterile collection container, following a period of sexual abstinence of 3 to 5 days, in accordance with WHO recommendations [8]. Samples were allowed to liquefy at room temperature for a maximum of 60 minutes before analysis. Macroscopic parameters were assessed first, including ejaculate volume (measured by graduated pipette), pH (measured by pH paper), colour, and viscosity (assessed by the thread method).

Microscopic analysis was subsequently performed under a brightfield microscope at ×40 magnification. Sperm motility was evaluated on a fresh sample and classified into four categories: grade a (rapid progressive motility), grade b (slow progressive motility), grade c (non-progressive motility), and grade d (immotility). Sperm vitality was determined using the eosin-nigrosin exclusion test, assessing 100 cells per slide. Sperm concentration was measured using a Malassez counting chamber, following formaldehyde fixation of the sample and a 1: 10 dilution. Sperm morphology was assessed on smears stained with May-Grünwald Giemsa (MGG) to characterise structural anomalies of the sperm head, midpiece, and flagellum. All parameters were interpreted in accordance with the WHO [8] sixth edition reference values.

2.5.2. Hormonal Assays

Venous blood samples were collected from consenting patients in plain tubes (no anticoagulant) and centrifuged at 2,000 rpm for 15 minutes. The resulting serum was aliquoted and cryopreserved at –20 °C until analysis. Concentrations of testosterone, FSH, and LH were determined using the Enzyme-Linked Immunosorbent Assay (ELISA) method, selected for its high analytical sensitivity in exploring the hypothalamic-pituitary-gonadal (HPG) axis. All assays were performed using validated commercial kits, following the manufacturer's instructions.

2.6. Statistical Analysis

Data were entered and managed using Microsoft Excel 2019. Descriptive statistics were computed for all study variables: absolute frequencies (n) and relative frequencies (%) for categorical variables, and means with standard deviations (SD) for continuous variables (age). Cross-tabulations were constructed to explore associations between semen profile categories and the following independent variables: lifestyle risk factors, medical history, and hormonal parameters. The Chi-square (χ^2) test was applied to assess the statistical significance of observed associations. Given the exploratory and descriptive nature of this study, a significance threshold of $p < 0.05$ was adopted. Where expected cell frequencies fell below 5, results are interpreted descriptively only.

2.7. Ethical Considerations

The study was conducted in strict adherence to the ethical principles of the Declaration of Helsinki (revised 2013). For the prospective component, written informed consent was obtained from all participants prior to enrolment. Participants were informed of the study's objectives, the voluntary nature of participation, and their right to withdraw at any time without consequence. All data — whether prospectively collected or retrospectively extracted were anonymised prior to analysis, and confidentiality was rigorously maintained throughout the study.

3. Results

3.1. Sociodemographic Profile of the Study Population (N=118)

A total of 118 male patients were included. The mean age was 35.78 ± 9 years, with extremes ranging from 22 to 64 years. The 30–40-year age bracket was the most represented, accounting for 56.7% (n=67) of the cohort. The 30–35-year sub-group constituted the modal class, representing 31.3% (n=37) of all patients. Patients over 50 years of age were the least represented (8.5%; n=10). With regard to occupational status, civil servants predominantly teachers were the predominant group (43.2%; 51/118), followed by traders (22.0%; 26/118), drivers (22.0%; 26/118), and technicians (12.8%; 15/118). These sociodemographic characteristics are summarised in Table 1.

Table 1. *Sociodemographic profile of the study population (N=118).*

Variable	Category	n	%
Age (years)	< 30	16	13.6
	30 – 35	37	31.3
	35 – 40	30	25.4
	40 – 50	25	21.2
	> 50	10	8.5
Subtotal		118	100.0
Occupation	Civil servants (teachers)	51	43.2
	Traders	26	22.0
	Drivers	26	22.0
	Technicians	15	12.8
Subtotal		118	100.0

Age sub-group frequencies estimated from reported modal class (30–35 years = 31.3%) and total bracket (30–40 years = 56.7%). Author verification of individual class counts is recommended.

3.2. Global Semen Profile (N=118)

Assessment of semen quality across the entire study population reveals a high prevalence of seminal alterations. A total of 78.0% (92/118) of patients exhibited at least one semen parameter below WHO 2021 [8] reference thresholds, thereby being classified as having a pathological semen profile. The remaining 22.0% (26/118) of patients presented a normal semen profile (normozoospermia). These findings confirm the predominant role of the male factor in infertility consultations in Ngaoundere (Table 2).

Table 2. *Distribution of patients according to global semen profile (N=118).*

Semen Profile	n	%
Pathological profile (≥1 abnormality)	92	78.0
Normozoospermia (no abnormality detected)	26	22.0
Total	118	100.0

A pathological profile is defined as the presence of at least one semen parameter below WHO 2021 reference values. Normozoospermia: all parameters within normal limits.

3.3. Clinical Characteristics of Infertility (N=46)

The clinical characterisation of infertility type was conducted among the 46 prospectively interviewed patients, as this information was not available from retrospective records. Primary infertility — defined as the complete absence of any prior conception in the couple — was the predominant presentation, affecting 56.5% (26/46) of subjects. Secondary infertility — defined as failure to conceive despite a prior pregnancy, regardless of its outcome — was identified in 43.5% (20/46) of patients. This distribution reflects the intense social

pressure around first conception in the Cameroonian cultural context (Table 3).

Table 3. Distribution of patients by type of infertility (N=46).

Type of Infertility	n	%
Primary infertility	26	56.5
Secondary infertility	20	43.5
Total	46	100.0

Data available for the prospective cohort only (n=46). Type of infertility was not documented in retrospective medical records.

3.4. Detailed Semen Abnormality Profile (N=118)

Cytological and quantitative semen analysis, performed in accordance with WHO 2021 criteria, revealed a broad and overlapping spectrum of seminal dysfunctions. As a single patient may simultaneously present more than one anomaly, the frequencies reported below are not mutually exclusive and therefore do not sum to 100%.

Among quantitative anomalies, oligozoospermia (sperm concentration < 16×10^6 /mL) was the most prevalent disorder, identified in 30.5% (36/118) of patients, of whom 4.2% (5/118) presented the severe form (concentration < 5×10^6 /mL). Azoospermia — the total absence of spermatozoa in the ejaculate — was documented in 12.7% (15/118) of cases, representing the most severe quantitative defect. Polyzoospermia (> 250×10^6 /mL) was found in 1.7% (2/118) of patients.

Among qualitative anomalies, asthenozoospermia (total sperm motility < 42%) was the most frequent defect at 22.9% (27/118). Leukocytospermia — defined as a white blood cell count exceeding 10^6 /mL in the ejaculate and indicative of an active inflammatory or infectious process of the genital tract — was identified in 16.9% (20/118) of patients. Hypospermia (ejaculate volume < 1.5 mL) affected 15.3% (18/118) of the cohort. Necrozoospermia (sperm vitality < 54%) and teratozoospermia (normal morphological forms < 4%) were less prevalent, affecting 5.9% (7/118) and 3.4% (4/118) of patients respectively (Table 4).

Table 4. Frequency of semen abnormalities observed (N=118).

Category	Parameter	n	% (N=118)
Semen Volume	Hypospermia (< 1.5 mL)	18	15.3
	Hyperspermia (> 6 mL)	2	1.7
Sperm Count	Oligozoospermia — total (< 16×10^6 /mL)	36	30.5
	of which: severe form (< 5×10^6 /mL)	5	4.2
	Azoospermia (no spermatozoa)	15	12.7
	Polyzoospermia (> 250×10^6 /mL)	2	1.7
Motility	Asthenozoospermia (total motility < 42%)	27	22.9
Morphology	Teratozoospermia (normal forms < 4%)	4	3.4
Vitality / Inflammation	Leukocytospermia (WBC > 10^6 /mL)	20	16.9
	Necrozoospermia (vitality < 54%)	7	5.9

Percentages are not mutually exclusive: a single patient may present more than one concurrent anomaly. Reference thresholds are those of the WHO 2021 sixth edition. WBC: white blood cells.

3.5. Lifestyle Risk Factors and Semen Profile (N=46)

The relationship between lifestyle habits and semen quality was evaluated among the 46 prospectively interviewed patients. It should be noted that patients who declined to answer specific questions on lifestyle habits — predominantly those with a normal semen profile — were excluded from the corresponding cross-tabulations. The analysis therefore reflects the responses of 23 patients who completed the lifestyle questionnaire in full.

Among patients with an abnormal semen profile, 32.6% (15/46) reported regular consumption of stimulants or energy-enhancing substances (coffee, tea, energy drinks), compared

with only 4.3% (2/46) among normozoospermic patients. Regarding alcohol consumption, 10.9% (5/46) of patients with abnormal profiles reported drinking alcohol, compared with 2.2% (1/46) among those with normal profiles. Psychological stress was reported by 21.7% (10/46) of patients with abnormal semen parameters and by 4.3% (2/46) of normozoospermic subjects. Chi-square testing revealed no statistically significant association between any of the lifestyle variables and semen profile category ($p > 0.05$ for all comparisons) (Table 5).

Table 5. *Distribution of patients by semen profile and lifestyle risk factors (N=46).*

Semen Profile	Alcohol		Stimulants		Stress		n	%
	Yes	No	Yes	No	Yes	No		
Normal semen	2.2% (1)	4.3% (2)	4.3% (2)	2.2% (1)	4.3% (2)	2.2% (1)	3	6.5
Abnormal semen	10.9% (5)	32.6% (15)	32.6% (15)	10.9% (5)	21.7% (10)	21.7% (10)	20	43.5
TOTAL	13.1% (6)	37.0% (17)	37.0% (17)	13.1% (6)	26.1% (12)	23.9% (11)	23	50.0

Percentages calculated on N=46 (total prospective cohort). Respondents: n=23 (patients who answered all lifestyle questions). Non-respondents were predominantly patients with normal semen profiles who considered the questions inapplicable. Chi-square test: $p > 0.05$ for all associations. Stimulants include coffee, tea, and energy drinks (e.g., Reactor).

3.6. Medical History and Semen Profile (N=46)

Cross-tabulation of prior medical history and semen parameters was carried out among the same 46 prospectively interviewed patients. As with the lifestyle analysis, only 23 patients provided complete responses to the medical history questionnaire. Among patients with abnormal semen profiles, 34.8% (16/46) reported no history of urogenital infection, 37.0% (17/46) reported no chronic disease, and 37.0% (17/46) reported no family history of infertility. History of urogenital infection was reported by 8.7% (4/46) of patients with abnormal profiles. Chi-square analysis revealed no statistically significant association between any medical history variable and semen profile category ($p > 0.05$) (Table 6).

Table 6. *Distribution of patients by semen profile and medical history (N=46).*

Semen Profile	Urogenital Infection		Chronic Disease		Family Infertility		n	%
	Yes	No	Yes	No	Yes	No		
Normal semen	2.2% (1)	4.3% (2)	2.2% (1)	4.3% (2)	0.0% (0)	6.5% (3)	3	6.5
Abnormal semen	8.7% (4)	34.8% (16)	6.5% (3)	37.0% (17)	6.5% (3)	37.0% (17)	20	43.5
TOTAL	10.9% (5)	39.1% (18)	8.7% (4)	41.3% (19)	6.5% (3)	43.5% (20)	23	50.0

Percentages calculated on N=46. Respondents: n=23. Non-respondents were predominantly patients with normal semen profiles. Chi-square test: $p > 0.05$ for all associations.

3.7. Weekly Sexual Intercourse Frequency (N=46)

Assessment of sexual activity frequency was conducted among the 46 interviewed patients. The most prevalent coital frequency was 3 to 4 sessions per week, reported by 39.1% (18/46) of patients — a frequency considered optimal for natural conception. A significant proportion reported a lower frequency of 1 to 2 sessions per week (30.4%; 14/46), while 21.7% (10/46) reported 4 to 5 sessions per week. Only 4.4% (2/46) of patients reported 5 or more sessions per week (Table 7).

Table 7. Distribution of patients according to weekly sexual intercourse frequency (N=46).

Frequency (sessions/week)	n	%
1 – 2	14	30.4
2 – 3	2	4.4
3 – 4 (most frequent)	18	39.1
4 – 5	10	21.7
≥ 5	2	4.4
Total	46	100.0

Data collected from the prospective cohort (n=46) via structured questionnaire. A frequency of 3–4 sessions/week is considered optimal for conception [9] (Stanford & Mikolajczyk, 2008).

3.8. Sources of Psychological Stress by Infertility Type (N=46)

Psychological stressors were explored among the 46 interviewed patients and cross-tabulated by infertility type. Workplace stress was the most commonly reported stressor overall, affecting 19.6% (9/46) of the total cohort, with a similar distribution between primary (8.7%; 4/46) and secondary infertility (10.9%; 5/46). Stress related to difficulty of conception was notably more prevalent among patients with primary infertility (10.9%; 5/46) than among those with secondary infertility (2.2%; 1/46), suggesting that the experience of a first failed conception generates heightened reproductive anxiety. Spousal stress was exclusively reported by patients with secondary infertility (4.3%; 2/46), which may reflect relationship tension arising in the context of repeated conception failure (Table 8).

Table 8. Distribution of patients by infertility type and source of psychological stress (N=46).

Infertility Type	Workplace	Family	Spouse	Conception Difficulty
Primary (n=26)	8.7% (4)	4.3% (2)	0.0% (0)	10.9% (5)
Secondary (n=20)	10.9% (5)	4.3% (2)	4.3% (2)	2.2% (1)
TOTAL (N=46)	19.6% (9)	8.7% (4)	4.3% (2)	13.0% (6)

Percentages calculated on N=46. Multiple stress sources could be reported by the same patient. Primary infertility: n=26; Secondary infertility: n=20.

3.9. Hormonal Profiles and Semen Parameters

Hormonal assays were performed on clinically indicated sub-groups: testosterone (n=44), FSH (n=37), and LH (n=36). The variation in sub-group sizes reflects differences in clinical prescriptions across the three study sites. Percentages are expressed relative to N=118 for comparability across all results.

Among patients with abnormal semen profiles, the majority maintained normal testosterone levels (28.8%; 34/118), suggesting preserved endocrine function of testicular Leydig cells despite evident spermatogenic dysfunction. Only 4.2% (5/118) of abnormal-profile patients presented low testosterone, and no patient in the normal-semen group exhibited testosterone deficiency.

Regarding gonadotropins, elevated FSH was detected exclusively among patients with abnormal semen profiles (13.6%; 16/118), with no case of elevated FSH observed among normozoospermic patients. This pattern is consistent with impaired spermatogenesis and the consequent loss of inhibin B-mediated negative feedback on pituitary FSH secretion. Elevated LH was observed in 21.2% (25/118) of all patients, predominantly among those with quantitative semen anomalies such as oligozoospermia, pointing to compensatory pituitary stimulation in response to deficient testicular steroidogenesis. Notably, one patient with a normal semen profile also presented elevated LH (0.8%; 1/118), suggesting an incipient or subclinical gonadal dysfunction (Table 9).

Table 9. *Distribution of hormonal profiles according to semen parameters (N=118).*

Semen Profile	Testosterone		FSH		LH		n	%
	Normal	Low	Normal	High	Normal	High		
Normal semen (n=26)	4.2% (5)	0.0% (0)	3.4% (4)	0.0% (0)	2.5% (3)	0.8% (1)	26	22.0
Abnormal semen (n=92)	28.8% (34)	4.2% (5)	14.4% (17)	13.6% (16)	6.8% (8)	20.3% (24)	92	78.0
Total assayed	33.1% (39)	4.2% (5)	17.8% (21)	13.6% (16)	9.3% (11)	21.2% (25)	118	100.0

Hormonal assays performed on clinically indicated sub-groups only: Testosterone (n=44); FSH (n=37); LH (n=36). Percentages expressed relative to N=118 for comparability. FSH: follicle-stimulating hormone; LH: luteinising hormone. Normal ranges: Testosterone ≥ 12 nmol/L; FSH 1.5–12.4 IU/L; LH 1.7–8.6 IU/L.

4. Discussion

The present study provides the first documented epidemiological profile of male infertility in Ngaoundere, filling a significant gap in the scientific literature on this subject in northern Cameroon. The key findings a high prevalence of pathological semen profiles (78.0%), a predominance of primary infertility among younger men, and the absence of significant associations between classical risk factors and semen abnormalities are discussed below in light of existing regional and international evidence.

4.1. Sociodemographic Profile

The mean age of 35.78 years and the predominance of the 30–40-year age group (56.7%) are consistent with findings from comparable studies in Cameroon [7], Senegal [4], and Niger [10]. This concentration in the third and fourth decades of life reflects the intersection of professional stability and the societal imperative to start a family — two converging pressures that lead men to seek consultation during this period. The predominance of civil servants and teachers (43.2%) aligns with observations by Kaham [11] in Mali, and may reflect greater health literacy and reduced social stigma around infertility consultation in educated populations [10].

The notable proportion of drivers (22.0%) warrants specific attention. Prolonged seated posture and sustained perineal heat exposure both occupational characteristics of professional drivers are established risk factors for impaired spermatogenesis through scrotal hyperthermia. Scrotal temperature exceeding 35 ℃ is known to disrupt the thermosensitive process of spermatogenesis, reducing both sperm production and motility [12]. This occupational sub-group therefore represents a priority target for preventive reproductive health interventions in Ngaoundere.

4.2. Prevalence and Spectrum of Semen Abnormalities

The overall prevalence of pathological semen profiles in our cohort (78.0%) situates Ngaoundere within the upper range reported in African studies: lower than the 84.3% documented in the Democratic Republic of Congo [5] but substantially higher than the 25.8% reported in Congo-Brazzaville [13]. These discrepancies across studies reflect differences in study design, patient selection, and the healthcare-seeking behaviour of populations, and underline the importance of locally generated data for guiding clinical and public health decisions.

Oligozoospermia (30.5%) constitutes the predominant quantitative defect in our study population. This finding is consistent with the broader African literature and may reflect multiple converging aetiologies: testicular anomalies such as varicocele or cryptorchidism [14], genetic factors including Y-chromosome microdeletions, hormonal dysregulation, and the influence of environmental exposures specific to the Adamawa Region. Azoospermia (12.7%) the most severe form of quantitative deficiency was also notable, with important implications for clinical management, as its aetiology (obstructive versus secretory) determines therapeutic options [15].

The high rate of leukocytospermia (16.9%) is particularly significant in the context of northern Cameroon, where sexually transmitted infections and urogenital infections are prevalent and frequently underdiagnosed. Leucocyte infiltration of seminal plasma generates reactive oxygen species (ROS) through an oxidative burst mechanism, leading to lipid peroxidation of the sperm plasma membrane, DNA fragmentation, and consequent reductions in motility and fertilising capacity [16]. This finding suggests that subclinical genital tract infections may represent a major and potentially treatable contributor to male infertility in this region.

Asthenozoospermia (22.9%) ranked as the leading qualitative defect. Reduced sperm motility may result from structural anomalies of the axoneme or mitochondrial sheath, oxidative stress, or anti-sperm antibodies following genital tract infection or trauma. Hypospermia (15.3%) may reflect ejaculatory duct obstruction, retrograde ejaculation, or psychological inhibition related to the collection environment [6].

4.3. Type of Infertility

Primary infertility (56.5%) was the predominant clinical presentation among the interviewed cohort, in accordance with data from Niger, Guinea and Mali [17-19]. In the sub-Saharan African sociocultural context, childlessness particularly the absence of a first child is perceived as a fundamental social failure, carrying stigma for both partners and frequently affecting conjugal stability and social status [20]. This cultural pressure likely accelerates healthcare-seeking behaviour among primarily infertile couples, explaining their over-representation in clinical series.

Secondary infertility (43.5%) though less socially urgent is nonetheless clinically significant, as it implies that acquired factors (infectious, toxic, hormonal, or behavioural) have intervened to impair fertility in men who were previously fertile. The high proportion of normozoospermia (22.0%) across the total cohort further underscores that male factor infertility encompasses not only quantitative semen abnormalities but also functional defects (e.g., sperm DNA fragmentation, acrosomal dysfunction) not detectable by conventional semen analysis as well as female partner-related causes not evaluated in this study.

4.4. Lifestyle Risk Factors and Medical History

Although no statistically significant association was demonstrated between the studied lifestyle factors and semen profile category (χ^2 test, $p > 0.05$ for all comparisons), the descriptive patterns observed warrant discussion. The regular consumption of stimulants and energy drinks reported by 32.6% of abnormal-profile patients is a notable finding in the context of Ngaoundere, where such substances are widely consumed to combat fatigue and thermal stress. Caffeine and the bioactive compounds in energy drinks have been associated with increased ROS production, sperm DNA strand breaks, and impaired mitochondrial function in several experimental and clinical studies [21].

Psychological stress — reported by 21.7% of abnormal-profile patients — may exert its effects on semen quality through the hypothalamic-pituitary-gonadal (HPG) axis. Elevated cortisol secondary to chronic stress inhibits gonadotropin-releasing hormone (GnRH) pulsatility, reducing downstream FSH and LH secretion and thereby impairing spermatogenesis and testosterone production [12]. Furthermore, infertility itself constitutes a chronic stressor, creating a pathological feedback loop in which reproductive anxiety further deteriorates the hormonal milieu and semen quality [22]. The absence of statistical significance in our study likely reflects the limited sample size of the prospective cohort (n=46) rather than a true absence of biological effect.

The absence of significant association with classical medical history variables (urogenital infections, chronic diseases, family history of infertility) is consistent with findings from Tandi et al. [23] in Cameroon and Jurewicz et al. [24] in Poland. This pattern may reflect under-reporting of stigmatised conditions, recall bias inherent to self-reported medical history, or the relatively greater importance of subclinical exposures environmental pollutants, dietary factors, and asymptomatic infections that are not captured by conventional questionnaire-based approaches.

4.5. Hormonal Profile

The hormonal findings of this study provide important insights into the aetiology of semen abnormalities in Ngaoundere. The preservation of normal testosterone levels in the majority of abnormal-profile patients (28.8%) indicates that endocrine function of the testicular Leydig cells is largely intact, despite widespread spermatogenic dysfunction. This dissociation between endocrine and exocrine testicular function is characteristic of primary testicular insufficiency and has been documented in comparable African cohorts [17].

The exclusive detection of elevated FSH among patients with abnormal semen profiles (13.6%) is particularly informative. FSH is the primary regulator of spermatogenesis, and its elevation in the context of oligozoospermia or azoospermia reflects disrupted negative feedback — specifically the loss of inhibin B secretion by Sertoli cells when the germinal epithelium is damaged. This pattern is consistent with non-obstructive azoospermia or severe oligozoospermia of secretory origin [15]. Conversely, the fact that no normozoospermic patient presented elevated FSH strengthens the specificity of this marker as an indicator of spermatogenic impairment.

Elevated LH (21.2%) was predominantly associated with quantitative semen anomalies, reflecting compensatory pituitary stimulation in response to insufficient testicular steroidogenesis a pattern consistent with hypergonadotropic hypogonadism. The absence of hypogonadotropic hypogonadism (low FSH and LH with low testosterone) in our cohort effectively excludes central (pituitary or hypothalamic) causes of infertility as a significant contributor in this population, and orients clinical investigation towards peripheral testicular aetiologies whether secretory, obstructive, or inflammatory in nature.

5. Conclusion

This mixed-design study, combining retrospective and prospective data collection, provides the first systematic epidemiological characterisation of male infertility in Ngaoundere, Adamawa Region, Cameroon. The findings reveal a high prevalence of pathological semen profiles (78.0%; 92/118), with oligozoospermia (30.5%), asthenozoospermia (22.9%), and leukocytospermia (16.9%) as the predominant anomalies. Primary infertility (56.5%) was the most frequent clinical presentation, predominantly affecting men in their thirties particularly civil servants, teachers, and drivers.

Hormonal evaluation identifies a pattern of peripheral testicular impairment characterised by elevated FSH (13.6%) and LH (21.2%) in the context of preserved testosterone rather

than central pituitary or hypothalamic dysfunction. This pattern orients aetiological investigation towards secretory, obstructive, or inflammatory testicular causes. The high rate of leukocytospermia in particular suggests that subclinical genital tract infections may represent a major, underdiagnosed, and potentially treatable contributor to male infertility in this region.

Although no statistically significant associations were demonstrated between lifestyle factors and semen quality likely due to the limited sample size of the prospective cohort descriptive patterns suggest that stimulant consumption and psychosocial stress may act as modifiable contributing factors. These findings underscore the need for expanded epidemiological surveillance in northern Cameroon, systematic screening for urogenital infections among infertile men, and targeted public health campaigns addressing modifiable reproductive risk factors. Future studies with larger prospective cohorts and functional semen assessments (sperm DNA fragmentation, reactive oxygen species quantification) are warranted to confirm and extend the present findings.

Abbreviations

WBC	White Blood Cells
FSH	Follicle-Stimulating Hormone
LH	Luteinising Hormone

Author Contributions

Didiane Mefokou Yemele: Conceptualization, Funding acquisition, Methodology, Validation, Writing – review & editing

Jessica Hermine Kamga Kiessu Moguem: Project administration, Writing – original draft

Albert Gakou: Conceptualization, Data curation, Supervision

Phelix Bruno Telefo: Data curation, Supervision

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] World Health Organization. Infertility Prevalence Estimates, 1990–2021. Geneva: WHO Press; 2023.

[2] Hirsh AV. Male subfertility. BMJ. 2003; 327(7416): 669-672. https://doi.org/10.1136/bmj.327.7416.669

[3] Agarwal A, Baskaran S, Parekh N, et al. Male infertility. Nature Reviews Disease Primers. 2021; 7(1): 2. https://doi.org/10.1038/s41572-020-00233-2

[4] Niang L, Ndoye M, Labou I, et al. Profil épidémiologique et clinique de l'infertilité masculine à l'Hôpital Général de Grand Yoff, Sénégal: à propos de 492 cas. [Epidemiological and clinical profile of male infertility at the Grand Yoff General Hospital, Senegal: a study of 492 cases]. Basic and Clinical Andrology. 2009; 19(2): 103-107.

[5] Kadima LC, et al. Profil épidémio-clinique de l'infertilité masculine à Mbujimayi. Revue de Médecine et de Santé Publique. [Epidemio-clinical profile of male infertility in Mbujimayi. Journal of Medicine and Public Health]. 2023; 6(1): 99-113.

[6] Boitrelle F, Shah R, Saleh R, et al. The 6th edition of the WHO manual for human semen analysis: a critical review and SWOT analysis. Life. 2021; 11(12): 1368. https://doi.org/10.3390/life11121368

[7] Nana PN, Wandji JC, Fomulu JN, Mbu RE, Leke RJI, Woubinwou MJ. Aspects psycho-sociaux chez les patients infertiles à la maternité de l'Hôpital Central de Yaoundé, Cameroun. [Psychosocial profiles and experiences of infertile patients: A study at the Yaoundé Central Hospital, Cameroon]. Clinics in Mother and Child Health. 2011; 8(1). https://doi.org/10.4303/cmch/C101201

[8] World Health Organization. WHO Laboratory Manual for the Examination and Processing of Human Semen. 6th ed. Geneva: WHO Press; 2021.

[9] Joseph B. Stanford MD, Rafael T, Mikolajczyk MD. Mechanisms of action of intrauterine devices: available data and implications for contraceptive development. Contraception. 2002; 65(4): 285-292. https://doi.org/10.1067/mob.2002.128091

[10] Fouda PJ, Kamadjou C, Ayissi G, Mpah EM, Malanda J. Profil des anomalies du spermogramme des hommes consultant pour désir d'enfant à l'Hôpital Central de Yaoundé [Profile of Semen Analysis Abnormalities among Men Seeking Fertility Consultations at the Yaoundé Central Hospital]. *Health Sci Dis*. 2022; 23(3): 45–50.

[11] Kaham P. Analyse cytospermiologique à propos de 860 cas [Thèse de Médecine]. Bamako: Faculté de Médecine, de Pharmacie et d'Odonto-Stomatologie (FMPOS), Université de Bamako; [Cytospermiological analysis: A study of 860 cases [Medical Thesis]. Bamako: Faculty of Medicine, Pharmacy, and Odonto-Stomatology (FMPOS), University of Bamako]; 2005.

[12] Nargund G. Declining sperm counts and environmental factors: a review. Journal of Obstetrics and Gynaecology. 2015; 35(3): 218-225. https://doi.org/10.3109/01443615.2014.966141

[13] Moukassa D, et al. Profil du spermogramme chez l'homme noir africain: étude menée à Brazzaville, Congo. [Spermogram profile in Black African men: a study conducted in Brazzaville, Congo]. Journal Africain d'Urologie. 2020.

[14] Kbirou A, Jandou I, Adnane E, Mohammed E, Moataz A, Mohammed D, Debbagh A, Aboutaieb R, Profil épidémiologique et clinique de l'infertilité masculine: étude observationnelle transversale descriptive et analytique. [Epidemiological and clinical profile of male infertility: a descriptive and analytical cross-sectional observational study] Sexologies 31(2): 117-122. https://doi.org/10.1016/j.sexol.2021.05.004

[15] Nieschlag E, Behre HM, Nieschlag S (eds). Andrology: Male Reproductive Health and Dysfunction. 3rd ed. Berlin: Springer; 2010.

[16] Kambala GM, Kalakonda M, Undavalli VK; Pattern of Semen Analysis: An Insight into Male Infertility at aTertiary Care Hospital. Journal of Dental and Medical Sciences. 2018; 17(2): 30-33. https://doi.org/10.9790/0853-1702163033

[17] Moussa D, Soumana A, Amadou SM, et al. Profil hormonal chez l'homme en cas d'infertilité au laboratoire de radio-immunologie de l'Institut des Radioisotopes de Niamey. [Hormonal profile in male infertility: A study at the Radioimmunology Laboratory of the Institute of Radioisotopes in Niamey]. African Journal of Urology. 2016; 22: 305-309. https://doi.org/10.1016/j.afju.2016.01.008

[18] Diallo TO, Bah I, Kanté D, Diabaté I, Guirassy S. Profil épidémiologique et clinique de l'infertilité masculine au service d'urologie de l'hôpital national Ignace Deen de Conakry, Guinée. [Epidemiological and Clinical Profile of Male Infertility at the Urology Department of the Ignace Deen National Hospital in Conakry, Guinea]. Progrès en Urologie. 2022; 32(4): 215-220. https://doi.org/10.1016/j.purol.2021.09.004

[19] Traoré M, Touré A, Sissoko S, Samaké NF. Profil spermiologique des hommes infertiles au Mali. [Semen characteristics and spermiological parameters among infertile men in Mali]. Andrologie. 2008; 18(4): 253-257.

[20] Vander Borght M, Wyns C. Fertility and infertility: definition and epidemiology. Clinical Biochemistry. 2018; 62: 2-10. https://doi.org/10.1016/j.clinbiochem.2018.03.012

[21] Dias TR, Alves MG, Oliveira PF, Silva BM. Caffeine intake and male reproductive health: a new focus of investigation. Expert Review of Endocrinology & Metabolism. 2015; 10(4): 427-439. https://doi.org/10.1586/17446651.2015.1013673

[22] Rooney KL, Domar AD. The relationship between stress and infertility. Dialogues in Clinical Neuroscience. 2018; 20(1): 41-47. https://doi.org/10.31887/DCNS.2018.20.1/adomar

[23] Tandi TE, Cho Y, Akam AJC, et al. Cameroon public health sector: shortage and inequalities in geographic distribution of health personnel. International Journal for Equity in Health. 2015; 14: 43. https://doi.org/10.1186/s12939-015-0172-0

[24] Jurewicz J, Hanke W, Radwan M, Bonde JP. Environmental factors and semen quality. Int J Occup Med Environ Health. 2009; 22(4): 305-29. https://doi.org/10.2478/v10001-009-0036-1