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Nursing Students' Knowledge of Gallstones: Comprehensive Management and Complications

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Abstract: Gallstones are a prevalent global health issue, necessitating comprehensive knowledge among nursing students for effective patient care. This study assessed nursing students' understanding of gallstone management and complications, identifying gaps in their knowledge. A descriptive cross-sectional study was conducted with 101 undergraduate nursing students from the University of Kufa. Data were collected via a validated questionnaire, analyzing knowledge levels across socio-demographic variables using SPSS (version 26). Statistical significance was set at $p \leq 0.05$. Most students (78.22%) demonstrated moderate knowledge (mean score = 0.57, SD = 0.14), with significant gaps in pathophysiology, risk factors, and rare complications. No statistically significant relationships were found between knowledge levels and socio-demographic variables ($p > 0.05$). While foundational knowledge exists, critical deficiencies highlight the need for enhanced education in gallstone management. Curriculum enhancements, integrated clinical scenarios, targeted interventions, and further research are recommended to bridge knowledge gaps and improve clinical preparedness.

Keywords: Gallstones, Nursing Students, Knowledge Assessment, Curriculum Enhancement

Introduction

Historical background

Gallstones, or cholelithiasis, have been documented since ancient times, with evidence found in Egyptian mummies dating back to 1000 BCE (Tazuma, 2006). The understanding of gallstone pathology evolved significantly in the 19th and 20th centuries with advancements in medical imaging and surgical techniques, such as cholecystectomy (Stinton & Shaffer, 2012). Despite these developments, gallstone disease remains a major global health concern, affecting approximately 10–15% of adults in Western countries (Lammert et al., 2016). The rising prevalence of obesity and metabolic syndrome has further increased the incidence of gallstones, making it a critical area of study for healthcare professionals (Di Ciaula et al., 2019). Nursing students, as future frontline healthcare providers, must be well-versed in gallstone pathophysiology, management, and complications to ensure optimal patient care.

Introduction

Gallstones are a common gastrointestinal disorder, often leading to complications such as cholecystitis, pancreatitis, and cholangitis if not managed promptly (Gutt et al., 2020). Current research emphasizes the importance of early diagnosis and evidence-based interventions, including dietary modifications, pharmacological treatments, and surgical options (Portincasa et al., 2016). However, studies highlight a significant gap in nursing students' knowledge regarding the management of cholelithiasis, particularly in recognizing early symptoms and implementing preventive measures (Kareem et al., 2022). A recent survey revealed that only 45% of nursing students could accurately identify risk factors for gallstones, highlighting the need for enhanced education on this topic (Pak & Lindseth, 2016). Furthermore, while existing literature extensively covers the medical and surgical management of various health conditions, there is limited emphasis on nursing-specific interventions and patient education strategies (Jarelnape et al., 2024). This study aims to assess nursing students' knowledge of gallstone management and identify areas for curricular improvement.

Importance of the study

Enhancing nursing students' knowledge of gallstones is essential for fostering better patient outcomes.

Nurses are integral in the early identification of symptoms, patient education regarding lifestyle modifications, and postoperative care following gallbladder surgery (HOLCOMB, 2005). Misdiagnosis or delayed treatment of gallstone-related complications can lead to severe morbidity, increasing healthcare costs and hospital stays (Shabanzadeh et al., 2017). By evaluating current knowledge gaps, this study will contribute to the development of targeted educational programs that better prepare nursing students for clinical practice (Hasanah et al., 2024). Additionally, findings from this research may inform nursing curricula revisions, ensuring that future nurses are equipped with the latest evidence-based practices in gallstone management (Wei et al., 2021). Ultimately, improving nursing education in this area can lead to earlier detection, better patient counseling, and reduced complications associated with gallstone disease (Bao et al., 2025).

Statement of the Problem

Nursing Students' Knowledge of Gallstones: Comprehensive Management and Complications.

Objectives of the Study

a. To assess the nursing students' knowledge regarding the incidence and clinical consequences of gallstones in patients.

b. To find out the relationship between nursing students' knowledge and demographic data.

Definition of Terms

Knowledge

a. Theoretical Definition

Knowledge in nursing research refers to the awareness, understanding, and application of information related to health concepts, practices, and phenomena (Waltz et al., 2005).

b. Operational Definition

In this study, knowledge would be measured through observable indicators such as nursing students' ability to recall, explain, and apply information about gallstones, their management, and complications.

Gallstones

a. Theoretical Definition

Gallstones are concretions formed within the gallbladder or bile ducts due to imbalances in bile composition. They can be asymptomatic or symptomatic, causing conditions such as biliary colic, acute cholecystitis, or gallstone pancreatitis ("National Institute for Health and Care Excellence: Guidelines," 2014).

b. Operational Definition

Gallstones in this research context would be defined by clinical criteria such as imaging findings (ultrasound or CT scans) confirming their presence in the gallbladder or bile ducts. Indicators might include symptoms reported by patients (e.g., pain or jaundice) and diagnostic results used to confirm their existence and associated complications.

Materials and Methods

Study Design

We conducted a descriptive cross-sectional study. Data was collected from the nursing students between March 1st, 2025, and March 5th, 2025.

Administrative Arrangements

We got permission from the Central Scientific Committee, Faculty of Nursing, University of Kufa. This approval facilitated access to the student population and ensured adherence to ethical guidelines. The administrative process included submitting the research title for review (detailed in Appendix B).

Setting of the Study

The study was conducted at the Faculty of Nursing, University of Kufa, Iraq. This setting was chosen due to its relevance to the research objectives and the availability of undergraduate nursing students across different academic levels and study types (Morning and Night).

The Sample of the Study

A purposive sample of 101 undergraduate nursing students was selected from the Faculty of Nursing, University of Kufa. The sample included students from the 2nd, 3rd, and 4th academic years, stratified

by study type:

a. Morning students: 37 (36.63% of the sample).

b. Night students: 64 (63.37% of the sample).

Sampling Criteria

Inclusion criteria

Undergraduate nursing students enrolled in the 2nd, 3rd, and 4th year at the Faculty of Nursing, University of Kufa.

Students actively participating in either morning or night study programs.

Exclusion Criteria

First-year undergraduate nursing students were deemed to have limited exposure to advanced clinical knowledge.

Instrument of the Study

By reviewing related Guidelines (American College of Gastroenterology (ACG), Society of American Gastrointestinal Surgeons (SAGES), American Society for Gastrointestinal Endoscopy (ASGE), European Association for Endoscopic Surgery (EAES)), the questionnaire was prepared and modified depending on previous Guidelines, and it was divided into four main parts (part one contained socio-demographic data, part two included undergraduate nursing students' knowledge regarding gallstone causes, symptoms and risk factors, part three included nursing students' knowledge regarding complications of gallstones, and part four included general information about patients with Gallstones). The total number of questions for this tool was 44.

Current Study Validity

The capability of collecting needed data by questionnaire is called validity. For determining the validity of the created questionnaire (10) experts (who have more than five years of experience in the medical and nursing profession) were consulted in order to explore the current study's questionnaire for its competence, relevance, intelligibility, and clearness to achieve the selected objectives.

A primary copy of the current study questionnaire was constructed and offered to the experts detailed. Furthermore, the majority of experts approved that the questionnaire was well-designed and developed in order to assess nursing students' knowledge of gallstones: comprehensive management and complications. Moreover, the suggestions of the vast majority of experts were taken into consideration. So far, the final copy of the research tool has been reformed and prepared for carrying out the study.

Data Collection

The researchers, by using the developed and modified questionnaire and by means of checklist technique, collected data. The total number of collected samples was 101 undergraduate nursing students who were selected purposively. The data collection period continued from March 1st, 2025, to March 5th, 2025.

The Statistical Analysis

All the data in the current study were entered into the SPSS program (version 26). The means and the standard deviation were calculated. Chi-square (non-parametric test) and Multiple response crosstab were used for qualitative data. A p-value ≤ 0.05 was considered statistically significant.

Result

This chapter displays the results of the data analysis systematically in tables, and these correspond with the objectives of the study as follows:

Table 1. Distribution of Socio-Demographic Characteristics for the Nursing Students (N=101).

Socio-Demographic Characteristics	Rating and Intervals	F.	%
Age groups (Years)	<= 25	91	90.10
	> 25	10	9.90
Sex	Males	52	51.49

Study type	Females	49	48.51
	Morning	37	36.63
	Night	64	63.37
Level of education	2nd year nurse's students	25	24.75
	3rd year nurse's students	27	26.73
	4th year nurse's students	49	48.51
Economic status	Low	17	16.83
	Medium	80	79.21
	High	4	3.96
Marital status	Married	26	25.74
	Unmarried	71	70.30
	Widowed	2	1.98
	Divorced	2	1.98
Place of residence	Rural	27	26.73
	Urban	74	73.27
Total		101	100%

%= percentage, F. = frequency.

Table 1 shows the socio-demographic distribution of the nursing students (N=101). The table reveals that the majority (90.1%) are aged 25 years or younger, indicating a predominantly young student population.

The gender distribution is nearly balanced, with males slightly outnumbering females (51.49% vs. 48.51%). Most students (63.37%) are enrolled in night studies.

In terms of educational level, the highest proportion of students are in their 4th year (48.51%), followed by 3rd and 2nd years. The economic status data shows that the majority (79.21%) perceive their status as medium, with few reporting high (3.96%) or low (16.83%) economic status.

Regarding marital status, most students are unmarried (70.30%), while smaller proportions are married (25.74%) or report being widowed or divorced. Lastly, a larger portion of students reside in urban areas (73.27%) compared to rural areas (26.73%), see figures 1 to 7.

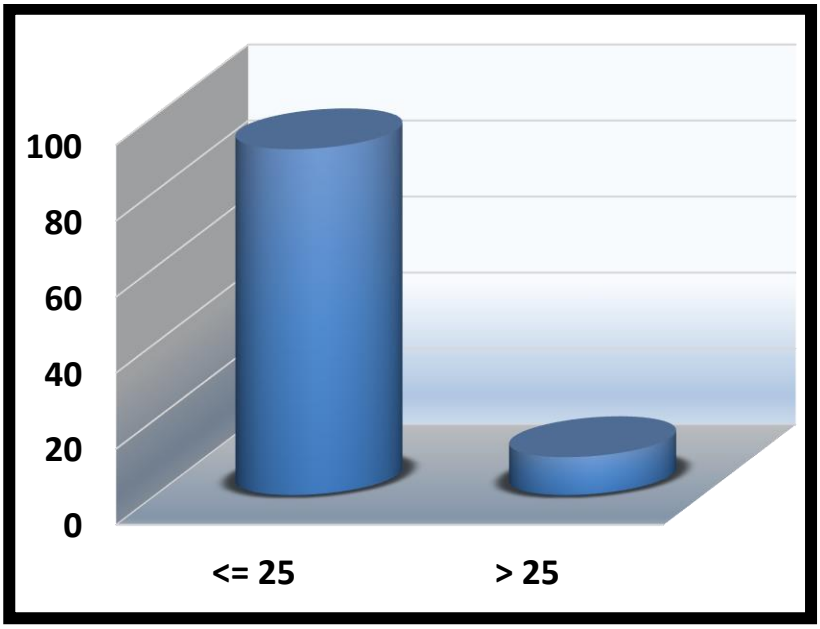

Figure 1. Bar chart of Nursing Students (N=101) according to their Age groups (Years).

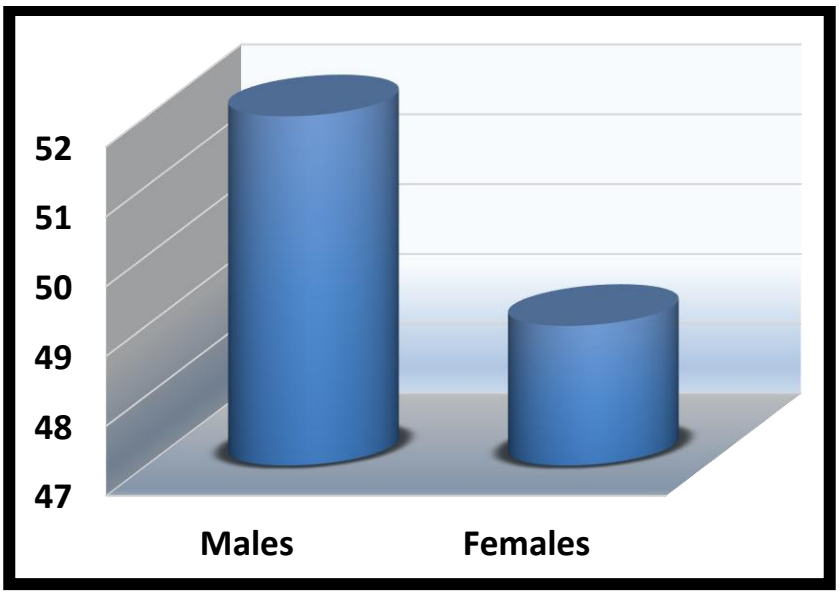

Figure 2. Bar chart of Nursing Students (N=101) according to their Sex.

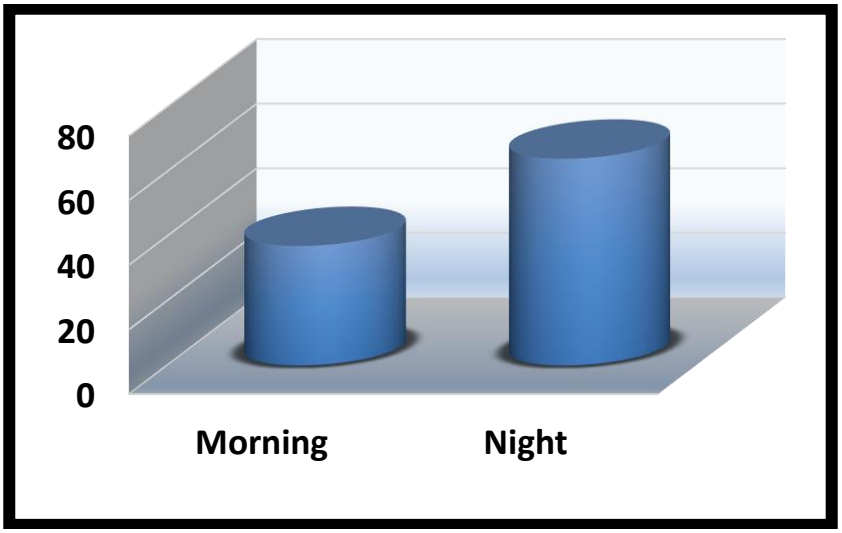

Figure 3. Bar chart of Nursing Students (N=101) according to their study types.

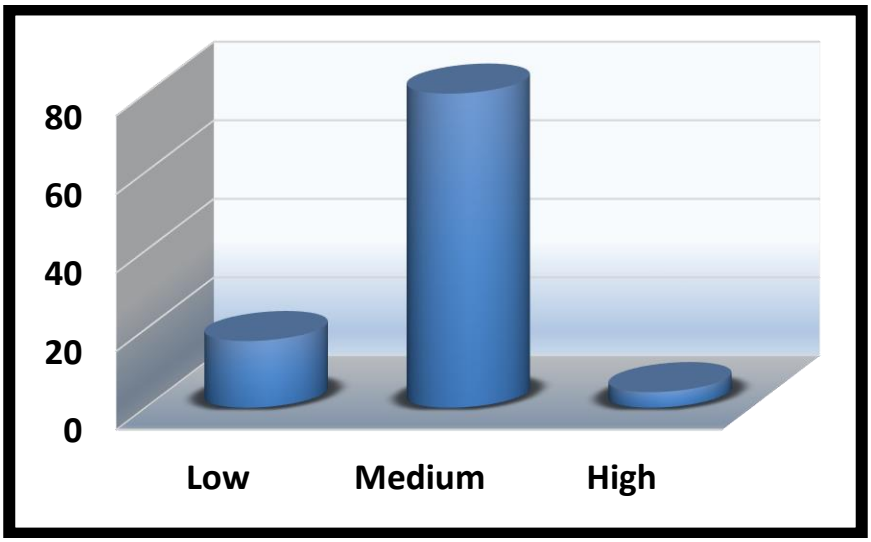

Figure 4. Bar chart of Nursing Students (N=101) according to their Economic status.

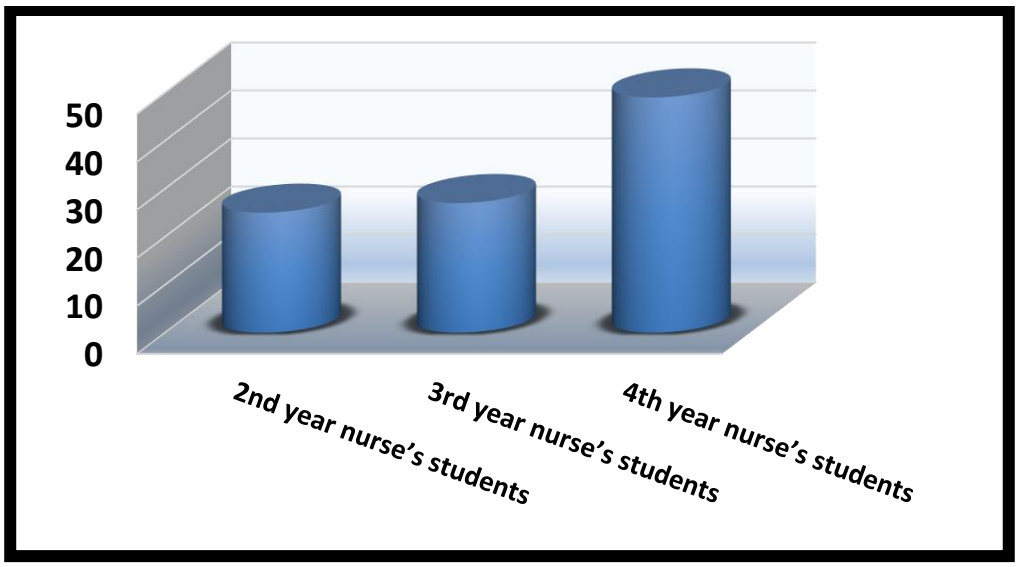

Figure 5. Bar chart of Nursing Students (N=101) according to their education.

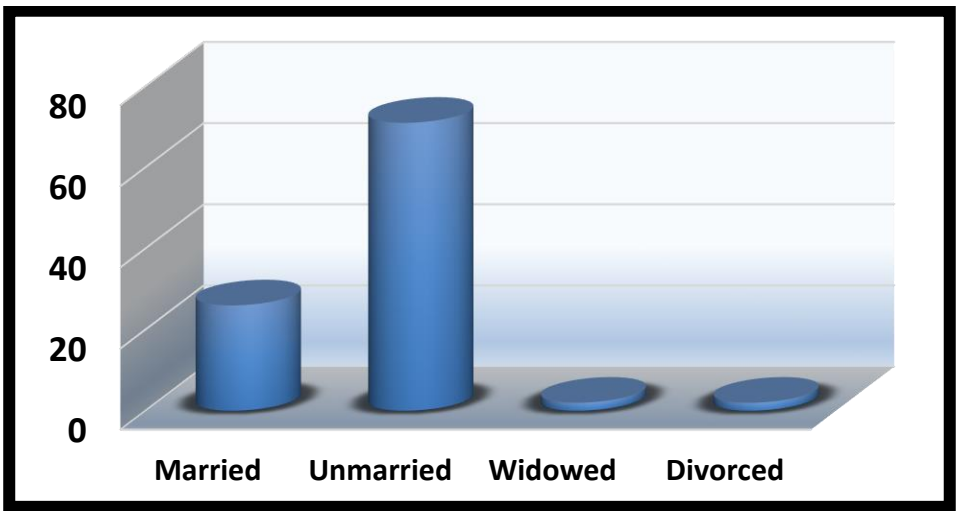

Figure 6. Bar chart of Nursing Students (N=101) according to their martial status.

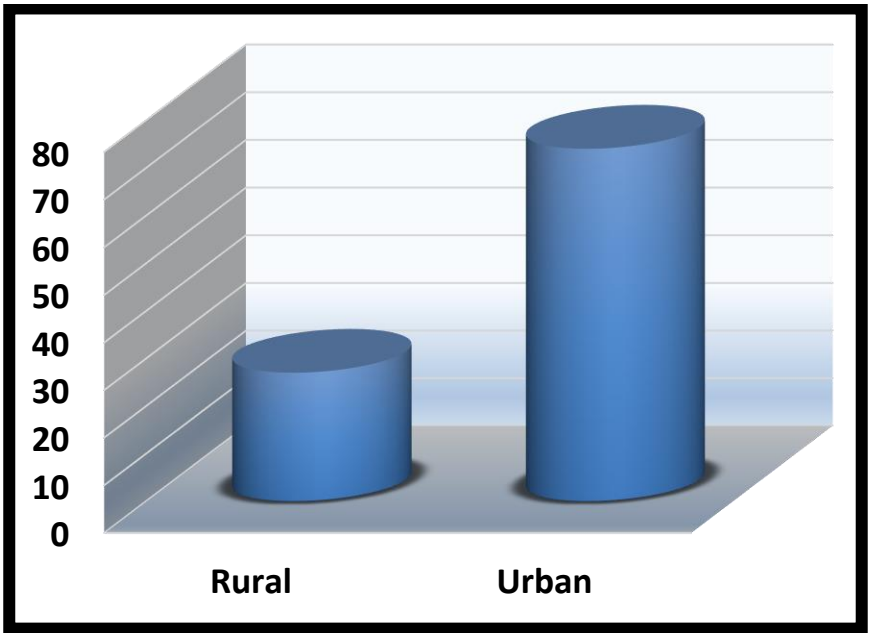

Figure 7. Bar chart of Nursing Students (N=101) according to their Residence.

Table 2. Statistical distribution of Nursing students' knowledge regarding gallstone causes, symptoms, and risk factors (N=101).

Knowledge Items	Rating and Intervals	F.	%	MS	SD	Assess
Q1	Incorrect	71	70.30	.30	.46	Poor
	Correct	30	29.70			
Q2	Incorrect	53	52.48	.48	.50	Moderate
	Correct	48	47.52			
Q3	Incorrect	42	41.58	.58	.50	Moderate
	Correct	59	58.42			
Q4	Incorrect	21	20.79	.79	.41	Good
	Correct	80	79.21			
Q5	Incorrect	80	79.21	.21	.41	Poor
	Correct	21	20.79			
Q6	Incorrect	49	48.51	.51	.50	Moderate
	Correct	52	51.49			
Q7	Incorrect	53	52.48	.48	.50	Moderate
	Correct	48	47.52			
Q8	Incorrect	27	26.73	.73	.44	Good
	Correct	74	73.27			
Q9	Incorrect	23	22.77	.77	.42	Good
	Correct	78	77.23			
Q10	Incorrect	23	22.77	.77	.42	Good
	Correct	78	77.23			
Q11	Incorrect	0	0	1.00	.00	Good
	Correct	101	100			
Q12	Incorrect	64	63.37	.37	.48	Moderate
	Correct	37	36.63			
Q13	**Incorrect**	**45**	**44.55**	**.55**	**.50**	**Moderate**
	Correct	**56**	**55.45**			
Q14	**Incorrect**	**37**	**36.63**	**.63**	**.48**	**Moderate**
	Correct	**64**	**63.37**			
Q15	**Incorrect**	**59**	**58.42**	**.42**	**.50**	**Moderate**
	Correct	**42**	**41.58**			

%= percentage, F. = frequency, Mean <=0.33: Poor, 0.34-0.67: Moderate, 0.68 and more: Good, Assess.: Assessment.

Table 2 presents the statistical distribution of nursing students' knowledge regarding the causes, symptoms, and risk factors of gallstones. The results show a mixed level of understanding among students. While some questions (Q4, Q8, Q9, Q10, and Q11) were answered correctly by a majority, with mean scores indicating a "Good" level of knowledge (e.g., Q11 with a perfect mean score of 1.00), several others (e.g., Q1 and Q5) revealed significant knowledge gaps, falling into the "Poor" category with low mean scores (.30 and .21 respectively). The remaining items largely fall under the "Moderate" category, reflecting partial understanding. This overall pattern suggests that while students have a solid grasp of some key facts, particularly in areas like Q11, where all respondents answered correctly, there are still notable deficiencies in knowledge.

Table 3. Statistical distribution of overall items Nursing students' knowledge regarding gallstone causes, symptoms, and risk factors (N=101).

Overall Items	Rating and Intervals	F.	%	MS	SD	Assess
Nursing students' knowledge regarding gallstone causes, symptoms, and risk factors	Poor	2	1.98	.57	.14	Moderate
	Moderate	79	78.22			
	Good	20	19.80			

%= percentage, F. = frequency, Mean <=0.33: Poor, 0.34-0.67: Moderate, 0.68 and more: Good, Assess.: Assessment.

Table 3 shows the overall knowledge of nursing students regarding the causes, symptoms, and risk factors of gallstones. The majority of students (78.22%) demonstrated a "Moderate" level of knowledge, with a mean score of 0.57 and a standard deviation of 0.14, indicating a relatively consistent performance across the group. A smaller proportion (19.80%) achieved a "Good" level of knowledge, while only a minimal number (1.98%) fell into the "Poor" category. These findings suggest that although most students possess a fair understanding of gallstone-related topics, there is still room for improvement to elevate more students into the "Good" knowledge bracket through enhanced curriculum focus or supplementary educational strategies, see figure 8.

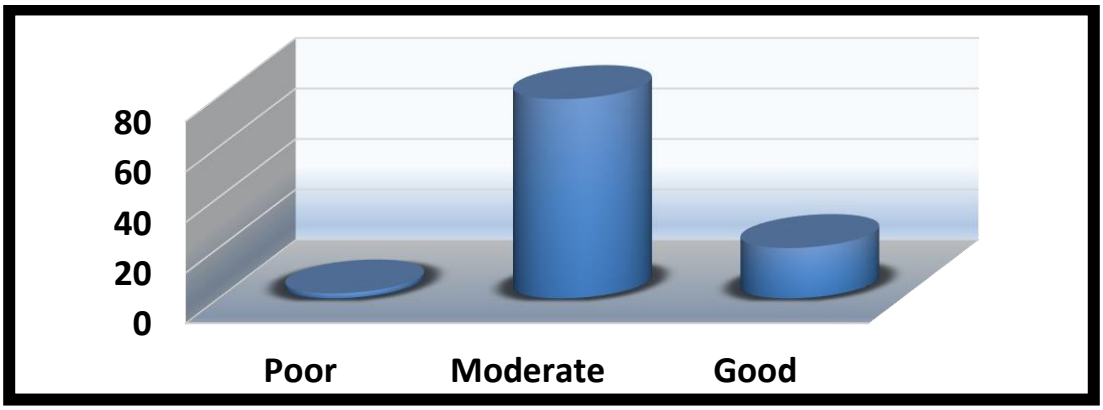

Figure 8. Bar chart distribution of overall items Nursing students' knowledge regarding gallstone causes, symptoms, and risk factors.

Table 4. Statistical distribution of nursing students' knowledge regarding complications of gallstones (N=101).

Knowledge Items	Rating and Intervals	F.	%	MS	SD	Assess
Q1	Incorrect	33	32.67	.67	.47	Moderate
	Correct	68	67.33			
Q2	Incorrect	33	32.67	.67	.47	Moderate
	Correct	68	67.33			
Q3	Incorrect	30	29.70	.70	.46	Good
	Correct	71	70.30			
Q4	Incorrect	50	49.50	.50	.50	Moderate
	Correct	51	50.50			
Q5	Incorrect	58	57.43	.43	.50	Moderate
	Correct	43	42.57			
Q6	Incorrect	29	28.71	.71	.45	Good

Q7	Correct	72	71.29	.60	.49	Moderate
	Incorrect	40	39.60			
Q8	Correct	61	60.40	.39	.49	Moderate
	Incorrect	62	61.39			
Q9	Correct	39	38.61	.45	.50	Moderate
	Incorrect	56	55.45			
	Correct	45	44.55			

%= percentage, F. = frequency, Mean <=0.33: Poor, 0.34-0.67: Moderate, 0.68 and more: Good, Assess.: Assessment.

Table 4 presents the distribution of nursing students' knowledge regarding complications of gallstones. The majority of responses fall within the "Moderate" assessment range, indicating that students have a fair but incomplete understanding of gallstone complications. Specifically, six out of nine questions (Q1, Q2, Q4, Q5, Q7, and Q9) yielded mean scores between 0.34 and 0.67, highlighting moderate knowledge levels. Only two items (Q3 and Q6) reached the "Good" category with mean scores of 0.70 and 0.71, respectively, suggesting stronger awareness in these specific areas. One item (Q8) approached the "Poor" threshold with a relatively low mean of 0.39.

Table 5. Statistical distribution of overall items Nurses students' knowledge regarding complications of gallstones (N=101).

Overall Items	Rating and Intervals	F.	%	MS	SD	Assess
Nurses students' knowledge regarding complications of gallstones	Poor	10	9.90	.57	.21	Moderate
	Moderate	64	63.37			
	Good	27	26.73			

%= percentage, F. = frequency, Mean <=0.33: Poor, 0.34-0.67: Moderate, 0.68 and more: Good, Assess.: Assessment.

Table 5 presents the overall assessment of nursing students' knowledge regarding the complications of gallstones. The majority of students (63.37%) demonstrated a "Moderate" level of knowledge, with a mean score of 0.57 and a standard deviation of 0.21, indicating a fair but not comprehensive understanding. About a quarter of the students (26.73%) showed a "Good" level of knowledge, reflecting a stronger grasp of the subject, while a smaller portion (9.90%) fell into the "Poor" category, see figure 9.

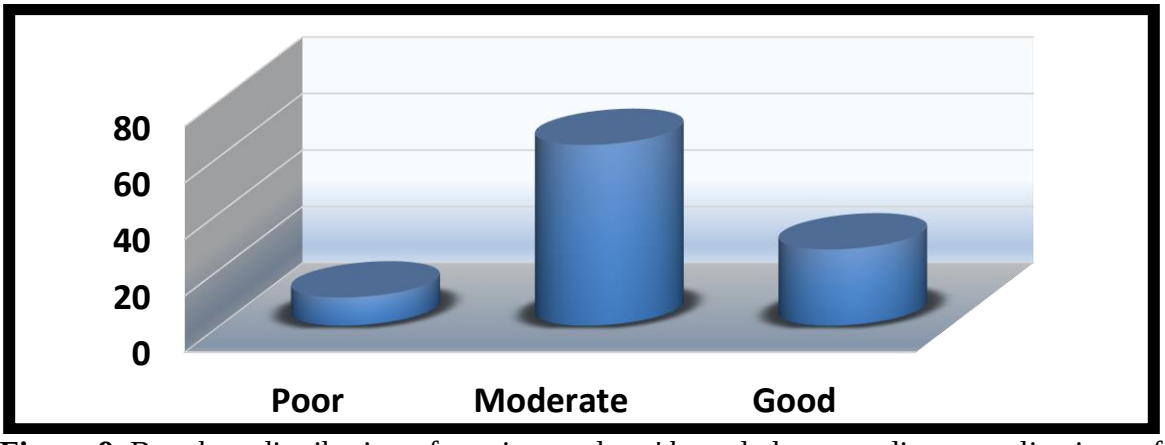

Figure 9. Bar chart distribution of nursing students' knowledge regarding complications of gallstones.

Table 6. Statistical distribution of general information about patients with gallstones (N=101).

Knowledge Items	Rating and Intervals	F.	%	MS	SD	Assess
Q1	Incorrect	58	57.43	.43	.50	Moderate
	Correct	43	42.57			
Q2	Incorrect	22	21.78	.78	.41	Good
	Correct	79	78.22			
Q3	Incorrect	65	64.36	.36	.48	Moderate
	Correct	36	35.64			
Q4	Incorrect	67	66.34	.34	.47	Moderate
	Correct	34	33.66			
Q5	Incorrect	64	63.37	.37	.48	Moderate
	Correct	37	36.63			
Q6	Incorrect	42	41.58	.58	.50	Moderate
	Correct	59	58.42			
Q7	Incorrect	59	58.42	.42	.50	Moderate
	Correct	42	41.58			
Q8	Incorrect	29	28.71	.71	.45	Good
	Correct	72	71.29			
Q9	Incorrect	74	73.27	.27	.44	Poor
	Correct	27	26.73			
Q10	Incorrect	85	84.16	.16	.37	Poor
	Correct	16	15.84			
Q11	Incorrect	69	68.32	.32	.47	Poor
	Correct	32	31.68			
Q12	Incorrect	32	31.68	.68	.47	Good
	Correct	69	68.32			
Q13	Incorrect	51	50.50	.50	.50	Moderate
	Correct	50	49.50			

%= percentage, F. = frequency, Mean <=0.33: Poor, 0.34-0.67: Moderate, 0.68 and more: Good, Assess.: Assessment.

Table 6 presents the distribution of nursing students' knowledge regarding general information about patients with gallstones. The findings reveal that most responses fall within the "Moderate" category, with 8 out of 13 questions having mean scores between 0.34 and 0.67. Only three questions (Q2, Q8, and Q12) were assessed as "Good," indicating a strong understanding in those areas. In contrast, three items (Q9, Q10, and Q11) fell into the "Poor" category, with particularly low mean scores—most notably Q10—suggesting significant knowledge gaps.

Table 7. Statistical distribution of overall items general information about patients with gallstones (N=101).

Overall Items	Rating and Intervals	F.	%	MS	SD	Assess
General information about patients with Gallstones	Poor	27	26.73	.45	.17	Moderate
	Moderate	63	62.38			
	Good	11	10.89			

%= percentage, F. = frequency, Mean <=0.33: Poor, 0.34-0.67: Moderate, 0.68 and more: Good, Assess: Assessment.

Table 7 shows the overall knowledge of nursing students regarding general information about patients with gallstones. The majority of students (62.38%) demonstrated a "Moderate" level of knowledge, with a mean score of 0.45 and a standard deviation of 0.17, indicating a fair but not comprehensive grasp of the topic. A significant portion (26.73%) fell into the "Poor" category, reflecting noticeable gaps in understanding, while only a small fraction (10.89%) achieved a "Good" level of knowledge, see figure 10.

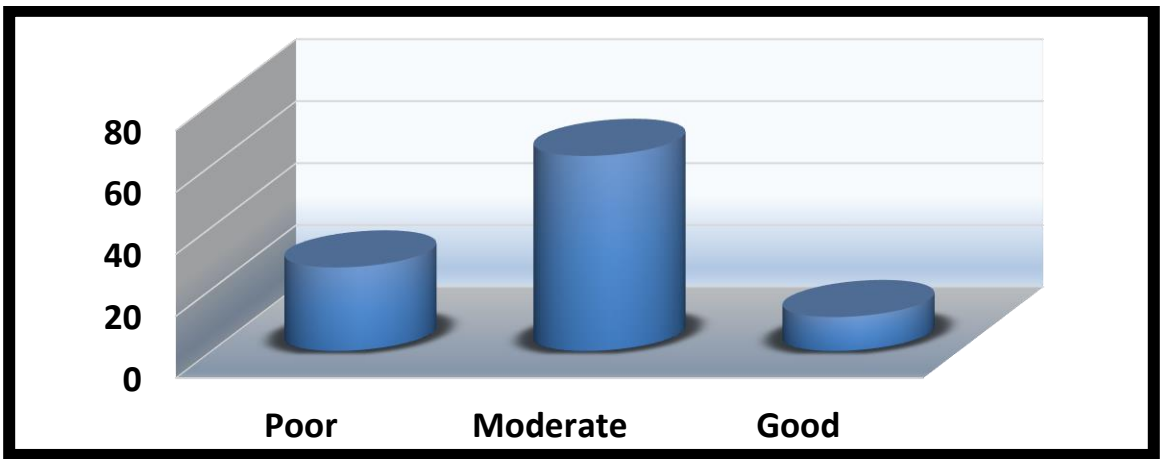

Figure 10. Bar chart distribution of overall items general information about patients with gallstones.

Table 8. Statistical distribution of overall items knowledge about patients with gallstones (N=101).

Overall Items	Rating and Intervals	F.	%	MS	SD	Assess
Knowledge about patients with Gallstones	Poor	6	5.94	.53	.12	Moderate
	Moderate	85	84.16			
	Good	10	9.9			

%= percentage, F. = frequency, Mean <=0.33: Poor, 0.34-0.67: Moderate, 0.68 and more: Good, Assess: Assessment.

Table 8 shows the overall assessment of nursing students' knowledge about patients with gallstones, combining all relevant knowledge domains. The majority of students (84.16%) demonstrated a "Moderate" level of knowledge, with a mean score of 0.53 and a relatively low standard deviation of 0.12, suggesting a consistent level of understanding across the group. However, only 9.9% reached the "Good" category, there is still a need to strengthen their knowledge base through focused educational strategies to ensure more students achieve a higher level of competence in managing and understanding gallstone-related patient care, see figure 11.

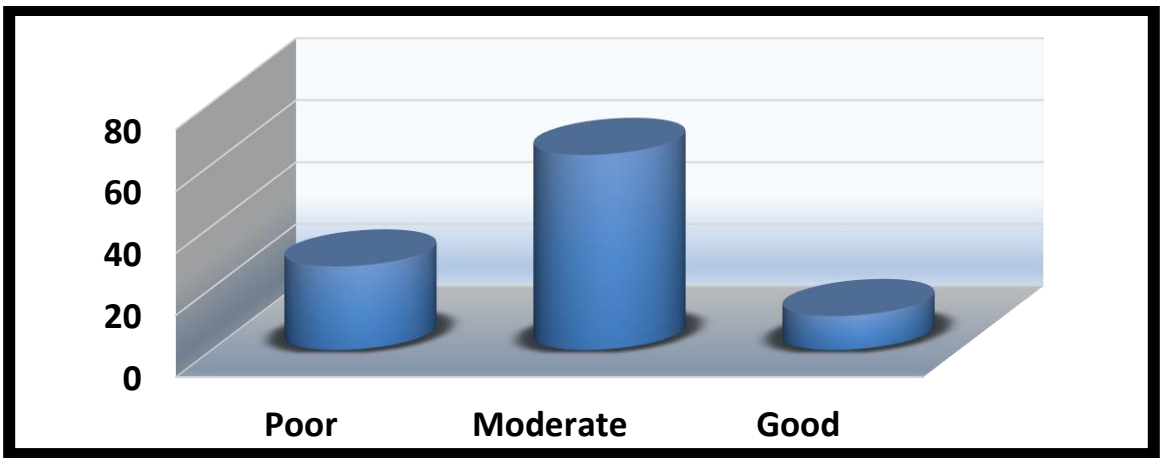

Figure 11. Bar chart distribution of overall items knowledge about patients with Gallstones.

Table 9. Statistical relationship between demographic data with overall items knowledge about patients with Gallstones (N=101) using one away ANOVA statistical test.

Socio-Demographic Characteristics	Rating and Intervals	Knowledge Level		P-value (Sig.)
		Mean	SD	
Age Groups (Years) *	<= 25	.53	.12	.085 (NS)
	> 25	.59	.07	
Sex*	Males	.55	.12	.184 (NS)
	Females	.52	.12	
Study type*	Morning	.55	.11	.218 (NS)
	Night	.52	.12	
Level of education	2nd year nurse's students	.52	.09	.201 (NS)
	3rd year nurse's students	.57	.10	
	4th year nurse's students	.52	.13	
Economic status	Low	.52	.11	.100 (NS)
	Medium	.53	.12	
	High	.66	.08	
Marital status	Married	.56	.09	.178 (NS)
	Unmarried	.52	.12	
	Widowed	.63	.13	
	Divorced	.59	.12	
Place of residence*	Rural	.53	.11	.914 (NS)
	Urban	.53	.12	

*Statistics done using independent t test

Table 9 shows a statistical relationship between nursing students' demographic data and their knowledge, using a one-way ANOVA and independent t-test for sex (N=101). The findings indicate no statistically significant differences (NS) in knowledge across all socio-demographic characteristics, as all p-values are greater than 0.05.

Discussion

1. Assessment of Nursing Students' Knowledge Regarding Gallstones

Socio-demographic characteristics

The study revealed that the majority of nursing students (90.1%) were aged 25 years or younger, with

a nearly balanced gender distribution (51.49% males, 48.51% females). Most students were enrolled in night studies (63.37%), and the largest proportion were in their 4th year (48.51%). Economic status was predominantly medium (79.21%), and most students were unmarried (70.30%) and resided in urban areas (73.27%). These findings align with trends in nursing education demographics, where younger students and urban residents dominate due to educational accessibility (Yang et al., 2022).

Knowledge of Gallstone Causes, Symptoms, and Risk Factors

The results demonstrated mixed levels of knowledge. While students exhibited strong understanding in specific areas (e.g., Q11, where 100% answered correctly), significant gaps were noted in others (e.g., Q1 and Q5, with mean scores of 0.30 and 0.21, respectively). Overall, 78.22% of students had a "Moderate" level of knowledge (mean score = 0.57, SD = 0.14), while only 19.80% achieved a "Good" level. This suggests that while foundational knowledge exists, critical areas such as pathophysiology and risk factors require reinforcement (Wilson et al., 2020).

Comparable studies have reported similar findings. For instance, a study by (Sun et al., 2022) found that nursing students often struggle with the biochemical mechanisms of gallstone formation, which correlates with the poor performance on Q1 and Q5 in this study. Another study by (Herber-Valdez et al., 2024) emphasized the need for integrated clinical scenarios in curricula to bridge these gaps.

Knowledge of Gallstone Complications

Students' knowledge of complications was predominantly "Moderate" (63.37%, mean score = 0.57, SD = 0.21), with only 26.73% achieving a "Good" level. Notably, Q3 and Q6 (mean scores = 0.70 and 0.71, respectively) reflected better understanding, likely due to their focus on common complications like cholangitis and pancreatitis. However, Q8 (mean score = 0.39) indicated poor knowledge of rarer complications, such as gallstone ileus. This aligns with findings by (Schneider et al., 2021), who noted that nursing programs often emphasize common conditions over rare but serious complications.

General Knowledge About Patients with Gallstones

The overall knowledge was "Moderate" (62.38%, mean score = 0.45, SD = 0.17), with 26.73% in the "Poor" category. Questions Q9, Q10, and Q11 (mean scores ≤ 0.32) revealed significant deficiencies in understanding diagnostic and management protocols. This is concerning, as timely diagnosis and intervention are critical in gallstone management (Gutt et al., 2020). A study by (Görücü et al., 2024) suggested that simulation-based learning could enhance students' clinical decision-making skills in such areas.

2. Relationship Between Knowledge and Demographic Data

The study found no statistically significant relationship between knowledge levels and socio-demographic variables ($p > 0.05$ for all comparisons). For example:

Age: No significant difference between students ≤25 and >25 years ($p = 0.085$).

Sex: No difference between males and females ($p = 0.184$).

Study Type: No difference between morning and night students ($p = 0.218$).

Education Level: No difference across 2nd, 3rd, and 4th-year students ($p = 0.201$).

These findings contrast with some studies, such as those by (Cohen & Levinthal, 1990) reported that advanced education levels correlate with better knowledge. However, the lack of significance in this study may reflect uniform curricular coverage across demographics or limitations in assessment tools (Clark & Nielsen, 2024).

Conclusion

Based on the presented results and their discussion:

This study assessed nursing students' knowledge of gallstones, their management, and complications. The majority of students demonstrated a moderate level of knowledge, with significant gaps in understanding the pathophysiology, risk factors, diagnostic procedures, and management protocols related to gallstones. There was no statistically significant relationship found between knowledge levels and socio-demographic variables such as age, sex, study type, or education level.

Recommendations

Based on the findings, the following recommendations are made:

Curriculum Enhancement: Nursing curricula should be enhanced to reinforce critical areas such as the pathophysiology of gallstone formation, risk factors, and rarer complications like gallstone ileus.

Integrated Clinical Scenarios: Incorporate integrated clinical scenarios and simulation-based learning to bridge the gap between theoretical knowledge and practical application, enhancing students' clinical decision-making skills.

Targeted Education: Develop targeted educational interventions to address specific knowledge gaps identified in the study, particularly in diagnostic and management protocols.

Further Research: Conduct further research using diverse assessment tools to explore factors influencing nursing students' knowledge of gallstones and to evaluate the effectiveness of educational interventions.

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