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Research Article

Hormonal Profiles And Aetiologies Of Infertility Among Women Attending The Assisted Reproductive Technology Unit At Douala Gynaeco-Obstetric And Paediatric Hospital, Cameroon.

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Abstract

Background: Hormonal assessment is essential for ovulation and ovarian reserve evaluation, but data from Cameroon's infertility services remain limited. The study described hormonal profiles in women receiving infertility care at HGOPED, compared distributions by age, body mass index (BMI), and aetiology, and described infertility types and indications for assisted reproductive technology (ART).

Methods: We conducted a retrospective descriptive study using records dated January 2024 to December 2025. Women aged >18 years with infertility and at least one valid luteinising hormone (LH), follicle-stimulating hormone (FSH), oestradiol, or anti-Müllerian hormone (AMH) result were eligible. Quantitative variables were summarised using means or medians, and qualitative variables as n/N (%). Kruskal–Wallis tests and Spearman correlations were applied with Benjamini–Hochberg correction.

Results: Mean age was 34.0 ± 7.2 years (n = 24). Secondary infertility accounted for 13/24 (54.2%) of cases, and irregular cycles for 14/22 (63.6%). Median hormone concentrations were 10.42 IU/L for LH (n = 23), 60.00 pg/mL for oestradiol (n = 20), 1.70 ng/mL for AMH (n = 21), and 8.90 IU/L for FSH (n = 24). The leading standardised aetiology was ovarian/ovulatory (24.0%). Differences in AMH and oestradiol concentrations across age groups were not statistically significant after adjustment (adjusted P = 0.058). Age was inversely correlated with AMH (ρ = −0.628; adjusted P = 0.011) and positively correlated with oestradiol (ρ = 0.595; adjusted P = 0.011).

Conclusion: Secondary infertility, irregular cycles, and ovarian/ovulatory aetiologies predominated at HGOPED.

Keywords: Infertility, Female; Ovarian Reserve; Anti-Müllerian Hormone; Follicle Stimulating Hormone; Reproductive Techniques, Assisted; Cameroon.

INTRODUCTION

Infertility is a disease of the male or female reproductive system, usually identified after 12 months of regular unprotected sexual intercourse without achieving pregnancy; contemporary international terminology also more broadly recognises impairment of an individual's or couple's reproductive capacity [1]. Approximately one in six people of reproductive age experience infertility during their lifetime [2,3]. Its impact extends beyond the absence of pregnancy and includes psychological distress, social stigma, financial hardship, and inequities in access to fertility care, particularly in low- and middle-income countries [3,4].

Diagnostic evaluation should be systematic, undertaken without unjustified delay, and centred on the couple. It generally includes assessment of ovulation and ovarian reserve, anatomical evaluation of tubal and uterine factors, and analysis of semen parameters [5,6]. Basal FSH and oestradiol provide cycle-dependent information on the hypothalamic–pituitary–ovarian axis, whereas AMH and antral follicle count are widely used to estimate ovarian response to stimulation [7,8]. These markers should be interpreted in relation to age, menstrual history, ultrasound findings, assay method, and clinical context; they predict

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the number of oocytes retrieved more consistently than spontaneous fecundability or live birth [7–9].

Endocrine and gynaecological disorders overlap in infertility care. Polycystic ovary syndrome (PCOS) is a common cause of oligo-anovulation; the 2023 international guidelines permit the use of AMH to help identify polycystic ovarian morphology in adults, but only within a validated diagnostic pathway and not as a stand-alone test [10,11]. Endometriosis, tubal disease, uterine disorders, and male factors may coexist and require integrated assessment [12–15]. In Douala, local studies have identified reproductive tract infections, fibroids, a history of pelvic surgery, and chronic pelvic pain as important factors associated with infertility and tubal damage [4,14].

Access to assisted reproductive technology remains unequal in sub-Saharan Africa. Availability in the public sector is limited, while high out-of-pocket expenditure, insufficient human resources, and the geographical concentration of services restrict access to care [16,17]. Context-specific clinical data are therefore needed to organise diagnostic pathways and rationalise indications for ovulation induction, intrauterine insemination (IUI), in vitro fertilisation (IVF), and intracytoplasmic sperm injection (ICSI).

Accordingly, the primary objective of this study was to analyse the hormonal profile of women receiving infertility care at HGOPED.

METHODS

Study design, period, and setting

This was a retrospective, descriptive, single-centre study based on clinical records dated from 1 January 2024 to 31 December 2025. The study was conducted in the outpatient gynaecology and assisted reproductive technology units of Douala Gynaeco-Obstetric and Paediatric Hospital (HGOPED), a referral hospital in Douala, Cameroon.

Study population and eligibility criteria

The target population comprised women consulting for infertility and receiving care through the HGOPED ART pathway. We used exhaustive, non-probability sampling of all eligible records. Inclusion criteria were age >18 years, documented primary or secondary infertility, follow-up in the HGOPED ART unit, and at least one valid female hormone result for LH, FSH, oestradiol, or AMH. Exclusion criteria were pregnancy; contraceptive use or hormonal treatment during the preceding three months; an active non-gynaecological endocrine disorder likely to invalidate interpretation; recent ovarian surgery; and absence of any valid hormone measurement.

Thirty records were collected during the study period. Five contained no female hormone result and were excluded from the primary analysis; data from 25 women were therefore analysed. Because exhaustive sampling was used, no a priori sample size calculation was performed.

Variables and definitions

Sociodemographic variables included age, place of residence, marital status, educational level, height, weight, and BMI. Reproductive variables included gravidity, parity, menstrual cycle regularity, age at menarche, type and duration of infertility, previous treatments, partner assessment, and availability of a semen analysis. Primary infertility was defined as no previous pregnancy, whereas secondary infertility was infertility occurring after at least one previous pregnancy [1].

Infertility aetiology was standardised into eight categories: ovarian/ovulatory, tubal, uterine, male, endometriosis/pelvic, mixed, unexplained, or undocumented. In the study protocol, diminished ovarian reserve was defined by a low age-specific AMH concentration and/or reduced antral follicle count and/or elevated FSH in the early follicular phase. A diagnosis of PCOS required oligo-anovulation and/or hyperandrogenism together with compatible ultrasound or AMH findings interpreted within a recognised diagnostic framework [10,11]. Unexplained infertility was a diagnosis of exclusion following adequate evaluation of both partners [13]. ART variables captured whether an indication was present and the intervention proposed or performed: ovulation induction, IUI, IVF, or ICSI.

Data sources, measurement, and bias control

Data were abstracted from existing clinical and assisted reproductive technology records using the study data-collection framework. Hormone concentrations were analysed as documented in the records; assay platforms were not consistently recorded and assay-level harmonisation was therefore not possible. To limit selection and classification bias, all eligible records were reviewed, predefined eligibility criteria were applied, aetiologies were standardised before analysis, and variable-specific denominators were reported.

Statistical analysis

Analyses were performed using R version 4.5.0 for Windows. Quantitative variables were summarised as mean ± standard deviation (SD) when informative and as median with interquartile range (IQR) because of the small sample sizes and non-normal distributions. Qualitative variables were presented as n/N (%) to make variable-specific denominators explicit. Normality of hormone distributions was assessed using the Shapiro–Wilk test; oestradiol and AMH deviated from normality ($P < 0.001$ and $P = 0.013$, respectively). Analyses used available cases for each variable; missing observations were not imputed.

Age was grouped into four categories: <30, 30–34, 35–39, and ≥40 years. BMI categories followed World Health Organization

thresholds. Kruskal–Wallis tests compared hormone distributions across age, BMI, and standardised aetiological groups. Spearman coefficients quantified associations between age and each hormone. The false discovery rate was controlled using the Benjamini–Hochberg procedure within predefined families of related tests [22]. A two-sided adjusted P value <0.05 was considered statistically significant.

Ethical considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki. The protocol was submitted for evaluation to the Ethics Committee of Douala Gynaeco-Obstetric and Paediatric Hospital, and research authorisation No. 2026/0036/L/HGOPED/DG/DGA/DHRI/SRI was obtained. Because this retrospective study used existing coded medical records without direct participant contact, the requirement for individual written informed consent was waived in accordance with applicable institutional procedures. Data were anonymised and handled confidentially with access restricted to the research team.

Reporting guideline, registration, and use of generative AI

The manuscript was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [21]. Trial registration was not applicable because this was a retrospective observational study and no intervention was assigned. ChatGPT (OpenAI) was used as an assistive tool for language editing, translation, manuscript structuring, and formatting; it was not used to generate, alter, or analyse study data. All suggestions were checked and revised by the authors, who retain full responsibility for the manuscript.

RESULTS

Record selection and participant characteristics

Thirty records were reviewed, and five were excluded because they contained no female hormone measurement. The analytical sample comprised 25 records. Mean age was 34.0 ± 7.2 years, and median age was 33.5 years (IQR, 27.8–39.0). Mean BMI was 26.0 ± 4.5 kg/m². Median duration of infertility was 4.0 years (IQR, 2.0–7.2). Secondary infertility accounted for 13/24 (54.2%) of cases, and irregular cycles for 14/22 (63.6%) (**Table 1**).

Table 1. Sociodemographic and reproductive characteristics of the analytical sample.

Variable	Measure/category	Value
Age (years)	Mean ± SD; median [IQR]	34.0 ± 7.2; 33.5 [27.8–39.0] (n = 24)
BMI (kg/m²)	Mean ± SD; median [IQR]	26.0 ± 4.5; 25.9 [23.6–28.9] (n = 18)
Duration of infertility (years)	Median [IQR]	4.0 [2.0–7.2] (n = 24)
Age group (years)	<30 30–34 35–39 ≥40	8/24 (33.3%) 5/24 (20.8%) 6/24 (25.0%) 5/24 (20.8%)
Marital status	Married Cohabiting Single Divorced	17/25 (68.0%) 3/25 (12.0%) 3/25 (12.0%) 2/25 (8.0%)
Type of infertility	Primary Secondary	11/24 (45.8%) 13/24 (54.2%)
Menstrual cycle	Regular Irregular	8/22 (36.4%) 14/22 (63.6%)

Hormonal profile

At least one hormone result was available for every included record, although completeness varied. LH was available for 23 participants, oestradiol for 20, AMH for 21, and FSH for 24. Median concentrations were 10.42 IU/L for LH, 60.00 pg/mL for oestradiol, 1.70 ng/mL for AMH, and 8.90 IU/L for FSH (**Table 2**).

Table 2. Hormone concentrations in the analytical sample.

Hormone	Mean ± SD	Median [IQR]	Minimum–maximum
LH (IU/L)	9.86 ± 3.08	10.42 [7.80–11.90]	1.77–14.59
Oestradiol (pg/mL)	67.81 ± 43.31	60.00 [47.50–69.00]	30.25–241.60
AMH (ng/mL)	2.34 ± 2.08	1.70 [0.70–3.10]	0.10–7.07
FSH (IU/L)	10.19 ± 4.41	8.90 [7.08–13.80]	3.23–18.20

AMH, anti-Müllerian hormone; FSH, follicle-stimulating hormone; IQR, interquartile range; LH, luteinising hormone; SD, standard deviation.

Infertility aetiologies and indications for ART

The leading aetiologies were ovarian/ovulatory factors (6/25; 24.0%), mixed factors (5/25; 20.0%), and tubal factors (4/25; 16.0%). Uterine and male factors each accounted for 3/25 (12.0%) (Table 3).

The intervention proposed or performed was IVF in 7/25 cases (28.0%), ICSI in 3/25 (12.0%), ovulation induction in 3/25 (12.0%), IUI in 2/25 (8.0%), and combined ovulation induction and IUI in 1/25 (4.0%) (**Table 3**).

Table 3. Standardised infertility aetiologies and ART modalities proposed or performed.

Category	n	%
Infertility aetiology		
Ovarian/ovulatory	6	24
Mixed	5	20
Tubal	4	16
Uterine	3	12
Male	3	12
Undocumented	2	8
Unexplained	1	4
Endometriosis/pelvic	1	4
ART modality		
IVF	7	28
Ovulation induction	3	12
ICSI	3	12
IUI	2	8
Ovulation induction + IUI	1	4

ART, assisted reproductive technology; ICSI, intracytoplasmic sperm injection; IUI, intrauterine insemination; IVF, in vitro fertilisation.

Hormone distributions by age, BMI, and aetiology

AMH concentrations decreased across age groups, from a median of 4.80 ng/mL among women aged <30 years to 0.50 ng/mL among those aged ≥40 years. Oestradiol increased across the same groups. Unadjusted age-group tests yielded P = 0.029 for both AMH and oestradiol; after Benjamini–Hochberg correction within the four-hormone family, both adjusted P values were 0.058 (Table 4). LH and FSH did not differ significantly across age groups.

In Spearman analyses, age was inversely correlated with AMH (ρ = −0.628; n = 20; adjusted P = 0.011) and positively correlated with oestradiol (ρ = 0.595; n = 20; adjusted P = 0.011). Correlations with LH (ρ = −0.203; adjusted P = 0.485) and FSH (ρ = 0.089; adjusted P = 0.685) were not statistically significant.

Table 4. Hormone concentrations by age group.

	Age group				
Hormone	**<30 years**	**30–34 years**	**35–39 years**	**≥40 years**	**Adjusted P**
LH (IU/L)	12.92 [10.91–13.65] (n = 7)	7.40 [7.00–8.20] (n = 5)	9.35 [8.75–10.32] (n = 6)	11.60 [9.93–12.52] (n = 4)	0.094
Oestradiol (pg/mL)	54.50 [46.00–61.50] (n = 6)	48.00 [45.00–59.00] (n = 5)	61.00 [54.00–72.00] (n = 5)	84.00 [76.75–126.40] (n = 4)	0.058
AMH (ng/mL)	4.80 [2.13–6.00] (n = 7)	2.60 [2.40–2.90] (n = 5)	1.30 [0.90–1.50] (n = 5)	0.50 [0.35–0.55] (n = 3)	0.058

FSH (IU/L)	6.70 [5.70–13.82] (n = 7)	7.80 [7.50–8.10] (n = 5)	10.20 [9.38–12.23] (n = 6)	13.70 [5.32–15.30] (n = 5)	0.649

Values are medians [IQR] (available n). P values from Kruskal–Wallis tests were adjusted using the Benjamini–Hochberg procedure for the four hormone comparisons across age groups.

DISCUSSION

Main findings

Among the 25 records containing at least one hormone result, the median hormonal profile was as follows: LH, 10.42 IU/L; oestradiol, 60.00 pg/mL; AMH, 1.70 ng/mL; and FSH, 8.90 IU/L. Secondary infertility and irregular cycles were common. Ovarian/ovulatory, mixed, and tubal factors were the leading aetiological categories.

Interpretation of the hormonal profile

The age-related decline in the follicular pool is biologically accompanied by reductions in AMH and antral follicle count, followed by an increase in FSH during the early follicular phase. AMH and antral follicle count are useful predictors of ovarian response to stimulation, whereas basal FSH and oestradiol are more variable and depend on cycle timing [7–9,20]. ESHRE ovarian stimulation guidelines recommend AMH or antral follicle count for predicting a high or low response [8]. However, ovarian reserve tests should not be equated with measures of oocyte quality or the probability of spontaneous conception: population-based studies have shown that a low AMH concentration or elevated FSH does not necessarily predict reduced short-term fecundability [19]. Irregular cycles were present in nearly two-thirds of records with menstrual information, and ovarian/ovulatory causes were the most frequent aetiological group. This finding is consistent with the central role of ovulatory disorders in infertility assessment [5,6]. However, the dataset contained neither female androgen nor prolactin values and provided no analysable data on thyroid function or antral follicle count. Consequently, PCOS, hyperprolactinaemia, thyroid-related ovulatory disorders, and diminished ovarian reserve could not be rigorously classified. Updated PCOS guidelines emphasise that AMH should not be used as a stand-alone diagnostic test and that assay method, age, and population characteristics must be considered [10,11]. Although no BMI-related hormone differences were detected after correction, obesity may influence ovulatory function and treatment response [18].

Aetiological context and couple assessment

Tubal factors accounted for 16.0% of cases and contributed to several mixed aetiologies. This finding is clinically relevant in Douala, where previous studies have associated tubal infertility with Chlamydia and Mycoplasma infections, uterine fibroids, pelvic surgery, and chronic pelvic pain [14]. Another multicentre study in Douala also associated infertility with reproductive tract infections, fibroids, dysmenorrhoea, and a history of abortion [4]. The present data do not permit estimation of these associations, but they support systematic documentation of infectious history, hysterosalpingography, pelvic ultrasound, and previous surgical procedures during the prospective phase.

Male factors accounted for 12.0% of standardised aetiologies and contributed to mixed cases; however, partner assessment was documented in only 48.0% of records, and a semen analysis was available in only 48.0%. Contemporary infertility care requires parallel assessment of both partners because male factors may be isolated or contributory causes and may reveal treatable or clinically important conditions [6,15]. Improving completeness of couple-level data is therefore a higher-priority quality objective than merely expanding female hormonal assessment.

Implications for ART

IVF was the most frequently recorded ART modality, followed by ICSI and ovulation induction. In principle, treatment selection should consider the couple's aetiology, age, duration of infertility, ovarian reserve, semen findings, tubal status, and previous treatments. ESHRE guidelines recommend IUI with ovarian stimulation as a first-line option for some couples with unexplained infertility, whereas IVF or ICSI may be indicated in cases of tubal disease, severe male factor infertility, advanced reproductive age, or failure of a less complex treatment [13].

In Africa, ART remains uncommon in the public sector and is generally financed through household out-of-pocket expenditure [16,17]. Our data may therefore help identify avoidable diagnostic delays and plan therapeutic pathways suited to available resources.

Strengths and limitations

This study documents hormonal profiles and infertility aetiologies among women attending the assisted reproductive technology unit at Douala Gynaeco-Obstetric and Paediatric Hospital. However, it was a single-centre study, and the findings cannot be generalised to the Cameroonian population.

CONCLUSION

This study highlights the predominance of secondary infertility and ovarian/ovulatory causes among women attending

the HGOPED ART unit. The observed hormonal variations, particularly the decline in AMH with age, underscore the importance of early, individualised hormonal assessment to guide care effectively. Larger multicentre studies are needed to confirm these findings.

Declarations

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing/Conflicts of Interest

All authors declare that they have no financial or non-financial competing interests that could have influenced this work.

Ethics approval and consent to participate

The study protocol was submitted for evaluation to the Ethics Committee of Douala Gynaeco-Obstetric and Paediatric Hospital, and research authorisation No. 2026/0036/L/HGOPED/DG/DGA/DHRI/SRI was obtained. Given the retrospective nature of the study, which used existing medical records without direct contact with participants, the requirement for individual informed consent to participate was waived in accordance with applicable institutional procedures. All data were coded, anonymised, and handled confidentially.

Consent for publication

Not applicable. The manuscript contains no individual-level data, images, or information that could identify a participant.

Availability of data

The anonymised data underlying the findings of this study are available from the corresponding author on reasonable request, subject to authorisation from Douala Gynaeco-Obstetric and Paediatric Hospital and compliance with applicable ethical and confidentiality requirements.

Availability of materials and code

No biological materials, new proprietary tools, or other study-specific materials were produced. The R code used for the statistical analyses is available from the corresponding author on reasonable request.

Author contributions (CRediT)

The detailed, named CRediT contribution statement is provided in the separate title-page file and is omitted here to preserve double-blind peer review. All authors meet the ICMJE authorship criteria, approved the final manuscript, and accept accountability for the work.

Use of generative AI tools (disclosure)

ChatGPT (OpenAI) was used as an assistive tool for language editing, translation, manuscript structuring, and formatting. It was not used to generate, alter, or fabricate study data. All AI-generated suggestions were checked and revised by the authors, who take full responsibility for the accuracy, integrity, and final content of the manuscript.

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Author contributions (CRediT)

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ICMJE authorship confirmation

All listed authors meet all four ICMJE authorship criteria, have approved the final version submitted for publication, and agree to be accountable for all aspects of the work.

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