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Nursing Students' Knowledge of Fetal Sex Selection at university of kufa in Alnajaf City-Iraq

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Abstract: Advances in reproductive technologies, such as non-invasive prenatal testing (NIPT) and preimplantation genetic diagnosis (PGD), now allow for highly accurate sex determination as early as seven weeks' gestation (Bowman-Smart *et al*., 2020). Objective to evaluate the knowledge and awareness of nursing students at the University of Kufa regarding fetal sex selection, including both medical and non-medical methods, as well as the ethical implications involved. A descriptive cross-sectional study was conducted from November 2024 to March 2025, involving a total of 200 students from all four academic stages. A structured questionnaire was used to collect data on demographic variables, knowledge. The data were analyzed using SPSS version 26, with Chi-Square tests applied to identify statistically significant relationships. A total of 200 student participants were included in the study. The results, presented by age, gender, and academic stage groups, illustrate varying levels of knowledge across specific questions and help fulfill the study's objectives. These results revealed moderate levels of knowledge among students, with noticeable differences across gender, age, and academic stages. Female students demonstrated higher awareness levels (58% responded "I know") compared to males (50.75%). Third-stage students had the highest proportion of knowledge (57.14%). The analysis indicated that gender significantly influenced responses in 6 out of 18 questions, while academic stage showed significance in only 3 questions. Age was found to be a significant factor in just one question. Students demonstrated a moderate level of knowledge, with gender significantly influencing awareness and academic stage showing a moderate effect, while age had minimal impact. These results emphasize the need to strengthen nursing curricula to address knowledge gaps and promote ethical understanding of fetal sex selection. Further studies across various centers and hospitals with larger sample sizes are recommended to broaden insights while ensuring proper use of such knowledge.

Keywords: Knowledge, Ethics, Selection

Introduction

Fetal sex selection—the deliberate choice of a child's sex before birth—has evolved into a contentious issue at the intersection of medical innovation, cultural norms, and ethical responsibility. Advances in reproductive technologies, such as non-invasive prenatal testing (NIPT) and preimplantation genetic diagnosis (PGD), now allow for highly accurate sex determination as early as seven weeks' gestation (Bowman-Smart *et al*., 2020). While these tools were initially developed to screen for chromosomal abnormalities (e.g., trisomy 21) or mitochondrial DNA disorders (e.g., to avoid transgenerational risks), their misuse for non-medical sex selection has raised alarms, particularly in regions with entrenched son preference (e.g., India, China), where skewed sex ratios exceed 114 males per 100 females (Kaur,, 2020; Bowman-Smart *et al*., 2020). Concurrently, non-invasive methods, such as maternal dietary interventions (e.g., high sodium/potassium for male offspring) and ovulation timing (e.g., the Billings Method), are culturally embedded practices claiming success rates of 82–95% (Rai, *et al*., 2019; de Diego-Cordero *et al*., 2021).

The ethical landscape of fetal sex selection is fraught with contradictions. On one hand, PGD and NIPT offer legitimate pathways to prevent sex-linked genetic disorders (e.g., Duchenne muscular dystrophy) or chromosomal abnormalities (e.g., Turner syndrome) (Bowman-Smart *et al*., 2020).

For instance, selecting female embryos can mitigate the transmission of X-linked conditions, while avoiding male embryos may reduce risks of mitochondrial DNA disorders (e.g., Leigh syndrome) (Hollestelle, 2019; Chakravarty, *et al*., 2022).

On the other hand, the same technologies enable sex-selective terminations, perpetuating gender imbalances and reinforcing patriarchal norms (Rahm,, 2022). A 2020 Australian study found that multiparous women from China and India had significantly higher male-to-female birth ratios (1.22–

1.25) after accessing NIPT, suggesting covert misuse (Bowman-Smart *et al*., 2020).
Similarly, natural methods like the Billings ovulation technique, which claims 94.9% success in Nigeria for male selection, risk normalizing gender bias under the guise of family balancing (Rai, 2019). These practices clash with principles of gender equity and reproductive justice, demanding nuanced ethical reflection from healthcare providers. For nursing students, understanding these methods and their ethical, legal, and sociocultural ramifications is critical to delivering equitable, patient- centered care in diverse clinical settings.
This study addresses these gaps by evaluating nursing students' awareness of fetal sex selection methods and their ethical implications. Drawing on mixed-method surveys and case analyses, it aims to assess knowledge of medical (NIPT, PGD) and non-medical (diet, ovulation timing) sex selection techniques, explore attitudes toward ethical dilemmas, such as sex selection for family balancing vs. gender discrimination.

Results

Table 1. Frequency of knowledge according to age.

Age	Items	Frequency		
		I know n. (%)	**I'm not sure n. (%)**	**I don't know n. (%)**
< 20	P2Q1	25 (51.02%)	5 (10.2%)	19 (38.78%)
	P2Q2	19 (38.78%)	12 (24.49%)	18 (36.73%)
	P2Q3	44 (89.8%)	3 (6.12%)	2 (4.08%)
	P2Q4	34 (69.39%)	10 (20.41%)	5 (10.2%)
	P2Q5	30 (61.22%)	10 (20.41%)	9 (18.37%)
	P2Q6	34 (69.39%)	7 (14.29%)	8 (16.33%)
	P2Q7	19 (38.78%)	17 (34.69%)	13 (26.53%)
	P2Q8	23 (46.94%)	9 (18.37%)	17 (34.69%)
	P3Q1	14 (28.57%)	20 (40.82%)	15 (30.61%)
	P3Q2	11 (22.45%)	17 (34.69%)	21 (42.86%)
	P3Q3	9 (18.37%)	29 (59.18%)	11 (22.45%)
	P3Q4	13 (26.53%)	25 (51.02%)	11 (22.45%)
	P3Q5	13(26.53%)	12(24.49%)	24(48.98%)
	P3Q6	14 (28.57%)	16 (32.65%)	19 (38.78%)
	P4Q1	26 (53.06%)	12 (24.49%)	11 (22.45%)
	P4Q2	21 (36.21%)	26 (44.83%)	11 (18.97%)
	P4Q3	19 (38.78%)	11 (22.45%)	19 (38.78%)
	P4Q4	12 (24.49%)	22 (44.9%)	15 (30.61%)
20- 24	P2Q1	60 (51.72%)	12 (10.34%)	44 (37.93%)
	P2Q2	57 (49.14%)	13 (11.21%)	46 (39.66%)
	P2Q3	100 (86.21%)	5 (4.31%)	11 (9.48%)
	P2Q4	86 (74.14%)	10 (8.62%)	20 (17.24%)
	P2Q5	91 (78.45%)	9 (7.76%)	16 (13.79%)
	P2Q6	72 (62.07%)	8 (6.9%)	36 (31.03%)
	P2Q7	48 (41.38%)	21 (18.1%)	47 (40.52%)
	P2Q8	65 (56.03%)	19 (16.38%)	32 (27.59%)
	P3Q1	38 (32.76%)	30 (25.86%)	48 (41.38%)
	P3Q2	25 (21.55%)	42 (36.21%)	49 (42.24%)
	P3Q3	34 (29.31%)	38 (32.76%)	44 (37.93%)
	P3Q4	32 (27.59%)	44 (37.93%)	40 (34.48%)
	P3Q5	27(23.28%)	40(34.48%)	49(42.24%)
	P3Q6	28 (24.14%)	48 (41.38%)	40 (34.48%)
	P4Q1	54 (46.55%)	27 (23.28%)	35 (30.17%)
	P4Q2	30 (25.86%)	50 (43.1%)	36 (31.03%)

	P4Q3	46 (39.66%)	23 (19.83%)	47 (40.52%)
	P4Q4	28 (24.14%)	49 (42.24%)	39 (33.62%)
	P2Q1	20 (57.14%)	6 (17.14%)	9 (25.71%)
	P2Q2	20 (57.14%)	4 (11.43%)	11 (31.43%)
	P2Q3	30 (85.71%)	1 (2.86%)	4 (11.43%)
	P2Q4	20 (57.14%)	7 (20.0%)	8 (22.86%)
	P2Q5	26 (74.29%)	0 (0.0%)	9 (25.71%)
	P2Q6	25 (71.43%)	2 (5.71%)	8 (22.86%)
	P2Q7	14 (40.0%)	3 (8.57%)	18 (51.43%)
	P2Q8	22 (62.86%)	2 (5.71%)	11 (31.43%)
	P3Q1	14 (40.0%)	10 (28.57%)	11 (31.43%)
	P3Q2	8 (22.86%)	8 (22.86%)	19 (54.29%)
	P3Q3	9 (18.37%)	29 (59.18%)	11 (22.45%)
	P3Q4	5 (14.29%)	7 (20.0%)	23 (65.71%)
= > **25**	P3Q5	8(22.86%)	3(8.57%)	24(68.57%)
	P3Q6	9 (25.71%)	15 (42.86%)	11 (31.43%)
	P4Q1	22 (62.86%)	3 (8.57%)	10 (28.57%)
	P4Q2	6 (17.14%)	15 (42.86%)	14 (40.0%)
	P4Q3	18 (51.43%)	5 (14.29%)	12 (34.29%)
	P4Q4	12 (34.29%)	8 (22.86%)	15 (42.86%)

Table 2. Frequency of knowledge according to gender.

Gender	**Items**	**Frequency**		
		I know n. (%)	**I'm not sure n. (%)**	**I don't know n. (%)**
Male	P2Q1	36 (50.7%)	12 (16.9%)	23 (32.39%)
	P2Q2	34 (47.89%)	9 (12.68%)	28 (39.44%)
	P2Q3	59 (83.1%)	6 (8.45%)	6 (8.45%)
	P2Q4	43 (60.56%)	13 (18.31%)	15 (21.13%)
	P2Q5	47 (66.2%)	4 (5.63%)	20 (28.17%)
	P2Q6	41 (57.75%)	6 (8.45%)	24 (33.8%)
	P2Q7	29 (40.85%)	17 (23.94%)	25 (35.21%)
	P2Q8	39 (54.93%)	13 (18.31%)	19 (26.76%)
	P3Q1	24 (33.8%)	20 (28.17%)	27 (38.03%)
	P3Q2	17 (23.94%)	24 (33.8%)	30 (42.25%)
	P3Q3	16 (22.54%)	23 (32.39%)	32 (45.07%)
	P3Q4	22 (30.99%)	22 (30.99%)	27 (38.03%)
	P3Q5	30 (42.25%)	22 (30.99%)	19 (26.76%)
	P3Q6	15 (21.13%)	23 (32.39%)	33 (46.48%)
	P4Q1	30 (42.25%)	13 (18.31%)	28 (39.44%)
	P4Q2	27 (38.03%)	27 (38.03%)	17 (23.94%)
	P4Q3	32 (45.07%)	6 (8.45%)	33 (46.48%)
	P4Q4	28 (39.44%)	23 (32.39%)	20 (28.17%)
Female	P2Q1	69 (53.49%)	11 (8.53%)	49 (37.98%)
	P2Q2	62 (48.06%)	20 (15.5%)	47 (36.43%)
	P2Q3	115 (89.15%)	3 (2.33%)	11 (8.53%)
	P2Q4	97 (75.19%)	14 (10.85%)	18 (13.95%)
	P2Q5	100 (77.52%)	15 (11.63%)	14 (10.85%)
	P2Q6	90 (69.77%)	11 (8.53%)	28 (21.71%)
	P2Q7	52 (40.31%)	24 (18.6%)	53 (41.09%)
	P2Q8	71 (55.04%)	17 (13.18%)	41 (31.78%)
	P3Q1	42 (32.56%)	40 (31.01%)	47 (36.43%)

P3Q2	27 (20.93%)	43 (33.33%)	59 (45.74%)
P3Q3	36 (27.91%)	53 (41.09%)	40 (31.01%)
P3Q4	28 (21.71%)	54 (41.86%)	47 (36.43%)
P3Q5	67 (51.94%)	26 (20.16%)	36 (27.91%)
P3Q6	36 (27.91%)	56 (43.41%)	37 (28.68%)
P4Q1	72 (55.81%)	29 (22.48%)	28 (21.71%)
P4Q2	21 (16.28%)	64 (49.61%)	44 (34.11%)
P4Q3	51 (39.53%)	33 (25.58%)	45 (34.88%)
P4Q4	24 (18.6%)	56 (43.41%)	49 (37.98%)

Table 3. Frequency of knowledge according to stage.

Stage academic	Items	Frequency		
		I know n. (%)	I'm not sure n. (%)	I don't know n. (%)
First Stage	P2Q1	7 (13.46%)	21 (40.38%)	24 (46.15%)
	P2Q2	12 (23.08%)	19 (36.54%)	21 (40.38%)
	P2Q3	3 (5.77%)	2 (3.85%)	47 (90.38%)
	P2Q4	11 (21.15%)	5 (9.62%)	36 (69.23%)
	P2Q5	7 (13.46%)	12 (23.08%)	33 (63.46%)
	P2Q6	8 (15.38%)	12 (23.08%)	32 (61.54%)
	P2Q7	14 (26.92%)	17 (32.69%)	21 (40.38%)
	P2Q8	8 (15.38%)	19 (36.54%)	25 (48.08%)
	P3Q1	20 (38.46%)	17 (32.69%)	15 (28.85%)
	P3Q2	20 (38.46%)	23 (44.23%)	9 (17.31%)
	P3Q3	27 (51.92%)	14 (26.92%)	11 (21.15%)
	P3Q4	23 (44.23%)	17 (32.69%)	12 (23.08%)
	P3Q5	9(17.31%)	17(23.69%)	26(50.0%)
	P3Q6	20 (38.46%)	17 (32.69%)	15 (28.85%)
	P4Q1	10 (19.23%)	12 (23.08%)	30 (57.69%)
	P4Q2	24 (46.15%)	14 (26.92%)	14 (26.92%)
	P4Q3	10 (19.23%)	23 (44.23%)	19 (36.54%)
	P4Q4	23 (44.23%)	17 (32.69%)	12 (23.08%)
Second Stage	P2Q1	9 (18.75%)	13 (27.08%)	26 (54.17%)
	P2Q2	8 (16.67%)	17 (35.42%)	23 (47.92%)
	P2Q3	2 (4.17%)	3 (6.25%)	43 (89.58%)
	P2Q4	7 (14.58%)	5 (10.42%)	36 (75.0%)
	P2Q5	6 (12.5%)	4 (8.33%)	38 (79.17%)
	P2Q6	2 (4.17%)	12 (25.0%)	34 (70.83%)
	P2Q7	11 (22.92%)	20 (41.67%)	17 (35.42%)
	P2Q8	7 (14.58%)	17 (35.42%)	24 (50.0%)
	P3Q1	11 (22.92%)	19 (39.58%)	18 (37.5%)
	P3Q2	14 (29.17%)	20 (41.67%)	14 (29.17%)
	P3Q3	16 (33.33%)	20 (41.67%)	12 (25.0%)
	P3Q4	24 (50.0%)	17 (35.42%)	7 (14.58%)
	P3Q5	20(41.67%)	9(18.75%)	19(39.58%)
	P3Q6	22 (45.83%)	18 (37.5%)	8 (16.67%)
	P4Q1	13 (27.08%)	8 (16.67%)	27 (56.25%)
	P4Q2	25 (52.08%)	16 (33.33%)	7 (14.58%)
	P4Q3	9 (18.75%)	17 (35.42%)	22 (45.83%)
	P4Q4	17 (35.42%)	19 (39.58%)	12 (25.0%)

Third Stage	P2Q1	2 (4.0%)	20 (40.0%)	28 (56.0%)
	P2Q2	4 (8.0%)	20 (40.0%)	26 (52.0%)
	P2Q3	2 (4.0%)	4 (8.0%)	44 (88.0%)
	P2Q4	2 (4.0%)	8 (16.0%)	40 (80.0%)
	P2Q5	3 (6.0%)	6 (12.0%)	41 (82.0%)
	P2Q6	2 (4.0%)	10 (20.0%)	38 (76.0%)
	P2Q7	6 (12.0%)	23 (46.0%)	21 (42.0%)
	P2Q8	8 (16.0%)	13 (26.0%)	29 (58.0%)
	P3Q1	12 (24.0%)	24 (48.0%)	14 (28.0%)
	P3Q2	13 (26.0%)	28 (56.0%)	9 (18.0%)
	P3Q3	17 (34.0%)	13 (26.0%)	20 (40.0%)
	P3Q4	11 (22.0%)	17 (34.0%)	22 (44.0%)
	P3Q5	7 (14.0%)	13 (26.0%)	20 (60.0%)
	P3Q6	22 (44.0%)	14 (28.0%)	14 (28.0%)
	P4Q1	8 (16.0%)	13 (26.0%)	29 (58.0%)
	P4Q2	22 (44.0%)	12 (24.0%)	16 (32.0%)
	P4Q3	10 (20.0%)	14 (28.0%)	26 (52.0%)
	P4Q4	24 (48.0%)	14 (28.0%)	12 (24.0%)
Fourth Stage	P2Q1	5 (10.0%)	18 (36.0%)	27 (54.0%)
	P2Q2	5 (10.0%)	19 (38.0%)	26 (52.0%)
	P2Q3	2 (4.0%)	8 (16.0%)	40 (80.0%)
	P2Q4	7 (14.0%)	15 (30.0%)	28 (56.0%)
	P2Q5	3 (6.0%)	12 (24.0%)	35 (70.0%)
	P2Q6	5 (10.0%)	18 (36.0%)	27 (54.0%)
	P2Q7	10 (20.0%)	18 (36.0%)	22 (44.0%)
	P2Q8	7 (14.0%)	11 (22.0%)	32 (64.0%)
	P3Q1	17 (34.0%)	14 (28.0%)	19 (38.0%)
	P3Q2	20 (40.0%)	18 (36.0%)	12 (24.0%)
	P3Q3	16 (32.0%)	25 (50.0%)	9 (18.0%)
	P3Q4	18 (36.0%)	23 (46.0%)	9 (18.0%)
	P3Q5	12 (24.0%)	16 (32.0%)	22 (44.0%)
	P3Q6	15 (30.0%)	21 (42.0%)	14 (28.0%)
	P4Q1	11 (22.0%)	23 (46.0%)	16 (32.0%)
	P4Q2	20 (40.0%)	19 (38.0%)	11 (22.0%)
	P4Q3	10 (20.0%)	24 (48.0%)	16 (32.0%)
	P4Q4	15 (30.0%)	19 (38.0%)	16 (32.0%)

Table 4. Overall relationship among students' knowledge according to age, gender and academic stage.

Socio-Demographic Characteristics	Rating and Intervals	Statistical Test	P-Value
Age	< 20 20-24 = >25	1.668	0.8340 (NS)
Gender	Males Females	1.355	0.179 (NS)
Academic stage	First Second Third Fourth	3.715	0.021 (S)

Table 5. Relationship between various socio-demographic characteristics (age, gender, and academic stage) and the questionnaire items.

Socio-Demographic Characteristics	Items	p-value	Statistically indicator
Age (< 20, 20-24, and = >25)	P2Q1	0.6257	NS
	P2Q2	0.6257	NS
	P2Q3	0.6257	NS
	P2Q4	0.1665	NS
	P2Q5	0.0089	St. S.
	P2Q6	0.1892	NS
	P2Q7	0.0261	St. S.
	P2Q8	0.3883	NS
	P3Q1	0.3036	NS
	P3Q2	0.6625	NS
	P3Q3	0.0081	St. S.
	P3Q4	0.0013	St. S.
	P3Q5	0.0289	St. S.
	P3Q6	0.8464	NS
	P4Q1	0.2542	NS
	P4Q2	0.4392	NS
	P4Q3	0.7366	NS
	P4Q4	0.2764	NS
Gender (male and female)	P2Q1	0.1961	NS
	P2Q2	0.834	NS
	P2Q3	0.1346	NS
	P2Q4	0.0947	NS
	P2Q5	0.005	St. S.
	P2Q6	0.1663	NS
	P2Q7	0.593	NS
	P2Q8	0.5518	NS
	P3Q1	0.9158	NS
	P3Q2	0.8535	NS
	P3Q3	0.1399	NS
	P3Q4	0.2193	NS
	P3Q5	0.2074	NS
	P3Q6	0.0412	St. S.
	P4Q1	0.0277	St. S.
	P4Q2	0.0026	St. S.
	P4Q3	0.0122	St. S.
	P4Q4	0.0057	St. S.
Academic stage (first, second, third, and four stages)	P2Q1	0.3177	NS
	P2Q2	0.4159	NS
	P2Q3	0.4718	NS
	P2Q4	0.0135	St. S.
	P2Q5	0.146	NS
	P2Q6	0.1136	NS
	P2Q7	0.4159	NS
	P2Q8	0.6617	NS
	P3Q1	0.293	NS
	P3Q2	0.3592	NS
	P3Q3	0.0216	St. S.

P3Q4	0.0072	St. S.
P3Q5	0.0304	St. S.
P3Q6	0.4927	NS
P4Q1	0.022	St. S.
P4Q2	0.4062	NS
P4Q3	0.414	NS
P4Q4	0.5813	NS

Conclusion

The findings reveal that overall knowledge among students was moderate, with notable variation across demographic groups. Female students and those in the third academic stage exhibited higher awareness levels, suggesting a potential correlation between academic exposure and understanding of the topic. Statistical analysis showed that gender significantly influenced knowledge in several areas, indicating possible gender-based differences in interest or access to information. Academic stage was a less consistent but still relevant factor, while age had minimal impact. These results underscore the need for more comprehensive educational efforts within the nursing curriculum to address gaps in knowledge and enhance ethical awareness surrounding fetal sex selection practices.

Recommendation

Preparing future nurses to understand and manage the medical, ethical, and cultural aspects of fetal sex selection is essential for promoting patient-centered and equitable care in clinical practice, so this study recommended performed other studies about this topic in all centers and province hospitals, also increase sample size to elevate knowledge for important this, but with understand the limited and avoid misuse..

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