PHARMACY STUDENTS' LEVEL OF KNOWLEDGE REGARDING THE DISPENSING OF STERILE COMPOUNDED MEDICATIONS

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ABSTRAK
Dalam Standar Pelayanan Kefarmasian dan Standar Akreditasi Rumah Sakit, dispensing obat steril merupakan kompetensi penting yang wajib dimiliki Tenaga Kefarmasian di Rumah Sakit. Salah satu keterampilan yang dikuasai oleh tenaga vokasi farmasi adalah pencampuran obat suntik. Penelitian ini bertujuan untuk mengetahui tingkat pengetahuan mahasiswa DIII Farmasi Perguruan Tinggi X tahun 2024 tentang pencampuran obat suntik. Penelitian ini menggunakan metode deskriptif kuantitatif dengan desain cross-sectional. Sampel penelitian terdiri dari 113 mahasiswa semester 6 yang dipilih menggunakan metode total sampling. Instrumen yang digunakan adalah kuesioner. Skor tingkat pengetahuan dihitung berdasarkan jumlah jawaban benar, dengan total skor jawaban benar dikalikan 100%. Data dianalisis secara univariat. Hasil penelitian menunjukkan bahwa 46 mahasiswa (41%) memiliki tingkat pengetahuan yang sangat baik, 26 mahasiswa (23%) memiliki tingkat pengetahuan baik, 30 mahasiswa (27%) masuk kategori cukup, 8 mahasiswa (7%) tergolong kurang, dan 3 mahasiswa (3%) berada pada kategori gagal. Disarankan agar pembelajaran terkait pencampuran obat suntik bagi mahasiswa DIII Farmasi Perguruan Tinggi X dilakukan secara lebih intensif untuk meningkatkan tingkat pengetahuan mereka.

Kata kunci **:** injeksi, obat, pencampuran, pengetahuan

ABSTRACT
In pharmaceutical service standards and hospital accreditation standards, the dispensing of sterile drug preparations is a critical competency required of hospital pharmacy staff. One of the key skills of pharmacy professionals is the ability to compound injectable medications. The purpose of this study is to assess the knowledge level of DIII Pharmacy students at X Public University in 2024 regarding the mixing of injectable medications. The research used a descriptive quantitative method with a cross-sectional design. The sample consisted of 113 sixth semester students selected using the total sampling method. A questionnaire was used as the research instrument. Knowledge scores were calculated based on the number of correct answers, with the total number of correct answers multiplied by 100%. Data analysis was performed using univariate analysis. The results showed that 46 students (41%) demonstrated very good knowledge. In the good knowledge category, there were 26 students (23%). For the fair, poor and failed categories, 30 students (27%) were classified as fair, 8 students (7%) as poor and 3 students (3%) as failed. It is recommended that more intensive instruction on injectable drug compounding be provided to DIII pharmacy students at X Public University to enhance their knowledge in this area.

Keywords ***:*** *injection, knowledge, medicine, mixing*

INTRODUCTION

According to lthe regulation outlined in Permenkes No. 72 of 2016, clinical pharmacy is a vital pharmaceutical service. Clinical pharmacy involves direct services to patients, with a pharmacist responsible for delivering these services. One specific type of clinical pharmacy is the dispensing of sterile medicine preparations. These sterile medicines are guaranteed to be safe for the product, the patient, and the environment within a hospital setting. The Standar Nasional Akreditasi Rumah Sakit (SNARS) in Indonesia mandates that both the preparation and use of medicines must ensure safety for the environment and for the personnel involved in preparing sterile products. In

alignment with the guidelines for dispensing sterile preparations, pharmacists are required to follow aseptic techniques during the dispensing process. Pharmacists must possess the necessary competencies and skills for effective management, including proficiency in aseptic dispensing techniques (Depkes RI, 2009). This aligns with studies that indicate pharmacists compounding injectable medicines can achieve precise dosing according to established recipes (Rambe et al., 2023).

The ldemand for Standard Operating Procedures in Pharmaceutical Services and Hospital Accreditation Standards emphasizes the competency of pharmacy personnel in hospitals. Pharmacy staff members are required to possess specific competencies as outlined by the Ministry of Health (Kemenkes, 2022). A study conducted at RSUD Soediran Mangun Sumarso in Wonogiri found that aseptic dispensing was performed by two pharmacist assistants during a shift from 9:00 AM to 3:00 PM (Rusmiyati & Anggraini, 2022). This practice aligns with the guidelines for dispensing sterile preparations, which stipulate that aseptic dispensing must be carried out by qualified pharmaceutical staff (Depkes RI, 2009). Compounding errors are becoming a significant concern, particularly in larger community pharmacy chains where heavy workloads increase the likelihood of mistakes. The involvement of pharmacy technicians in physically compounding medications shifts the pharmacist's responsibilities towards administrative and logistical tasks, focusing on supervising prescription filling processes (G John, et al., 2006).

In the Phar 426 and Phar 572 courses, students' compounding of ondansetron was recorded on video. This approach was standardized across both courses to ensure a consistent and comparable learning environment. In Phar 426, students' aseptic techniques were evaluated through direct observation by the instructor, while in Phar 572, no such evaluation was conducted. Although video recording effectively captures gross manipulations and supports the assessment of aseptic techniques and challenges faced by students, its resolution is insufficient to detect the precise volume within a compounding pharmacist's syringe. Future research could explore advanced imaging technologies to better visualize syringe plunger positions and air bubbles (Kosinski M Tracy, et al., 2017).

The practice of compounding has been an integral aspect of the pharmacy profession for a considerable length of time. In the relatively recent past, the practice of pharmacy compounding preceded the establishment of pharmaceutical companies whose purpose was to manufacture and market medications in ready-to-use dosage forms for patients. The terminology used to define pharmacy compounding varies slightly between different agencies. As defined by the Food and Drug Administration, pharmacy compounding is a practice whereby a pharmacist, physician, or, in the case of an outsourcing facility, a person under the supervision of a licensed pharmacist, combines, mixes, or alters the ingredients of a drug to create a medication tailored to the needs of an individual patient. In contrast, the United States Pharmacopeia (USP), which sets quality standards for drugs, defines compounding as "the preparation, mixing, assembling, altering, packaging, and labeling of a drug in accordance with the prescription of a licensed practitioner." However, both agencies stipulate that the objective of compounding is to address the specific requirements of each patient. For instance, in the case of pediatric or geriatric patients, the pharmacist may be tasked with preparing a liquid dosage form for a patient who is unable to take a commercially available solid dosage form. Additionally, prescriptions are compounded when drug dosage forms or strengths are limited, for use in special patient populations, including animals, during drug shortages, or due to drug discontinuation. Furthermore, the extemporaneous compounding of investigational drugs for use in the physician's office constitutes a significant aspect of the compounding profession (Hussain A, et al., 2023).

In the United States, guidelines for good compounding practice are contained in USP Chapter 795. Many other countries have adopted these guidelines. Good Compounding

Practice (GCP) provides more detailed guidance on good compounding in the preparation of compounded drug formulations for human or animal use (Siamidi, N. Pippa, and C. Demetzo, 2017). Drug compounding is one of the pharmaceutical activities that can be performed by pharmaceutical personnel, consisting of pharmacists and pharmacy technicians. Drug compounding is the provision of drugs needed by individual patients, which is done in pharmacies or health care facilities due to the limited availability of available drugs (Dooms and M. Carvalho, 2018).Supporting buildings, facilities, and equipment can determine the quality of compounded drug preparations. Compounded preparations in Indonesia are generally powders, dry syrups, and compounded ointment preparations (C. J. Watson, J. D. Whitledge, A. M. Siani, and M. M. Burns, 2021).

The research also examines the skills of pharmacy lstudents at the university level, with a focus on their knowledge of intravenous mixing.

METHODS

This study employed a quantitative descriptive approach with a cross-sectional design. The research was conducted in January 2024 at University X, involving a sample of 113 sixth-semester Pharmacy students from the same institution. Respondents' knowledge levels were assessed using a validated questionnaire, with correct answers scored as 1 and incorrect answers scored as 0. The data were analyzed descriptively through percentage calculations.

RESULTS

The statistical analysis of the research was univariate. This analysis aimed to examine the profile characteristics of age, graduation, work, and knowledge level. The knowledge score was derived from the total number of correct answers provided by the respondents, expressed as a percentage out of 100.

Calculation using the formulas:

$$Persentage = \frac{total\ score}{maximal\ score}\ x\ 100\%$$

Category result level knowledge in 5 level there are best, good, enough, less and fail. The sample of study is phatmacy vocational students in university X 113 respondents.

Table 1. Caracteristic Respondents (n=113)

Kategori		Frekuensi	%
Age			
	23 year	3	2.7%
	22 year	36	31.9%
	21 year	70	61.9%
	20 year	4	3.5%
Gender			
	Male	11	10%
	Female	102	90%

According to table 1, the majority of the respondents are 21 years old (61.9%). Regarding gender, there were more female respondents than male, with 102 females (90%) participating.

Table 2. Percentage Of Correct Answer

No	Question	Skor	%
1.	Regulation of Standard Pharmacy services in Hospital No 72 Tahun 2016	113	100%
2.	The current paradigm of hospital pharmacy services has shifted towards patient care.	89	79,5%
3.	Dispensing of sterile drug preparations is included in Clinical Pharmacy	105	92,9%
4.	PKPO standard stands for Pharmaceutical Services and Drug Use	102	90,3%
5.	The following drugs should not be stored at room temperature Anti-Hepatitis B serum	107	94,7%
6.	Storage requirements for emergency drugs are as follows, except strictly guarded at all times.	95	84,8%
7.	Mixing of chemotherapy drugs is done in BSC.	99	87,6%
8.	Misreading the prescription so that the patient gets the wrong medicine, including medication errors in the Transcribing phase.	93	82,3%
9.	Ceftriaxone injectable antibiotic preparation is often confused with Cefotaxime. The appropriate tall man letters for Ceftriaxone and Cefotaxime to increase staff awareness are cefTRIAXONE and cefOTAXIME.	91	80,5%
10.	Solubility is the amount of solubility of 1 part by weight of a solid or 1 part by volume of a liquid in a given volume of solvent at room temperature	72	63,7%
11.	Clean room is a room with controlled conditions that are allowed to be used as a sterile drug preparation manufacturing room.	111	98,2%
12.	Clean room (Clean room) equivalent to class 10,000	26	23,3%
13.	Hand washing room and changing room equivalent to Class 100,000	59	52,7%
14.	Critical parameters of the sterile room that must be controlled include temperature and humidity, room pressure difference and particle count.	101	90,2%
15.	LAF used for mixing sterile non-cytostatic drugs Horizontal Air Flow	84	74,3%
16.	Things that need to be considered in mixing injectable drugs include the following except Type of preparation	67	59,3%
17.	The following are examples of hypertonic solutions Dextrose 50%, NaCL 3%	86	76,1%
18.	Drugs that have been reconstituted need to set a limit of use called the time limit date of use (BUD).	111	98,2%
19.	The main completeness of the drug reconstitution request form is the patient's identity.	94	83,2%
20.	For pediatric patients, what is needed when calculating the drug dose is body weight.	106	93,8%
21.	When dissolving injectable drugs in the form of powders, the first thing to do is to calculate the concentration of the drug solution to be made.	37	31,7%
22.	To make a dextrose solution with a concentration of 15% as much as 100 ml, it requires dextrose with a strength of 10% (833 ml) and 40% (267ml).	44	38,9%
23.	The volume of medicine to be taken if 50 mg of medicine X 10% is needed is 500 ml.	107	94,7%
24.	The drug including concentrated electrolyte is KCl.	99	87,6%
25.	Remaining injectable drugs that can still be used (multidose) must be given information Patient identity, date of opening and BUD	83	73,5%
26.	Meropenem is less stable in dextrose.	60	53,1%
27.	Midazolam can be dissolved in NaCl 0.9%, dextrose and RL.	44	39,6%
28.	Storage Duration Reconstituted Meropenem in NS 2 hours at room temperature	36	31,9%
29.	Formulation Injectable drugs are in the form of dry powder, except for the small amount of microbacterial contamination.	23	20,4%
30.	Problems in injectable drug administration are Pain, Extravasation, Allergy	94	83,2%

In the table 2 show result of research This study employed a questionnaire consisting of 30 items, designed using Google Forms, which were subsequently disseminated among pharmacy students. Participants were required to complete the survey by providing their responses to the questions. The researchers meticulously analyzed the results to determine the proportion of questions answered correctly by the students. As illustrated in the accompanying table, seven questions were answered accurately by 91% to 100% of the participants, while nine questions fell within the range of 81% to 90% correct responses. Conversely, it is noteworthy that 14 questions were answered correctly by fewer than 70% of the students, indicating potential gaps in knowledge.

In Question Regulation of Standard Pharmacy services in Hospital No 72 Tahun 2016 correct answers113 responden (100%), The current paradigm of hospital pharmacy services has shifted towards patient care. and correct answers 89 responden (79,5%), Dispensing of sterile drug preparations is included in Clinical Pharmacy correct answers 105 responden (92,9%), PKPO standard stands for Pharmaceutical Services and Drug Use correct answers 102 (90,3%), The following drugs should not be stored at room temperature Anti-Hepatitis B serum correct answers 107 responden (94,7%), Storage requirements for emergency drugs are as follows, except strictly guarded at all times correct answers 95 responden (84,8%), Mixing of chemotherapy drugs is done in BSC correct answers 99 responden (87,6%), Misreading the prescription so that the patient gets the wrong medicine, including medication errors in the Transcribing phase correct answers 93 responden (82,3%), Ceftriaxone injectable antibiotic preparation is often confused with Cefotaxime.

The appropriate tall man letters for Ceftriaxone and Cefotaxime to increase staff awareness are cefTRIAXONE and cefOTAXIME correct answers 91 responden (80,5%), Solubility is the amount of solubility of 1 part by weight of a solid or 1 part by volume of a liquid in a given volume of solvent at room temperature correct answers 72 responden (63,7%), Clean room is a room with controlled conditions that are allowed to be used as a sterile drug preparation manufacturing room correct answers 111 responden (98,2%), Clean room (Clean room) equivalent to class 10,000 correct answers 26 responden (23,3%), Hand washing room and changing room equivalent to Class 100,000 correct answers 59 responden (52,7%), Critical parameters of the sterile room that must be controlled include temperature and humidity, room pressure difference and particle count correct answers 101 responden (90,2%), LAF used for mixing sterile non-cytostatic drugs Horizontal Air Flow correct answers 84 responden (74,3%), Things that need to be considered in mixing injectable drugs include the following except Type of preparation correct answers 67 responden (59,3%),

The following are examples of hypertonic solutions Dextrose 50%, NaCL 3% correct answers 86 responden (76,1%), Drugs that have been reconstituted need to set a limit of use called the time limit date of use (BUD) correct answers 111 responden (98,2%), The main completeness of the drug reconstitution request form is the patient's identity correct answers 94 responden (83,2%), For pediatric patients, what is needed when calculating the drug dose is body weight correct answers 106 responden (93,8%), When dissolving injectable drugs in the form of powders, the first thing to do is to calculate the concentration of the drug solution to be made correct answers 37 responden (31,7%), To make a dextrose solution with a concentration of 15% as much as 100 ml, it requires dextrose with a strength of 10% (833 ml) and 40% (267ml) correct answers 44 responden (38,9%), The volume of medicine to be taken if 50 mg of medicine X 10% is needed is 500 ml correct answers 107 responden (94,7%), The drug including concentrated electrolyte is KCl correct answers 99 responden (87,6%), Remaining injectable drugs that can still be used (multidose) must be given information Patient identity, date of opening and BUD correct answers 83 responden (73,5%), Meropenem is less stable in dextrose correct answers 60 responden (53,1%), Midazolam can be dissolved in NaCl 0.9%, dextrose and RL correct answers 44 responden (39,6%), Storage Duration Reconstituted

Meropenem in NS 2 hours at room temperature correct answers 36 responden (31,9%), Formulation Injectable drugs are in the form of dry powder, except for the small amount of microbacterial contamination correct answers 23 responden (20,4%), Problems in injectable drug administration are Pain, Extravasation, Allergy correct answers 94 responden (83,2%).

Table 3. Level Knoweldge Responden (n=113)

Skor Tingkat Pengetahuan		F	%
Best	80% - 100 %	46	41%
Good	66% - 79 %	26	23%
Enough	56% - 65%	30	27%
Less	40% - 55%	8	7%
Fail	< 40%	3	3%
Total		**113**	**100%**

As shown in the table, 46 students (41%) were categorized as having the best level of knowledge, while 26 students (23%) were categorized as having a good level of knowledge. The remaining levels of knowledge included enough, less, and fail with 30 students (27%), 8 students (7%), and 3 students (3%) respectively. In a study by Wardany (2024), the evaluation of aseptic dispensing of injection drugs in a hospital setting found that 23.08% fell into the good category, while 76.92% were categorized as less proficient.

DISSCUSION

This finding is consistent with a study by Genatrika (2021), which reported that 65% of the participants were between the ages of 26 and 35. In terms of gender, there were more female respondents than male respondents, with 102 females (90%) participating. This is consistent with Ramadhani's research in 2019, which found that 65.2% of the health workers were female. This research comprised 30 questions distributed via Google Forms to students. All 113 students (100%) provided correct answers to the questions about regulatory standards in pharmaceutical services in hospitals. However, when it came to questions about clean rooms and drug constitution, not all students answered correctly. Specifically, only 23 students l(20. 4%) Answered the question on drug formulation in dry powder correctly, making this the lowest scoring question. This finding is simiar to Genatrika's study (2021), which found a positive correlation between training in compounding and knowledge in the same area ($r = 0.702$; $p < 0.05$). Training appears to significantly influence understanding topics such as compounding, which supports the theory that formation impacts knowledge, last posited by Notoatmodjo (2019).

A study conducted by Wardany in 2024, the evaluation of aseptic dispensing of injection preparations at the inpatient facility of Klaten Islamic General Hospital revealed a percentage of 23.08% falling within the excellent category, while 76.92% were categorized as less proficient. This outcome is similar to research conducted at RSUP DR. M. Djami Padang, where 22 healthcare workers (95.7%) exhibited a high level of knowledge, whereas 1 participant (4.3%) demonstrated an adequate level of knowledge. Moreover, Ulfa et al. corroborated the findings of this study by examining the suitability of aseptic dispensing of sterile drugs in both the ICU and NICU at RSUD Dr. Saifu Anwar Maang. In this context, 60% of the respondents were found to possess the most optimal knowledge. Additionally, the 2021 Genatrika study observed that personnel lacking formal training demonstrated proficiency in the requisite knowledge. Similarly, Utari (2022) found that pharmacy students demonstrated commendable knowledge in preparing antibiotic injections, with an accuracy rate of 87.8%. The mean student accuracy in the ondansetron sterile compounded dose was deemed

acceptable for both initial and retained skills. This is consistent with the findings of other research studies and did not differ significantly between various courses.

A paucity of data from hospital practices indicates that the error rates observed in classrooms are comparable to those seen in actual patient care settings. This is an unsurprising finding, given that many student pharmacists engage in sterile compounding in paid positions or have training levels equivalent to pharmacy technicians in sterile compounding settings. In light of the findings presented in this study and those of previous literature, it is imperative that all sterile compounding facilities, including those in pharmacy schools, establish the acceptable accuracy error rate for their specific site. This determination is of paramount importance for ensuring the safety and efficacy of the compounded sterile preparations that these students will provide in their practice.

The findings of Kosinski et al. (2017) substantiated that the typical student demonstrated an adequate level of proficiency in the preparation of ondansetron sterile compounded doses, both initially and over time. The observed accuracy errors exceeding 10% of the intended dosage were consistent with the findings of other studies, indicating no notable differences across courses. As previously stated, the limited data from hospital settings indicate that this classroom error rate is consistent with what is observed in patient care settings. Given that many student pharmacists engage in sterile compounding within employment environments or possess training equivalent to that of pharmacy technicians, it is essential for all sterile compounding institutions to ascertain an acceptable error rate. This will ultimately benefit the patients who will receive these students' compounded sterile preparations.

Research conducted by Wisniewski (2023) reveals a concerning trend in the competency levels of pharmacy students regarding the dispensation of sterile compounded medications. Despite the implementation of fundamental learning theories to convey essential content, student performance on accuracy assessments consistently fell short of anticipated standards set by instructors. This indicates that the transition of knowledge from hands-on compounding activities to the verification of compounded products is neither instinctive nor automatic. Moreover, while extending class durations and enhancing practical training opportunities were attempted, the COVID-19 pandemic severely restricted the scope and effectiveness of such hands-on training. Consequently, persistent efforts aimed at augmenting student proficiency in this capacity must be strategically integrated into forthcoming iterations of the curriculum.

Further insights emerged from the research by Kurniawan et al. (2024), which indicated that a majority of pharmacy practitioners demonstrated satisfactory knowledge scores, averaging 71.95%. In tandem, the adherence rate to Good Compounding Practices (GCP) was notably high at 82.92%. This correlation underscores the critical importance of comprehensive knowledge and the practical application of GCP in preserving the integrity and safety of medications produced through compounding processes. Ultimately, these principles should be firmly embedded within the education and training frameworks for pharmaceutical practitioners, as this will help to ensure the quality of compounded medications remains both safe and effective. A survey examining the incorporation of Continuing Education (CE) among various pharmacy schools and colleges across the United States revealed notable inconsistencies in the availability of both non-sterile and sterile compounding facilities. Several institutions currently fall short of the minimum requirements yet could enhance their capabilities by emulating successful models established elsewhere in the nation. It is imperative for leadership within pharmacy schools to allocate financial resources towards Continuing Education and to bolster support for faculty tasked with teaching compounding practices (Hussain A et al., 2023).

An analysis of pharmacists' knowledge regarding the stability of medications in relation to Good Compounding Practices (GCP) revealed a relatively low rate of accurate responses, with only 60.61% demonstrating proficiency. Moreover, a significant number of pharmaceutical

practitioners, including pharmacists and technicians, display a concerning lack of understanding about the Beyond Use Date (BUD) for pharmaceutical preparations that do not contain water, such as powders, dry syrups, and capsules. This finding is supported by empirical data indicating that many pharmacists and pharmaceutical technicians in Indonesia lack sufficient knowledge about BUD in the compounding of various non-sterile dosage forms (F. Cokro, S. T. Arrang, M. A. Chiara, and O. S. Hendra, 2022). Determining the BUD after compounding is considered a considerable challenge within compounding practice. The BUD serves as a critical endpoint that defines how long a compounded product can remain safe and effective for use. Thus, the stability of compounded drug products is closely linked to the careful selection of their BUD, which requires a prudent and well-informed approach blending both theoretical knowledge and practical experience (F. Cokro et al., 2022).

In contrast, research conducted by Choo et al. demonstrated that pharmacists' knowledge of compounding is rated highly, at 70.40%. Non-sterile compounding involves preparing medications that are packaged in sealed, light-resistant containers and stored at appropriate temperatures. Recommended guidelines for determining BUD are as follows: for dry syrup preparations, the BUD is six months or until the expiration date of any other materials used (whichever is closer); for water-containing oral preparations, the BUD is no more than 14 days, and these must be stored under cold conditions; for topical, mucosal, and semi-solid preparations, the maximum BUD is 30 days. Pharmacies are responsible for providing clear information to patients about the BUD of the products they receive, ensuring that these products can be used safely and effectively.

In compounding practice, understanding and adhering to the BUD are crucial for ensuring safety, efficacy, and regulatory compliance (D. A. P. S. Dewi and C. Wiedyaningsih, 2017). Continuous monitoring, research, and training are necessary to ensure that BUD is accurately calculated and followed in accordance with established pharmaceutical standards (64.50%). Some pharmacies accept a limited number of compounded prescriptions, partly due to insufficient compounding equipment and limited availability of drugs (H. S. Al-Khatib et al., 2019). According to guidelines, each licensed pharmacy is required to possess appropriate compounding equipment, which includes various instruments and devices used in the drug compounding process, such as containers, measuring devices, and sterilization equipment. The intention is to guarantee that drug compounding is carried out safely and effectively (L. V. Allen, 2012).

However, some pharmaceutical practitioners tend to minimize GCP indicators, which includes the necessity for continuous calibration of compounding equipment and the lack of available supplies. Only properly calibrated tools and scales can produce products that meet desired specifications. This deficiency can negatively impact the quality of the compounded product in terms of stability, potency, and other physical characteristics (D. Assefa et al., 2022). Therefore, it is vital to ensure that the tools utilized in compounding practice are regularly calibrated and comply with relevant pharmaceutical standards. Doing so will help maintain product quality, ensure patient safety, and meet regulatory requirements (A. D. Wollitz, C. Hong, and F. Blanco, 2021).

Pharmacy technicians are currently struggling with the implementation of washer-disinfectors and the use of full personal protective equipment (PPE) while compounding medications. The incorporation of washers, pure water (not mineral water), a proper mixing table base (stainless steel), and comprehensive PPE, including gloves, masks, and coveralls, are crucial components of compounding practices that ensure the safety of both patients and pharmacy personnel (A. D. Wollitz, C. Hong, and F. Blanco, 2021). A lack of awareness or compliance among pharmacy technicians can adversely affect compounding practices. Pharmacies need to adopt various strategies to guarantee that PPE is readily available for the continuous compounding of both sterile and non-sterile products (A. D. Wollitz, C. Hong, and

F. Blanco, 2021). In order to meet competency standards for drug preparation in accordance with operational guidelines, pharmacists and pharmacy technicians must apply fundamental principles of compounding. This ensures that the resultant compounded drug product meets acceptable criteria for dosage strength, quality, and purity, and adheres to the specific prescription or drug order (C. J. Watson, J. D. Whitledge, A. M. Siani, and M. M. Burn, 2021).

CONCLUSION

The findings reveal that 46 students (41%) have the best level of knowledge, while 26 students (23%) have a good level of knowledge. The remaining categories show 30 students (27%) with enough knowledge, 8 students (7%) with less knowledge, and 3 students (3%) failing.

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