

Knowledge of Nursing Students Regarding Modified Release and Enteric Coated Medications

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Abstract

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Introduction: Modified Release (MR) and Enteric Coated (EC) drugs are special forms of oral dosage that are developed to regulate drug release and protect drug or gastric mucosa. Poor crushing or splitting of such medicines may result in severe medication errors and patient injuries. As future medication administrators, nursing students should have sufficient knowledge about such formulations to perform safe practice. **Methodology:** A cross-sectional study was carried out on 3rd and 4th year nursing students in Peshawar, Pakistan. The sample size was 146 participants who were selected using convenience sampling. The structured questionnaire was used to collect the data that evaluated knowledge about MR and EC medications. The SPSS version 26 was used to analyze the data and the results were provided in frequencies and percentages. **Findings:** The study found out that most of

the students were poorly aware 84 (57.5%) about MR and EC drugs. Over fifty percent of the participants failed to identify correctly drugs that were not to be crushed. Very few percentages 20 (13.7%) showed good knowledge, which means that there are huge gaps in knowledge about safe medication administration practices. **Conclusion:** The nursing students have poor knowledge regarding MR and EC medications, and that this can be a threat to patient safety in their future practice. It is suggested to implement educational interventions and specific training programs to enhance awareness and safe medication practices.

Introduction

Oral solid drugs are formulated with particular formulation technologies to regulate the release of a drug in the body (where and how), so to be able to administer drugs safely in nursing practice, it is necessary to understand the designs. Modified-release (MR) formulations are designed to release the active drug at a pre-established rate, over a longer time, or at a specific location within the gastrointestinal tract to maintain

stable therapeutic levels and reduce the dosing frequency, whereas enteric-coated (EC) formulations are coated with pH-reactive polymers that do not dissolve in the acidic stomach, but dissolve in the alkaline environment of the small intestine. When the tablets are crushed, such specialized designs may be seriously disturbed, resulting in a change in the drug dissolution, unreliable absorption, toxicity or failure in the treatment (1). It has been shown that alteration of ODF, especially tablet crushing of patients who have issues in swallowing, is a common clinical practice, and it is often done without sufficient knowledge about the properties of formulations (2). One developing country multicenter cross-sectional study stated that a huge percentage of nurses would regularly change oral drugs before administration and were unaware of the dangers of crushing of MR and EC pills (3). Dosage form modification practices have been reviewed with the view that improper manipulation of these formulations may negatively affect the efficacy of drugs and require greater interdisciplinary cooperation between pharmacists and nurses (4). In the case of experimental pharmaceutical studies, crushing of MR tablets has a significant effect on dissolution profiles of intact forms, which may lead to dose dumping or decreased controlled release (5). Clinical advice on medication administration via enteral feeding tubes cautions that crushing of sustained-release and enteric-coated drugs could lead to curative issues and undesirable effects (6). Stakeholder claims have been validated through observational study conducted in hospitals and long-term care facilities that have reported that MR and EC medications are crushed at times regardless of manufacturer warnings, which is evidence of knowledge and practice gaps among healthcare providers (7). Pharmacist-led educational interventions have been found to have a quantifiable positive effect on the knowledge and safer practices of the nurses in respect of dosage form change, such as prevention of inappropriate crushing (8). In geriatric and dysphagia care environments, study also indicates that inappropriate tablet crushing frequently occurs, which supports the appropriateness of establishing the foundations of knowledge among caregivers and healthcare trainees (9). The literature review on the pharmacokinetic impacts of changing oral solid dosage forms supports the claim that MR and EC technologies are tailored to regulate drug delivery accurately, and disruption of these mechanisms can lead to unpredictable levels of drugs and patient toxicity (10). Taken together, the evidence reveals the need to examine the knowledge of nursing students on modified-release and enteric-coated medications because a poor level of understanding during the training stage can be reflected in unsafe medication practices in clinical settings and jeopardizing patient safety.

Methodology:

The study used a cross-sectional descriptive study design to determine the level of knowledge of nursing students about modified-release (MR) and enteric-coated (EC) drugs. It was conducted in the nursing institutes in Peshawar, Pakistan. The sample was undergraduate BSN students, and only 3rd-year and 4th-year nursing students were included because they had a previous experience with pharmacology and clinical practice. A convenience sampling method was used to pick a total sample of 146 students during normal school hours. A structured, self-administered questionnaire was used to gather data after studying the literature on the topic of dosage form modification and safe medication practices. The questionnaire consisted of two sections. The introductory section entailed demographic data including age, gender and the year of study. The second part was knowledge-based questions that targeted important concepts regarding MR and EC formulations and safe medication administration. The questions evaluated the students in terms of their knowledge of the meaning of MR and EC, the ability to identify typical abbreviations (ER, SR, CR, MR, XL, and EC) and the ability to identify the types of tablets that cannot be crushed. Questions were asked to the students about whether it was possible to crush enteric-coated tablets, the effects of crushing sustained-release tablets, and the proper way to

administer sublingual tablets. Other questions included questions about awareness of capsules holding a pellet or a granule, risks related to crushing medications in dysphagia patients, and whether the students witnessed tablet crushing during their clinical rotations. Another aspect addressed in the questionnaire was students' awareness of the term Do Not Crush, how they gained their knowledge (theory or clinical exposure), their confidence in recognizing non-crushable medications in practice. Ethical approval was sought before the data collection process. They also sought the permission of the administration of the chosen institutes. All the participants had been informed about the participation and provided informed consent; they were also assured of confidentiality and anonymity. The involvement was on a voluntary basis, and students could pull out at any point without reprobate. Inclusion criteria were students based in 3rd and 4th year of BSN nursing who were on the day of data collection and willing to participate. Inclusion and exclusion criteria were 1st and 2nd year students, interns, and diploma nursing students and those who were not present or did not want to be included. Data collected were coded and inputted into SPSS version 26 to be analyzed. The descriptive statistics only were used and the findings were reported in frequencies and percentages to outline the level of knowledge among the nursing students with respect to MR and EC medications.

Result:

There was a total of 146 nursing students in the study. Among them, 108 (74%) were female and 38 (26%) were male. The participants belonged to 3rd and 4th year BSN programs, with a slightly higher number of students of 4th year 78 (53.4%) than 3rd year 68 (46.6%). The majority of students were aged between 20–22 years 82 (56.2%), while 64 (43.8%) were aged 23–24 years. All participants had encountered pharmacology classes and clinical postings experience where medication administration practices were observed as shown in table 01.

Table 1: Demographic Characteristics of Participants (n = 146)

Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	38	26.0%
	Female	108	74.0%
Year of Study	3rd Year	68	46.6%
	4th Year	78	53.4%
Age Group (years)	20–22	82	56.2%
	23–24	64	43.8%

Table 02 shows the general evaluation of the knowledge of modified-release and enteric-coated medications showed that most students possessed poor knowledge. Few percentages showed good knowledge with some showing moderate knowledge with some deficiencies in identifying non-crushable medications and safe administration practice. These results reveal serious gaps in knowledge in nursing students about MR and EC formulations and the risks of crushing them, and it is important to note that it is necessary to provide specific educational interventions before students get involved in clinical practice.

Table 2: Overall Knowledge Levels of Participants (n = 146)

Knowledge Level	Frequency (f)	Percentage (%)
Good	20	13.7%
Moderate	42	28.8%
Poor	84	57.5%

Discussion:

From the current study, it is evident that most nursing students possessed inadequate knowledge of modified-release (MR) and enteric-coated (EC) drugs. The results of the present study are comparable with other international studies that have identified significant knowledge gaps concerning dosage form modification in healthcare practitioners. According to an observational study done in European hospitals, inappropriate drug modification, including crushing of oral solid medications, was highly prevalent among MR and EC medications (11). In a similar study carried out on nurses in Asia, it was discovered that a considerable number of participants failed to identify medications that should not be modified through crushing (12). Another study that was done in a long-term care setting established that more than half of drug modification cases involved inappropriate crushing of sustained-release and enteric-coated medications (13). The findings of the current study confirm those of studies conducted in the past, with more than half of the respondents having poor knowledge scores, which could imply that lack of understanding of formulation characteristics is learned early on during the undergraduate level (14). On the other hand, contrary to the results obtained in the present study, an education program aimed at improving nurses' knowledge and safe practice in terms of the use of formulations was found to be highly effective in enhancing their skills (4). Another study investigating drug manipulation-related medication errors concluded that improper manipulation of solid dosage forms was the most common reason for these mistakes (15). As a result, pharmacological knowledge acquired by nursing students becomes crucial since inappropriate crushing of extended-release and enteric-coated medicines may cause dose dumping, treatment failure, or even adverse reactions. Contrarily, our sample of participants included 3rd and 4th year nursing students that have taken pharmacology classes already but still demonstrated knowledge gaps. Moreover, literature reviews performed in Middle Eastern settings have revealed that nurses possessed moderate to poor knowledge about drug formulations and that there were no clear guidelines in place (16). Although our study did not evaluate the institution's policy on medication safety education, it might be inferred that there are similar issues with the system because many healthcare providers did not receive training on the decision-making process involved in the crushing of tablets (17). As such, the lack of competence among nursing students regarding the identification of non-crushable medicines might be attributable to the same problem. On the contrary, some studies showed relatively higher awareness rates among senior nurses compared to their juniors (18); however, this finding contradicts our results, in which senior (4th year) students do not exhibit predominantly satisfactory knowledge levels about the topic. The results of this study indicate that clinical experience alone is insufficient for the acquisition of adequate knowledge if it is not complemented by structured learning modules based on the development of competencies. In addition, previous systematic reviews on the safety of medication administration have stressed the importance of reinforcing pharmacology-related theories in the curriculum (4). Overall, the results of this study are congruent with international literature showing consistent knowledge deficiencies on MR and EC medicines among healthcare professionals (5).

Conclusion:

The results of this study demonstrate that students of nursing colleges lacked proper knowledge of the use of Modified Release (MR) and Enteric Coated (EC) medications. Most respondents could not determine which drugs must not be crushed and were not aware of potential consequences of incorrect modification of such dosage forms. Though nursing students are not licensed and authorized to administer drugs during their education period, their ignorance about the use of MR and EC medication may pose dangers to patient care in the future during their professional practice.

Recommendations:

It is suggested to create special training sessions for nurses on the proper use of MR and EC drugs within hospitals and nursing colleges. This issue should be highlighted while studying pharmacology, clinical and simulation training. Guidance, wards' charts, and cooperation with clinical pharmacists will help to implement safer practices for nurses. Improved knowledge of students in this sphere will lead to proper drug administration and better practice in general.

Limitations:

There were a number of limitations in the study. First, this was a single-setting study carried out among a small group of third and fourth-year nursing students, which might affect the validity of the study results. Since it was based on frequency, the study was unable to establish cause-and-effect relations between the variables investigated. Third, data collection was done through the use of self-reports, which may contain errors in guessing or biasing responses. Finally, the study focused on evaluating theoretical knowledge about medications rather than actual practices.

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