LIVE BIRTH RATE, TREATMENT OUTCOMES, AND PREDICTOR OF ASSISTED REPRODUCTIVE TECHNOLOGY AMONG INFERTILE COUPLES ATTENDING CENTER FOR FERTILITY AND REPRODUCTIVE MEDICINE IN ADDIS ABABA, ETHIOPIA

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ABSTRACT

BACKGROUND: Invitro fertilization has become a standard procedure with a record of more than 9 million births worldwide. One in every six couples is facing the problem of infertility. This infertility treatment is the only center in Ethiopia. The overall aim of this study was to investigates the live birth rate, treatment outcomes, and predictors of assisted reproductive technology among infertile couples attending a fertility center in Addis Ababa Ethiopia

METHODS: A retrospective study cohort study design was conducted at center for fertility and reproductive medicine of St. Paul's Hospital Millennium Medical College (SPHMMC) in Addis Ababa, Ethiopia, using structured checklists for extraction of data and phone interviews on infertile couples' treatment outcomes. Both binary binary and multivariable analysis, cox regression, and waiting time analyses were performed to identify predictors of treatment outcomes.

RESULT: The study found that the clinical pregnancy rate at the Fertility Center was 37.0% (n = 124). Among the 335 ART cycles analyzed, 88 resulted in live birth, yielding a live birth rate of 26.3% (95% CI: 21.5–31.0%). Factors significantly associated with increased odds of live birth included transfer of day-5 embryos compared with day-3 transfer (AOR = 2.48; 95% CI: 1.40–4.41), maternal age of 20–30 years compared with 31–40 years (AOR = 2.21; 95% CI: 1.28–3.83), optimal ovarian response defined as retrieval of 8–15 oocytes compared with poor response (≤4 oocytes) (AOR = 2.09; 95% CI: 1.05–4.20), and normal semen pH (7.2–8.0) compared with acidic semen pH (≤7.19) (AOR = 3.62; 95% CI: 1.01–12.99).

CONCLUSION: This study highlights actionable clinical factors that can improve ART success in Ethiopia. Prioritizing day-5 embryo transfer, optimizing ovarian response, focusing care on younger women, and addressing semen quality can significantly enhance live birth outcomes. Strengthening evidence-based, individualized ART practices will support better reproductive outcomes and guide quality improvement in fertility services.

KEYWORDS: Assisted Reproductive Techniques, Embryo Transfer, In Vitro Fertilization, Live Birth Rate, Treatment Outcome, Infertility, , Oocyte Retrieval, Pregnancy Outcome, Predictive Factors

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INTRODUCTION

Assisted Reproductive Technology (ART) encompasses procedures involving the in vitro handling of human oocytes, sperm, and embryos, with the primary goal of achieving pregnancy by collecting gametes, creating embryos in the laboratory, and transferring the most viable embryo into the uterus. ART procedures including in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI) have transformed infertility management, providing hope to millions of couples worldwide. Globally, more than five million births have resulted from IVF, reflecting rapid scientific and technological advancements that continue to expand the possibilities for individuals experiencing infertility[1-4].

Infertility remains a major reproductive health concern, defined as the inability to conceive after one year of unprotected intercourse. It affects approximately 15% of couples of reproductive age worldwide, with prevalence estimates ranging from 18% in the United States to 25% among Chinese couples[5-8]. More than 180 million couples in developing countries experience primary or secondary infertility, with infection-related tubal damage being the most common cause in sub-Saharan Africa[9]. Despite the growing need for fertility care, significant disparities in the availability, accessibility, and affordability of ART services persist between high-income and low-income settings.

The consequences of infertility are far-reaching and extend well beyond the inability to conceive. The Centers for Disease Control and Prevention (CDC) recognizes infertility as a public health concern due to its association with psychological distress, social stigma, economic strain, marital instability, and increased risk of chronic illnesses, including cardiovascular disease[10, 11]. In many African contexts, infertility carries profound gendered implications, with women disproportionately experiencing blame, social exclusion, and even abuse. Couples often seek treatment from various sources including spiritual healers, traditional practitioners, and modern medical facilities reflecting cultural beliefs about the origins of infertility and the limited availability of formal reproductive health services[3, 12, 13].

Although ART utilization is increasing worldwide, coverage in sub-Saharan Africa remains extremely low. Only a limited number of IVF centers operate across the region, and service accessibility is hampered by cost, infrastructure gaps, and shortages of trained specialists. An African registry analysis reported 153,917 ART procedures from 73 centers across 18 countries over five years, with clinical pregnancy rates remaining relatively stable (34.9% in 2013 and 31.7% in 2017)[2]. The African Network and Registry for Assisted Reproductive Technology (ANARA) continues to emphasize the need for comprehensive ART data to guide policy and strengthen fertility care provision.

In Ethiopia, infertility affects 15–20% of couples, with prevalence varying by region from 2.5% in SNNP to 15.1% in Addis Ababa and increasing with women's educational level[14]. Saint Paul's Hospital Millennium Medical College is currently the only public institution offering IVF services, with treatment costs ranging from 25,000 to over 120,000 birr, contributing to long waiting times and limited access[15]. Although Ethiopia's National Reproductive Health Strategy has prioritized infertility care expansion, progress remains limited[16]. Studies from Ethiopia and elsewhere indicate that ART outcomes significantly influence quality of life; women with successful ART cycles report higher satisfaction compared to those with unsuccessful outcomes, who often experience more miscarriages, ectopic pregnancies, and repeated treatment attempts[17, 18]. Given the limited availability of ART services in Ethiopia and the absence of comprehensive outcome data, it is crucial to assess treatment success rates and determinants of ART outcomes among infertile couples.

Methods

Study setting and design

A retrospective cohort study was conducted from April 2019 to September 2021 at St. Paul's Hospital Millennium Medical College and Hayahulet Fertility

Specialty Center in Addis Ababa, Ethiopia. The study included 1,742 infertile or subfertile couples who received assisted reproductive technology (ART) services at the center during this period. Eligible participants were couples diagnosed with infertility and registered in the center's medical records, including those treated for female, male, or combined factor infertility using homologous sperm, oocytes, and embryos through fresh or frozen–thawed embryo transfer.

Sample Size Determination and Sampling technique

The sample size was calculated using a single-population proportion formula based on a reported African clinical pregnancy rate (CPR) of 31.7% from a five-year regional ART trend analysis[2]. With a 95% confidence level (Z = 1.96), 5% margin of error, and 31.7% expected success rate, the initial sample size was computed and adjusted for a 10% non-response rate due to potential incomplete records, yielding a final sample size of 366. A computer-generated simple random sampling method was used to select records from the list of all couples who underwent ART between April 2019 and September 2021. Sampling was proportionally allocated by year and month, and selected records were retrieved and coded using SPSS version 25. Figure 1 presents the schematic sampling procedure. NB; Intrauterine insemination (IUI) cases (n=27) were excluded from the analysis. After exclusions, the final sample size included in the analysis was 335 ART cycles.

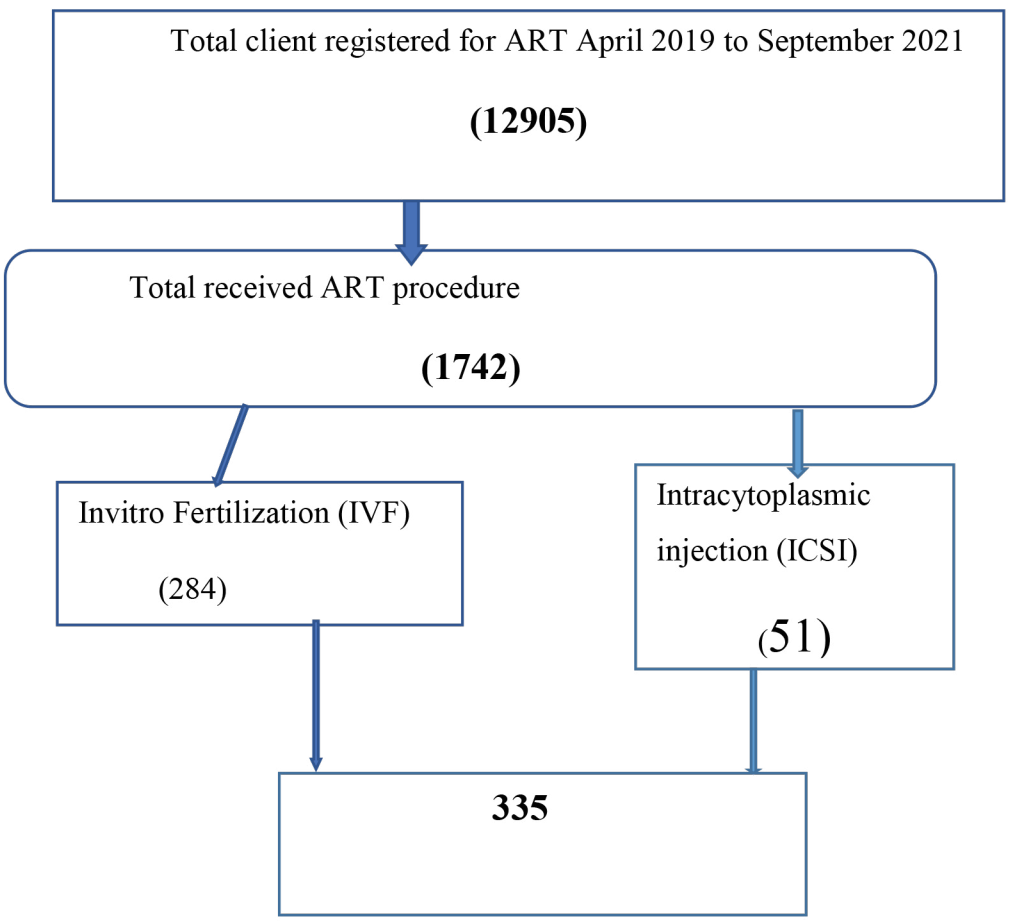

Figure 1: Schematic presentation of infertile couples in Ethiopia from April 2019 to September 2021 GC attended the Hayahulet Fertility Specialty Center at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

Data collection methods and techniques

Data were collected using a combination of structured checklists and telephone interviews. Three trained clinical nurses extracted information from patient medical records and contacted participants to obtain missing ART outcome data. Prior to data collection, the principal investigator provided training on the use of the checklist, document review procedures, and standardized phone-interview techniques. A pre-test was conducted on 5% of the sample to ensure clarity and validity of the instrument, and necessary adjustments were made accordingly. Because several ART outcome variables such as β-hCG test results, pregnancy status, live birth, abortion history, total treatment cost, mode of delivery, and waiting time were not consistently documented in medical records, telephone interviews were used to supplement and verify missing information. Data collection took place between January 18, 2022, and February 28, 2022, and all extracted data were accessed solely for research purposes. To maintain data quality, the investigator supervised data collectors, reviewed completed checklists daily, and addressed inconsistencies during data entry. Data cleaning was performed by examining frequencies and correcting errors prior to analysis.

Data Analysis Procedures and Management

Completed checklists were reviewed for completeness, and records with major missing information were excluded. Cleaned data were coded and entered into SPSS version 25 for analysis. Descriptive statistics were used to summarize socio-demographic and clinical characteristics. Binary and multivariable logistic regression analyses assessed the association between independent variables and delivery outcomes. Continuous variables were checked for normality using the Kolmogorov–Smirnov test. Survival analysis including life-table estimates, Kaplan–Meier curves, and Cox proportional hazards regression was conducted to evaluate time to successful pregnancy and identify predictors of live birth. Statistical significance was set at $p < 0.05$.

Operational and terms definitions

ART treatment outcome: In this study, ART treatment outcome was defined as the occurrence of clinical pregnancy and/or live birth among infertile couples who underwent assisted reproductive technology between April 2019 and September 2021. Outcomes were determined from medical records and, where necessary, supplemented by follow-up interviews. Only couples who received in vitro fertilization (IVF) or intracytoplasmic sperm injection (ICSI) were included. ART Treatment Success: In this study, ART treatment success was defined as achieving a live birth.

Clinical pregnancy: Detection of fetal heartbeat by ultrasound at approximately seven weeks of gestation.

Live birth: Delivery of a live infant at ≥37 completed weeks via vaginal birth or cesarean section.

Waiting time for successful ART/IVF: Time from first ART attempt to achieving pregnancy(19, 20).

Infertility: Failure to conceive after ≥12 months of unprotected intercourse.

Cumulative Live Birth Rate (CLBR): Delivery of a live neonate following fresh or subsequent frozen–thawed embryo transfer cycles (19, 20).

Result

The study achieved a completed response rate of 91.5% (335/366). The mean maternal age was 33.29 years (SD±4.83), ranging from 20 to 49 years, while the mean age of male partners was 41.36 years (SD±6.77), ranging from 34 to 51 years. More than half of the female participants (199; 59.4%) were aged 31–40 years, and a similar proportion of male partners (199; 59.4%) were aged 35–44 years.

All participants (335; 100%) were married, with a mean marital duration of 6.79 years (SD±3.63). Nearly half of the couples (162; 48.4%) had been married for 5–9 years without having a child. The average total cost incurred for ART procedures, including transportation, was USD 1,944.92 (SD±857.13), based on an exchange rate of 1 USD=51.70 Ethiopian Birr at the time of treatment. Almost all participants (98.6%) resided in urban areas (Table 1).

Table 1: Demographic and socioeconomic characteristics of infertile couples in Ethiopia from April 2019 to September 2021 (N=335)

Demographic and Social Characteristics	Category	Frequency (%)
Maternal age in year (n=335)	20 - 30 years	121 (36.1)
	31-40 years	199 (59.4)
	41-49 years	15(4.5)
Paternal age (n=335)	<=34 years	42 (12.5)
	35-44 years	199 (59.4)
	45-50 years	63(18.8)
	>=51years and above	31(9.3)
Marital status	Married	335(100.0)
Marriage duration without child (n=335)	<= 4 years	102 (30.4)
	5-9 years	162 (48.4)
	>=10 years since married	71(21.2)
Residence (n=335)	Rural	5 (1.5)
	Urban	330(98.5)
The total cost of the ART and transportation for treatment	<= 1,353.97 USD	102(30.4)
	1,353.98 – 2,321.08 USD	115(34.3)
(n=335) Average cost in US Dollar 1,944.92 ± 857.13 (SD) USD while 1USD=51.70 Birr	>= 2,321.08 USD	118(35.2)

Reproductive and infertility history

The reproductive and infertility history of the study participants showed that 304 respondents (90.7%) had no prior medical or surgical interventions related to reproductive health. The majority of participants (321; 95.8%) were nulliparous, with no previous history of pregnancy. Based on medical record review, 269 cases (80.3%) were classified as primary infertility, with female-factor infertility identified as the leading cause in 213 cases (63.6%). A history of abortion or miscarriage was reported by 66 participants (19.7%), of whom 57.7% had experienced four or fewer abortion episodes.

Hormonal investigations among female participants indicated that most values were within normal reference ranges, including follicle-stimulating hormone (FSH) in 158 (83.2%), luteinizing hormone (LH) in 188 (78.3%), thyroid-stimulating hormone (TSH) in 177 (95.2%), estradiol in 82 (76.0%), and anti-Müllerian hormone (AMH) in 18 (21.2%) of those tested. All female participants (335; 100%) were screened for HIV, hepatitis B virus, and syphilis (VDRL/RPR), with documented results in their medical records.

Pelvic ultrasound examination revealed normal findings in 220 women (65.7%). Hysterosalpingography (HSG) results demonstrated bilateral tubal blockage in 123 participants (36.7%) and unilateral blockage in 62 participants (18.5%) (Supplementary Table 2).

Transvaginal Ultrasound Eggs identified and retrieved

Transvaginal ultrasound assessment showed that most women demonstrated an adequate to optimal ovarian response. Overall, 141 participants (42.1%) had a poor ovarian response with ≤4 oocytes retrieved, 80 (23.9%) had an adequate/normal response with 5–7 oocytes retrieved, and 114 (34.0%) achieved an optimal ovarian response with 8–15 oocytes retrieved.

Semen Analysis of male partners in Ethiopia from April 2019 to September 2021 (N=335)

Among the semen analyses reviewed, 30 male partners (9.0%) were diagnosed with azoospermia. Low sperm concentration was observed in 45 participants (12.5%), while 28 samples (8.4%) showed complete absence of sperm motility (progressive or non-progressive). Abnormal sperm morphology, defined as 0–3% normal forms, was identified in 67 samples (20.0%). Additionally, 28 participants (8.4%) had no measurable semen volume, and 43 (12.8%) reported an abstinence period of five days prior to semen sample collection. Furthermore, 30 participants (9.0%) had acidic semen pH (≤ 7.19). Detailed findings are presented in Supplementary Table 3.

ART Treatment and outcome

All respondents (335; 100%) were undergoing assisted reproductive technology (ART) for the first time, with no prior treatment cycles. Among the ovarian stimulation protocols used, the long protocol was the most frequently applied, accounting for 187 cases (51.8%). Regarding ovulation induction, 350 women (96.7%) had undergone ovulation induction prior to ART treatment.

Embryo Fertilization and Transfer Characteristics

With respect to fertilization methods, the majority of couples (284; 78.5%) underwent in vitro fertilization (IVF), while the remainder received intracytoplasmic sperm injection. Fresh embryo transfer was performed in 303 cycles (90.5%). Regarding embryo transfer practice, two embryos were most commonly transferred (230 cycles; 68.7%), followed by single-embryo transfers (74 cycles; 22.1%) and three-embryo transfers (31 cycles; 9.3%). Most embryos were transferred on day 3 (231; 69.0%), and 157 embryos (46.9%) were classified as grade-two quality.

Clinical Outcomes

Among all ART procedures, 124 cycles (37.0%) had positive human chorionic gonadotropin (hCG) test results. Fetal cardiac activity was confirmed in 88 pregnancies, including 71 singleton, 14 twin, and 3 triplet gestations. Thirty-six cycles (10.7%) resulted in abortion or miscarriage. Overall, 88 couples (26.3%) achieved at least one live birth, yielding a total of 108 live births. No higher-order multiple pregnancies beyond triplets were observed (Supplementary Table 4).

Regarding delivery outcomes, 46 live births (52.3%) occurred at or before 37 weeks' gestation, and the majority of deliveries (86; 99.1%) were conducted via cesarean section.(see Supplementary Table 4).

Live Birth Delivery Rate

The live birth delivery rate, defined as the number of deliveries resulting in at least one live birth per 100 ART cycle attempts, was 32.2 per 100 cycles. This was calculated by dividing the total number of live births (108) by the number of first-cycle embryo transfers (335).

Overall, 627 embryos were transferred during first-attempt cycles, comprising 74 single-embryo, 230 two-embryo, and 31 three-embryo transfers. Accordingly, the live birth rate per embryo transferred was 17.2 per 100 embryos (108/627) (Supplementary Table 4).

ART Treatment Success

This study determined that the live birth rate among infertile couples attending the Hayahulet Fertility Specialty Center at St. Paul's Hospital Millennium Medical College, Ethiopia, was 26.3% (88/335; 95% CI: 21.5–31.0%) (Figure 3).

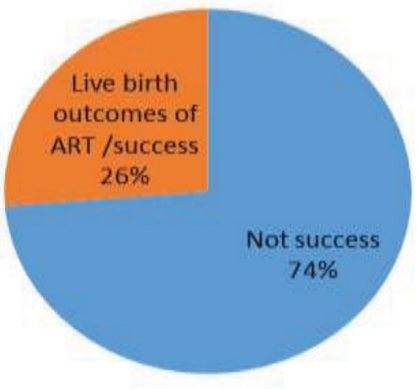

Figure 2: The proportion of success/ live birth of assisted reproductive technology among infertile couples at Hayahulet Fertility Specialty Center at St. Paul's Hospital Millennium Medical College, Ethiopia from April 2019 to September 2021.

This study determined ART outcomes (treatment success) were defined as a clinical pregnancy and revealed that the proportion of clinical pregnancy outcomes of ART was 37.0% (124/335), which ranged from 95%CI, 32.2 to 42.1% see details in Figure 3).

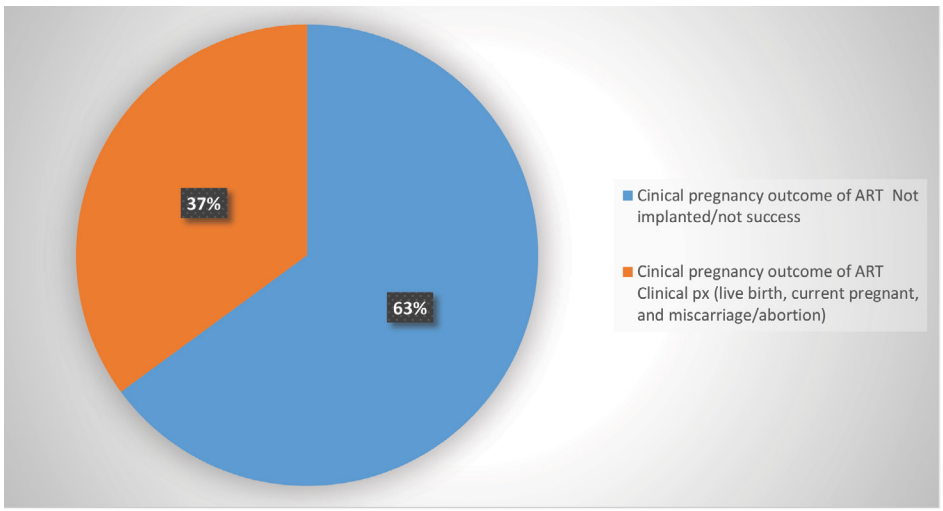

Figure 3: The proportion of clinical pregnancy outcomes of assisted reproductive technology among infertile couples in Ethiopia 2022.

The overall ovarian stimulation response was determined that 223(66.6%) had good responders who had retrieved >= 4 oocytes which ranges with 95% CI 61.8 to 71.3%. see details in Fig4.

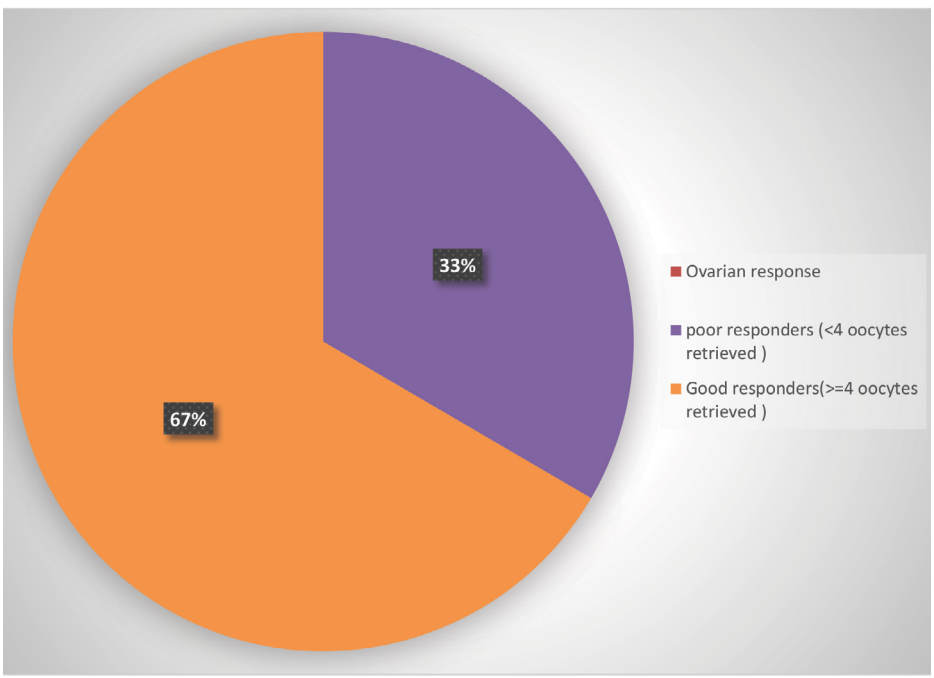

Figure 4: overall ovarian stimulation response of infertile female in Ethiopia from April 2019 to September 2021 (N=362)

Factors associated with the live birth outcome of assisted reproductive technology (ART)

Based on binary logistic regression analysis at PV less than 0.05, with 95%CI, the following variables were identified as candidates for multivariate logistic regression analysis: type of embryo used, number of embryo transfers (IVF/ICSI), days of embryo transfer, grade of embryos transferred, maternal age, retrieved egg (right and left), marital duration, and total cost of the procedures including transportation, respectively.

In the multivariable logistic regression analysis, several factors were independently associated with the live birth outcome of assisted reproductive technology (ART) among infertile couples attending the Hayahulet Fertility Specialty Center at St. Paul's Hospital Millennium Medical College, Ethiopia.

Embryo transfer on day 5 was significantly associated with higher odds of live birth compared with day-3 embryo transfer (AOR = 2.48; 95% CI: 1.40–4.41; p = 0.002). Maternal age was also a significant predictor; women aged 20–30 years had more than twice the odds of achieving a live birth compared with those aged 31–40 years (AOR = 2.21; 95% CI: 1.28–3.83; p = 0.005). Maternal age 41–49 years was not significantly associated with live birth outcome. Ovarian response showed a significant association with live birth. Couples with an optimal ovarian response, defined as retrieval of 8–15 oocytes, had significantly higher odds of achieving a live birth compared with those with a poor response (≤4 oocytes retrieved) (AOR = 2.09; 95% CI: 1.05–4.20; p = 0.040). However, retrieval of 5–7 oocytes (adequate/normal response) did not show a statistically significant association with live birth outcome.

Semen pH was also significantly associated with ART success. Couples with normal semen pH (7.2–8.0) had significantly higher odds of achieving a live birth compared with those with acidic semen pH (≤7.19) (AOR = 3.62; 95% CI: 1.01–12.99; p = 0.048).see detail in Table 5).

Table 5: Factors associated with the outcome of assisted reproductive technology (ART) among infertile couples in Ethiopia from April 2019 to September 2021 (N=335) Ethiopia, 2022

Factors associated with ART outcomes		the outcome of assisted reproductive technology (ART)		P-value	AOR (95% CI)
		Successful (n=88)	Not successful (n=274)		
Days of embryo transferred	3	46(13.7%)	185(55.2%)	1:00	
	5	41(12.2%)	63(18.8%)	0.002	2.48(1.4-4.41)
Maternal age	20 - 30 years	48(13 .3%)	81(22.4%)	0.005	2.21(1.28-3.83)
	31-40 years	39(10.8%)	178(49.2%)	1:00	
	41-49 years	48(13 .3%)	81(22.4%)	0.279	0.32(0.04-2.53)
Ovarian Response	≤4 eggs retrieved(poor)	7.2%(24)	34.9%(117(	1:00	
	5–7 eggs retrieved (Adequate/normal)	5.97%(20)	17.9%(60)	0.641	1.201(.55- 2.597)
	8–15 eggs retrieved (Best/optimal)	13.1%(44)	20.9%(70)	0.04	2.086(1.05 -4.204)*
Semen PH	<= 7.19	5(1.5%)	25(8.1%)		
	>= 7.2-–8.0	71(23.1%)	206(67.1%)	0.048	3.62(1.01–12.99)*

Key NB : *... P-value <0.05, **.... P-value < 0.01 & *** were significantly associated at the 0.001

predictor; women aged 20–30 years had more than twice the odds of achieving a live birth compared with those aged 31–40 years (AOR = 2.21; 95% CI: 1.28–3.83; p = 0.005). Maternal age 41–49 years was not significantly associated with live birth outcome. Ovarian response showed a significant association with live birth. Couples with an optimal ovarian response, defined as retrieval of 8–15 oocytes, had significantly higher odds of achieving a live birth compared with those with a poor response (≤4 oocytes retrieved) (AOR = 2.09; 95% CI: 1.05–4.20; p = 0.040). However, retrieval of 5–7 oocytes (adequate/normal response) did not show a statistically significant association with live birth outcome.

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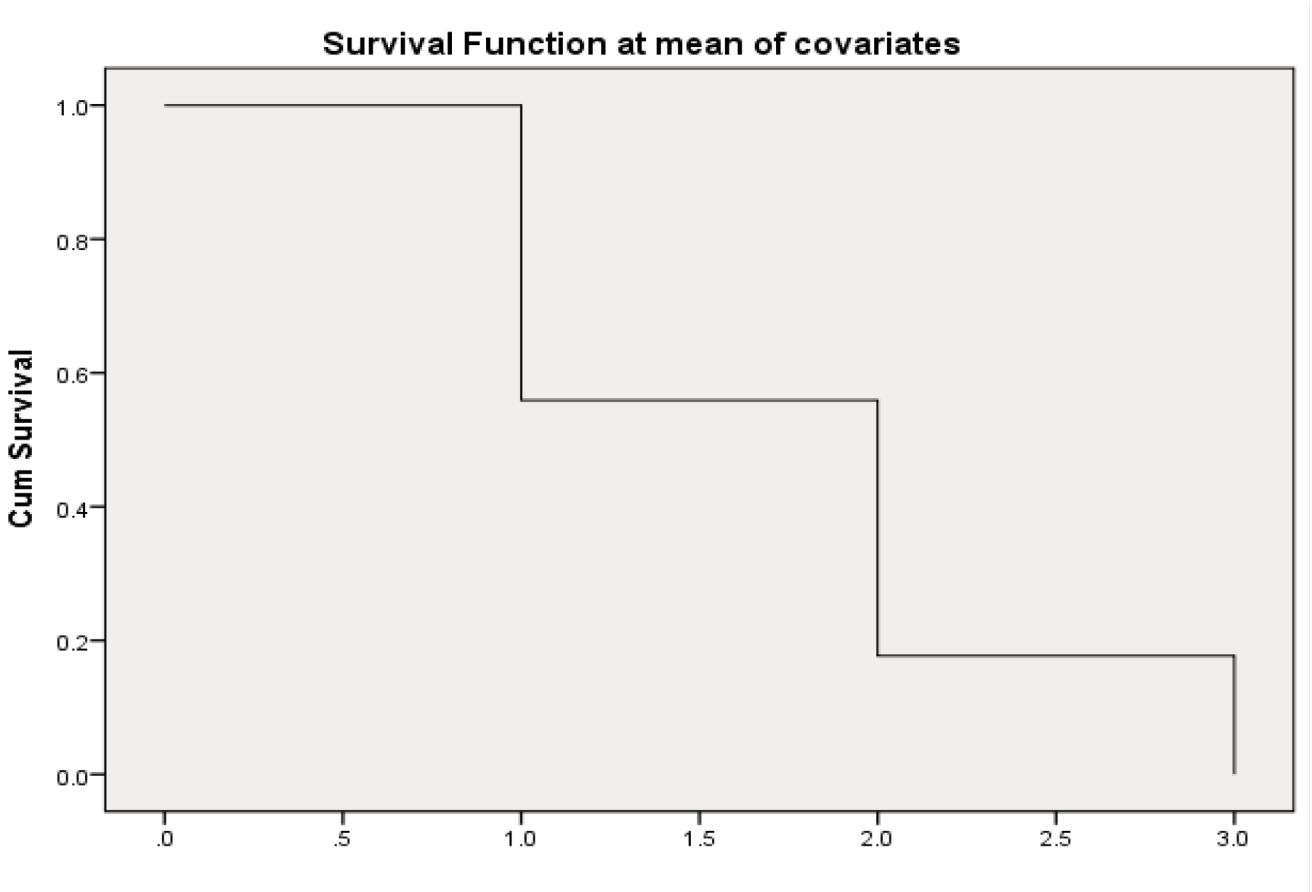

Figure 5: Relationship between the duration of treatment and the remaining couples for the treatment process. When treatment time is increased, the likelihood of survival success live birth is reduced

Predicting the likelihood of live birth of assisted reproductive technology outcomes among infertile couples

Infertile couples with a marital duration of 5–9 years without a biological child had 2.39 times higher odds of achieving a live birth following assisted reproductive technology compared with those married for ≤4 years (AHR = 2.39; 95% CI: 1.02–5.62). Transfer of frozen–thawed embryos was associated with substantially higher odds of live birth compared with fresh embryo transfer (AHR=8.00; 95% CI: 2.45–26.29).

The number of embryos transferred also predicted ART success; transferring two embryos increased the odds of live birth by 2.35 times compared with single-embryo transfer (AHR=2.35; 95% CI: 1.06–5.23). Ovarian response was significantly associated with live birth outcomes. Retrieval of 4–9 oocytes from the right ovary increased the odds of live birth by 2.02 times (AHR = 2.02; 95% CI: 1.19–3.44), while retrieval of ≥10 oocytes increased the odds by 1.70 times (AHR = 1.70; 95% CI: 1.18–6.15), compared with retrieval of 1–3 oocytes.

In addition, the total cost of ART procedures, including transportation, was significantly associated with live birth outcomes. Couples who spent 70,001–120,000 Ethiopian Birr had 2.66 times higher odds of achieving a live birth (AHR = 2.66; 95% CI: 1.32–5.35), while those who spent ≥120,001 Birr had 3.78 times higher odds (AHR = 3.78; 95% CI: 1.86–7.66), compared with couples who spent ≤70,000 Birr (Supplementary Table 6).

DISCUSSION

This study determined that the proportion of live births following assisted reproductive technology (ART) among infertile couples in Ethiopia was 26.3% (95% CI: 22.7%–31.0%). This rate is higher than that reported in a study conducted in Southern Brazil, where ART-related live births accounted for 0.4% of total live births in 2015[21]. The marked difference may be explained by variations in study design, outcome definitions, population characteristics, and health-care systems, as the Brazilian study reported population-level data rather than ART-specific cycle outcomes. The live birth rate observed in the current study is comparable to findings from Rome, which reported a 23.9% positive ART outcome,[22], and to a previous Ethiopian IVF study that documented a 25% live delivery rate[14]. In contrast, higher live birth rates have been reported in Iran, including a 45% overall live birth rate[23]and 29.7% success in the first cycle, increasing to 44.9% after multiple cycles [19]. These differences may be partly attributed to variations in maternal age distribution, as more than 65% of participants in the present study were older than 30 years, with a mean maternal age of 33 years, whereas the Iranian studies predominantly included women aged 20–29 years, a group known to have better reproductive potential and higher ART success rates. This study determined that the proportion of clinical pregnancy outcomes following assisted reproductive technology (ART) was 37.0% (95% CI: 32.0%–42.0%). This finding is consistent with a five-year trend analysis from Africa, which reported clinical pregnancy rates per embryo transfer ranging from 34.9% in 2013 to 31.7% in 2017[2],as well as with a previous Ethiopian study on IVF outcomes that reported an overall pregnancy rate of 30.1% in 2020[14]. The observed similarity may reflect comparable clinical practices, patient characteristics, and resource settings.

Regarding multiple gestations, the proportion of twin deliveries in the current study was 15.9% (14/88), while triplet deliveries accounted for 3.4% (3/88). These findings are comparable with the International Committee for Monitoring Assisted Reproductive Technologies (ICMART) report of 2014, which documented a decline in twin delivery rates following fresh non-donor embryo transfers from 20.4% in 2010 to 16.2% in 2014, alongside a reduction in triplet rates from 1.1% to 0.5%[24]. The similarity suggests a gradual shift toward safer embryo transfer practices and improved adherence to guidelines aimed at reducing higher-order multiple pregnancies.

The present study found that 66.6% of participants demonstrated a good ovarian response, defined as retrieval of four or more oocytes. This finding is broadly consistent with a previous Ethiopian study reporting good ovarian response in 76.4% of cases[14]. The slight variation may reflect differences in participant age distribution, ovarian reserve, and stimulation protocols used across studies.

This study identified that women aged 20–30 years were significantly more likely to achieve a live birth compared with those aged 31–40 years, consistent with evidence that younger maternal age predicts better ART outcomes. Additionally, retrieval of more than four oocytes significantly increased live birth likelihood, supporting previous studies showing oocyte yield as an independent predictor [14, 20, 25, 26]. This finding is strongly supported by previous studies, which consistently demonstrate that younger maternal age is a key predictor of successful ART outcomes. Additionally, retrieval of more than eight oocytes significantly increased live birth likelihood, supporting previous studies showing oocyte yield as an independent predictor. Higher oocyte numbers increase the chance of high-quality and surplus embryos, thereby improving live birth rates[20,25,26]. The relationship is biologically plausible, as a higher number of retrieved oocytes increases the likelihood of obtaining high-quality embryos and surplus embryos for transfer or cryopreservation, ultimately improving live birth rates.

This study found a cumulative live birth rate of 24.3% following ART, with most live births occurring in the first year and progressively declining with longer waiting time. The rate was lower than reports from other settings, possibly due to fewer oocytes retrieved, inclusion of only a single ART attempt, and shorter follow-up duration[19, 20]. These findings reinforce evidence that increased oocyte yield and repeated transfer opportunities improve cumulative live birth rates[20].

This study identified key predictors of live birth following ART, including the number of embryos transferred, oocyte yield, and use of frozen–thawed embryos[20, 25, 26]. These findings are consistent with prior studies showing that oocyte number and embryo quality independently predict live birth outcomes. Optimizing these factors may improve ART success and support more individualized patient counselling at St. Paul's Hospital.

Strengths and Limitations

This is the first Ethiopian study to assess ART outcomes, live birth survival, and predictors, providing a valuable baseline. However, its retrospective design may introduce selection bias. Prospective studies are needed to confirm and strengthen these findings.

Conclusions

This study identifies key modifiable factors to improve ART success in Ethiopia, including prioritizing day-5 embryo transfer, optimizing ovarian response, and focusing on younger maternal age, which is associated with better outcomes. Improving semen quality before treatment and adopting individualized, evidence-based ART practices such as tailored stimulation, careful embryo selection, and appropriate transfer strategies are essential. Patient-centered counseling, particularly regarding age and expectations, plays an important role, while early screening and timely initiation of ART can enhance live birth chances. In addition, policy support is needed to strengthen access, affordability, and quality of ART services, and further research using robust study designs is encouraged.

Declarations

Ethical Considerations

Ethical clearance was obtained from the Pan African University Ethical Review Board (Reference No. UI/EC/21/0742) and the St. Paul's Hospital Millennium Medical College Ethical Review Board (Reference No. PM23/326). Written permission to conduct the study was also obtained from the St. Paul's Hospital Millennium Medical College Fertility Specialty Center.

Given that birth outcomes were verified through medical records and follow-up interviews, verbal informed consent was obtained from all participants prior to contact, as approved by the respective ethical review boards. Participation was voluntary, and participants were informed of their right to decline or withdraw at any time without consequence.

Confidentiality and privacy were strictly maintained throughout the study. Personal identifiers were removed from the dataset, and all records were securely stored and accessed only by the research team.

Consent to publish: Not applicable

Availability of data and materials: Datasets used in the current study are available from the corresponding author upon reasonable request.

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Author Contributions

We would like to declare that Dr.Dereje Bayissa Demissie serve as the guarantor for this work. The guarantor accepts full responsibility for the overall content and integrity of the manuscript, ensuring that all authorship criteria have been met and that the work is accurately represented.

HWD contributed to the conception, design, conduct of the study, analyzed and interpreted the data, and prepared the manuscript contributed to the conception, design, and conduct of the study, analyzed and interpreted data, and prepared the manuscript

AO & DBD contributed to the design and conduct of the study, analyzed and interpreted the data, and prepared the manuscript. All authors read and approved the final manuscript.

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