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Awareness and acceptability of assisted reproductive technology among non-medical tertiary students in a low-resource setting

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Abstract

Background Assisted Reproductive Techniques (ART) have significantly advanced infertility treatment worldwide. However their availability and use in sub-Saharan Africa, remains limited although infertility is highly prevalent, with significant psycho-social challenges including stigma. This study assessed the awareness, attitudes, and perceptions of ART among non-medical tertiary students in Ghana.

Method A cross-sectional study was conducted among non-medical students in tertiary institutions in Ghana. Pre-tested questionnaires were administered to both post-graduate and undergraduate students after obtaining informed consent. Ethical approval was obtained from the Review Board at Community Health Department of the University of Ghana Medical School. The data collected was analyzed using SPSS (version-27) and the results presented using frequency tables, graphs, and charts. significance was *P*-value below 0.05 was considered statistically significant.

Results Overall, 196 participants from the two largest universities and other tertiary institutions in Ghana took part in this study. Majority (63.5%) of respondents demonstrated awareness on ART services, but 60.3% showed poor knowledge of the types of ART. Males generally exhibited lower knowledge of ART services compared to females, and knowledge of ART services showed an inverse relationship with age. In-vitro fertilization (IVF) was the most widely recognized and recommended ART technique, known by 65.1% of respondents who were aware of the types of ART. Most participants expressed reluctance to accept or recommend gamete donation due to religious reasons, fear of complications, and a preference for conventional means of procreation.

Conclusion The majority of tertiary students in Ghana are aware of ART for infertility treatment however, many are hesitant toward donor-gamete treatment protocols. Fear of complications and related costs pose major barriers to considering ART among the respondents. Participants unanimously suggested government subsidies and the inclusion of ART under the national health insurance coverage package.

Keywords Awareness, Acceptability, Assisted reproductive technology, Students

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Introduction

Infertility is a medical condition defined by a couples' inability to achieve a clinical pregnancy after 12 months of consistent, unprotected sexual intercourse [22].

According to the World Health Organization, infertility is a significant global social and public health issue, affecting approximately one in six individuals worldwide [23]. In developing countries, including those in

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sub-Saharan Africa, there is a higher prevalence of infertility due to various factors such as complications of pelvic inflammatory diseases, unsafe abortion practices, postpartum and iatrogenic infections [1]. Infertility rates of 30% to 40% have been reported in sub-Saharan Africa [5]. Infertility carries profound physical and psychological challenges for couples, including depression, stress, anxiety, and reduced social recognition [14].

In societies like Ghana, where very high value is placed on childbirth, infertility is particularly challenging, leading to stigma, social isolation, and marital instability. Infertility also impacts mental health, resulting in low self-esteem, deprivation, aggression, personality disorders, and even suicide especially among affected women.

A previous study in the North-East and Ashanti regions of Ghana showed that, many infertile married women, regardless of their education level, religious beliefs, or location, often attributed their infertility to supernatural causes. Despite recognizing some medical explanations, such as hormonal imbalances or previous contraceptive use, the incomprehensibility of their condition has often led them to supernatural reasoning [16].

Despite this distressing impact of infertility, there have been limited public health interventions for addressing infertility. Rather, majority of these interventions focus more on infectious diseases control, infant mortality reduction, and population control programs [5]. Globally, the use of Assisted Reproductive Techniques (ARTs) has continued to steadily revolutionize infertility management, including in developing countries such as Ghana. However, many individuals lack awareness of ART, also, there are barriers relating to accessibility, affordability, and regulation of these services [6]. Sociocultural attitudes, mistrust in the science, gender-related issues, and ethical concerns further hinder the practice and uptake of ART in the sub-Saharan African region.

Challenges in Ghana include limited availability of ART services, with only a few private institutions providing these services, often at high costs. The absence of a national regulatory framework, limited technology, and a scarcity of the expertise pose additional hurdles [6]. Existing literature is scarce in our context, particularly in accessing the knowledge level of ART.

This study therefore aimed to explore the level of awareness, attitudes, and perceptions of tertiary students in Ghana regarding Assisted Reproductive Techniques.

Method and materials

This multi-centered cross-sectional study primarily targeted students from Ghana's two largest institutions, the University of Ghana, Legon, in Accra, and the Kwame Nkrumah University of Science and Technology, Kumasi, along with students from other tertiary institutions. Online questionnaires, which were structured and pretested to ensure clarity and relevance of the questionnaire items, were administered to undergraduate and postgraduate students, excluding those in medical programs. To prevent duplication, responses were restricted to one email address per participant. Written informed consent was obtained from participants aged 18 and above, representing various public and private tertiary institutions before participation.

The minimum sample size was estimated, using the formula: $N = Z^2 P(1-P)/d^2$.

Where N is the sample size; Z is the statistical certainty at 95% confidence interval = 1.96; p is the prevalence of knowledge from previous similar study 0.61 [12]; d is the margin of error (5%), Hence the calculated sample size N is 86, plus 10% (7) giving the total of N = 93 participants per institution, summing to a total of 186 for the two major universities.

The resulting data was analyzed using SPSS software (version 27) and the findings were presented using graphs, frequency tables, and charts. Respondents' baseline sociodemographic characteristics were reported using means and standard deviations for continuous variables, while frequency and percentage were used for categorical variables. The responses were compared based on socio-demographic parameters, institution of study, course of study, and relationship status in relation to the study's outcome variables. The association between these factors and the level of awareness, as well as attitudes towards Assisted Reproductive Techniques (ARTs), was assessed using the student t-test and Pearson chi-square.

Statistical significance was considered at a 95% confidence interval, with a p-value less than 0.05. The study protocol received approval from the Review Board of the Community Health Department at the University of Ghana Medical School, College of Health Sciences, Korle Bu.

Results

A total of 196 tertiary students from the 2 main Universities and some other tertiary institutions in Ghana participated in the study. The sociodemographic characteristics of the participants are presented in Table 1, and their educational background information is provided in Table 2. Majority of respondents were aged 20–29 years. Undergraduate students constituted 88.9% of participants; 9.5% were pursuing postgraduate degree programmes, and 1.6% were in other tertiary non-degree programmes (Table 1).

Majority (91.5%) of respondents did not have any children, and 33.9% were enrolled in health-related but nonmedical courses. Regarding participants' future plans for having children, 78.8% expressed intention to have

Sociodemographic	Characteristics		
Variable	Subgroup	Frequency	Percent
Sex	Female	90	47.6
	Male	96	50.8
	Prefer not to say	3	1.6
Orientation	Asexual	14	7.4
	Bisexual	15	7.9
	Heterosexual	135	71.4
	Homosexual	25	13.2
Age	15–19	37	19.6
	20–29	130	68.8
	30–39	22	11.6
Marital Status	Cohabiting	2	1.1
	Divorced	1	0.5
	Married	7	3.7
	Single	179	94.7
Religion	African traditional Religion	1	.5
	Christian	178	94.2
	Eckankar	1	0.5
	Muslim	7	3.7
	None	2	1.1
Educational Charac	teristics		
Variable	Subgroup	Frequency	Percent
School	KNUST	30	15.9
	UENR	2	1.0
	Valley View University	3	1.5
	UPSA	2	1.0
	Tamale Technical University	5	2.6
	Accra Technical University	5	2.6
	Nursing Training School	5	2.6
	UHAS	27	14.3
	UCC	18	9.5
	UDS	4	2.1
	UEW	7	3.7
	UG	48	25.4
	Other	33	16.8
Level of Education:	Diploma	3	1.6
	Undergraduate	168	88.9
	Masters	15	7.9
	PhD	3	1.6
Programme	Arts	8	4.2
	Business related pro- grammes	19	10.1
	Education	13	6.9
	Engineering	20	10.6
	Health related programmes	64	33.9
	Humanities	40	21.2
	Pure Sciences/Physical Sci- ences/Computer Sciences	25	13.2
Number of children			
	Number of children	Frequency	Percent

Table 1 Sociodemographic characteristics of participants

 Table 1 (continued)

None	173	91.5
1 child	10	5.3
2—4 children	4	2.1
More than 4 children	2	1.1

children, 12.7% were unsure, and 8.5% had no future childbirth intentions. Approximately two-thirds (60.3%) of the respondents personally knew someone or a couple suffering infertility.

In terms of knowledge about infertility treatments, the majority of participants (62.8%) were aware of orthodox medical treatment options. Assisted reproductive technology (ART) was recognized by 45.2% of respondents, 51.6% believed in the potential of herbal medications, while 43.6% mentioned prayer-based healing as their solution (Fig. 1).

Overall, 63.5% of the respondents demonstrated knowledge about ARTs. Of the ART options, In Vitro Fertilization (IVF) emerged as the most widely known (65.1%), followed by surrogacy (38.6%), intracytoplasmic sperm injection (ICSI) (38.1%), and gamete cryopreservation (4.8%) (Fig. 2). Also, 41.3% of the respondents were knowledgeable on gamete donor protocols. Age was found to have a negative correlation with knowledge on ART, older individuals in the study displayed lower levels of awareness of ARTs, and this correlation was statistically significant (R=-0.182, p<0.01). Female participants exhibited significantly higher ART knowledge than males (p<0.000), and health-related program students showed greater awareness compared to other students (p<0.01) (Table 3).

Majority of participants (80.4%) considered ARTs to be important. Regarding respondents' attitudes, 58.7% were inclined to recommend ARTs for other couples, and 48.9% would opt for ART themselves if necessary. Among those who would not recommend ART, their reasons included religious beliefs, concerns about complications, preference for natural conception methods, and the high costs associated with ARTs.

In vitro fertilization was the most commonly recommended ART option, followed by ICSI and donor eggs. Donor sperm and embryo donations were the least popular choices among the respondents.

While majority of students (41.3%) were reluctant to donate their gamete, 36% were likely to donate. Similarly, 57.2% of respondents were unlikely to accept, 21.7% were neutral, and 21.2% were likely to accept donor gametes. Also, 43.4% of the participants would not consider surrogate carrier programs but 31.2% would accept surrogacy programs. Further, 41.8% of the respondents were unlikely to freeze their eggs or sperms, 25.9%

Likelihood to recommend ART for	Response	Frequency		Percent	Interpretation
Other Couple	Very unlikely	10		5.3	Likely
	Unlikely	22		11.6	
	Likely	56		29.6	
	Neutral	46		24.3	
	Very likely	55		29.1	
Own self	Very unlikely	15		7.9	Likely
	Unlikely	27		14.3	
	Likely	38		20.1	
	Neutral	55		29.1	
	Very likely	54		28.6	
Reasons for recommending ARTs	Reason	Frequency	Percent		
Not Likely to recommend	N/A	72	38.1		
Likely to recommend	Because of my sexual orientation	1	0.5		
	I will do anything to have babies	25	13.2		
	It is a blessing from God	31	16.4		
	It is versatile and flexible	22	11.6		
	Out of necessity	29	15.3		
	There are no complications from the procedure	9	4.8		
Reasons for not opting for or rec- ommending ART		Frequency	Percent		
N/A Reason		100	52.9		
	Babies born via ARTs are not real humans	1	0.5		
	Cultural reasons	4	2.1		
	Fear of complications	21	11.1		
	I want to have babies through sexual intercourse alone	20	10.6		
	It's too expensive	14	7.4		
	Religious reasons	21	11.1		
	The baby may die	2	1.1		
	The society may stigmatize me and my baby	6	3.2		

 Table 2
 Attitude of participants towards assisted reproductive technology

Treatment of Infertility



Fig. 1 Knowledge on treatment modalities for infertility



ARTs Known to Respondents

■ Gamete cryopreservation ■ None ■ ICSI ■ Surrogacy ■ Gamete donation ■ IVF **Fig. 2** Forms of assisted reproductive technology treatments known to students

were neutral, and 32.2% were likely to consider gamete cryopreservation.

In addressing the financial barrier to access ART, 66.1% participants advocated for governmental support for infertile couples to improve access by integrating ART into basic healthcare; 71.4% recommended subsidizing the cost of ART services, and 57.7% suggested including ART coverage under the National Health Insurance Scheme.

Discussion

This study aimed to assess the knowledge, attitudes, and perceptions of assisted reproductive techniques (ARTs) among non-medical university students in Ghana.

A total of 196 tertiary level students from various universities across Ghana participated in the study. The modal age group was found to be 20–29 years, there was a slightly higher representation of males compared to females, which is consistent with the demographic characteristics of Ghanaian tertiary students as reported in a previous study by Attuquayefio et al. [2].

The majority of participants identified as heterosexual. However, it is important to note that there is limited information available on the sexual orientation of Ghanaian students and the population as a whole, likely due to the legal restrictions and societal attitudes towards gender and non-heterosexual orientation in Ghana. Nevertheless, Quarshie et al. [20] reported that approximately 3.5% of Ghanaian adolescents identify as orientations other than heterosexual. In our study, approximately 20% of students identified as either homosexual or bisexual.

Most students reported not having any children, and only a small proportion expressed a lack of desire for future parenthood. It is noteworthy that a significant portion of respondents (60.3%) were aware of infertility issues and personally knew couples experiencing infertility. Approximately half of the students suggested herbal remedies as a potential treatment for infertility, while a similar proportion mentioned prayer-based approaches. It is important to acknowledge that these methods may not be widely endorsed by medical professionals as standard treatments. However, considering the holistic nature of healthcare, exploring prayer and faith-related practices as part of a comprehensive approach to infertility management can be considered.

Approximately 63.5% of the students in our study demonstrated awareness of assisted reproductive techniques (ARTs), and two-fifths of them were familiar with specific ART methods such as in vitro fertilization (IVF). This finding contradicts a study by Hiadzi et al., that have reported poor knowledge of ARTs among respondents [9], that study however involved 15 participants who were all married and seeking ART services at a private hospital. The appreciable level of ART knowledge among our participants could be attributed to the increasing popularity and use of ARTs, as well as the availability of information on these interventions through the internet and various media channels that students commonly use.

The lower level of knowledge on the specific ART types and its inverse relationship with participants' age may reflect the fact that ARTs are relatively new in Ghana, and the teaching of ARTs has not been incorporated into basic and secondary school curricula in Ghana. Furthermore, there has been some historical stigma surrounding ARTs, which has limited discussions on the topic in Ghana. Consequently, older individuals may have had

Associations between Socioden	nographic Features and Knowledge				
		Knowledge		Statistic	
Variable	Subgroup	Poor	Good	X ²	<i>p</i> -value
Sex	Female	43(47.8%)	47(52.2%)	13.19	0.00
	Male	70(72.9%)	26(27.1%)		
Marital Status	Cohabiting	1(50.0%)	1(50.0%)	0.78	0.86
	Divorced	1(100.0%)	0(0%)		
	Married	4(57.1%)	3(42.9%)		
	Single	108(60.3%)	71(39.7%)		
Religion	ATR	1(100.0%)	0(0%)	4.40	0.36
	Christian	108(60.7%)	70(39.3%)		
	Muslim	4(57.1%)	3(42.9%)		
	Eckankar	1(100.0%)	0(0%)		
	Non-religious	0(0%)	2(100.0%)		
Programme	Arts	6(75.0%)	2(25.0%)	16.38	0.01
	Business-Related	15(78.9%)	4(21.1%)		
	Education	9(69.2%)	4(30.8%)		
	Engineering	16(80.0%)	4(20.0%)		
	Health-related	28(43.8%)	36(56.3%)		
	Humanities	22(55.0%)	18(45.0%)		
	Pure/Physical/Computer Sciences	114(60.3%)	75(39.7%)		
Association between Institution	Attended and Knowledge on ARTs				
		Knowledge			
		Poor	Good		
Name of your current educa-	Accra Technical University	80.0%	20.0%		
tional institution:	KNUST	60.0%	40.0%		
	Nursing Training School	20.0%	80.0%		
	Other	75.8%	24.2%		
	Tamale Technical University	60.0%	40.0%		
	UCC	66.7%	33.3%		
	UDS	50.0%	50.0%		
	UENR	100.0%			
	UEW	57.1%	42.9%		
	UG	50.0%	50.0%		
	UHAS	51.9%	48.1%		
	UPSA	100.0%			
	Valley View University (VVU)	100.0%			
Total		60.3%	39.7%		

Table 3 Associations between sociodemographic features and knowledge

fewer opportunities for education on ARTs. The first successful IVF procedure in Ghana was performed in 1995, and since then, privately owned fertility clinics have emerged primarily in the capital city, Accra, and a few other urban areas [9].

Male respondents exhibited poorer knowledge of ARTs compared to their female counterparts, aligning with findings from previous studies [3, 7, 21]. Similarly, students pursuing health-related study programs demonstrated the highest level of knowledge regarding ARTs. This finding is consistent with the results reported

by Nouri et al. in 2014 [15]. Additionally, Chawłowska et al. [4] reported significantly higher levels of knowledge of ARTs among medical students. To ensure a more representative sample and avoid bias from exceptional knowledge in medical students, we excluded them from participating in our study, as ART education is already a routine part of their curriculum.

The respondents in our study displayed a generally positive attitude towards assisted reproductive techniques (ARTs), with approximately 80% considering these techniques important. Among the ART options, in vitro fertilization (IVF) emerged as the most popular choice among the students. This preference for IVF can be attributed to its widespread practice and recognition as the most well-known form of ART, as highlighted by Jain and Singh [11].

Furthermore, a significant number of students expressed their willingness to recommend ARTs for others or even consider them for themselves if the need arises. However, it is important to note that there were opposing viewpoints grounded in religious beliefs and a preference for conventional conception methods. In Ghana, the beliefs surrounding infertility and its treatment often revolve around the notion that fertility is controlled by supernatural forces. As a result, believers place their trust in deities and religious practices to address their fertility concerns. When faced with fertility challenges, they turn to these religious beliefs and rituals in the hope of finding a cure for their infertility [9].

Among the respondents, concerns about the potential complications of ARTs emerged as a barrier to recommending them. Despite expressing willingness to recommend ARTs to others, only 36.0% of students were open to voluntarily donating their sperm or eggs, and a mere 21.2% were willing to accept donated sperm or eggs themselves. These findings align with similar studies conducted among university students in Belgium, where only 34.3% were willing to donate their sperm and 26.4% would accept donor sperm or eggs if needed [19]. Likewise, a study conducted in Nigeria reported that only 40% of Nigerian students would be receptive to donated gametes [17]. Similarly, another study indicated that only one-third of female students would accept sperm donation if they required it [18].

Interestingly, our study found a relatively higher acceptance rate for surrogacy (31.2%) compared to a study conducted among Jordanian students, where the acceptance rate was 21% [13]. It is worth noting that the Jordanian students were predominantly Muslim, and religious beliefs may have influenced their attitudes towards ARTs involving surrogacy.

Furthermore, the tertiary students in Ghana expressed a strong belief that the government could enhance access to ART services by subsidizing their costs and making them more affordable. They advocated for the inclusion of ART services on the list of covered services under the National Health Insurance Scheme, with the aim of improving accessibility across basic healthcare institutions in the country.

Assisted Reproductive Technologies (ARTs) have gained widespread recognition and acceptance as essential interventions for addressing infertility and preserving fertility for various medical and social reasons. These techniques are now well-known and practiced by majority of the educated population. Several factors contribute to this increased awareness, including the growing popularity of ART services, probable increasing utilization of these services, their extensive coverage in online platforms and media, as well as their incorporation into educational curricula, particularly among healthcare students, notably nursing and medical students. However, it is important to acknowledge that the cost associated with ARTs remains a significant barrier to access in many developing countries, including Ghana. Numerous studies and literature, such as the work by Viola Horbst et al. [10] and Gerrits T. [8], consistently highlight the financial challenges that individuals and couples face in accessing ART services in resource-limited settings. These cost-related barriers hinder the equitable availability and utilization of ARTs, limiting their potential impact on addressing infertility and fertility-related concerns in these regions.

Limitations

- The study focused on literate Ghanaian participants, which may not fully capture the knowledge, attitudes, and perceptions of the average Ghanaian population towards ARTs. By excluding non-literate individuals, the study may not reflect the perspectives of a significant portion of the population, potentially limiting the overall generalizability of the findings.
- Limited marital and parental representation: The study had a small number of married participants and respondents with children. As a result, the responses obtained may primarily reflect participants' ideological thinking rather than their actual experiences with infertility and the use of ARTs. This limitation may affect the depth and accuracy of the attitudes and perceptions expressed in the study.
- Comparison between post graduate and under graduate responses was going to be additional information. and might have confirmed the negative correlation between age and ART knowledge.

Conclusion

This study found that while non-medical tertiary students in Ghana are generally aware of infertility and assisted reproductive technologies (ARTs), there is limited knowledge about the various types, with significant reluctance toward gamete donation due to religious beliefs, fear, and cost concerns. The findings underscore the need for government interventions to improve access to ART services, including cost subsidies and coverage under the National Health Insurance Scheme.

Supplementary Information

The online version contains supplementary material available at https://doi. org/10.1186/s12958-024-01292-w.

Supplementary Material 1.

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Human ethics

The research methodology, data collection, analysis, and reporting processes have been carried out with full compliance to the above ethical standards. All necessary approvals and consents have been obtained, and the rights and confidentiality of all participants have been safeguarded.

Authors' contributions

J.E.A.C. and S.P.E. conceived the research idea and drafted the initial study protocol. J.E.A.C, S.P.E. and S.D.A. supervised the data collection and S.D.A. lead the analysis. J.E.A.C., S.P.E. and M.K. drafted initial manuscript. All authors read through and approved the final manuscript for submission.

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Data availability

The data supporting the findings of this study are available within the article and its supplementary materials. Additional data are available from the corresponding author upon reasonable request.

Data availability

Data is provided within the manuscript or supplementary information files.

Declarations

Ethics approval and consent to participate

This study was approved by the university of Ghana Ethical and Protocol Review Committee. The study was conducted in accordance with the fundamental ethical principles outlined in the University of Ghana Ethics Policy, which encompasses the Declaration of Helsinki (1996), International Conference on Harmonization Good Clinical Practice (ICH GCP E6) Guidelines, Council for International Organizations of Medical Sciences (CIOMS) principles, the Belmont Report, and applicable laws and statutory regulations of Ghana and the University.

By adhering to these esteemed guidelines, we ensured the highest ethical standards in the design, implementation, and reporting of our research.

Consent to participate

Participants provided informed consent for the publication of their anonymized data. Confidentiality was strictly maintained, and no identifying information has been disclosed.

Competing interests

The authors declare no competing interests.

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