Knowledge and Practice of Community Pharmacists on Amlodipine Use in Karary Locality: A Cross-Sectional Study

Abstract

Background: Amlodipine is one of the most commonly prescribed medications for treating hypertension. Community pharmacists play a crucial role in ensuring patients adhere to their treatment regimens and in counseling them regarding the appropriate dosage and expected side effects of Amlodipine. This study investigated the knowledge and practices of community pharmacists concerning Amlodipine's indications, dosage, side effects, combinations, and drug interactions in the Karary locality.

Methods: A descriptive cross-sectional study was conducted. Data were collected through a questionnaire from a convenient sample of 163 pharmacists working in community pharmacies in the Karary locality.The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were represented using frequencies and percentages, and Fisher's Exact Test was applied to determine the association between independent and dependent variables.

Results: The study involved 163 community pharmacists, of whom 72.4% were female. The age distribution showed that 47.9% were between 20-25 years, and 38.7% were 26-30 years. The vast majority (85.3%) held a bachelor's degree. Most (79.8%) had 1-5 years of practice experience, and more than half (58.9%) worked 7-10 hours per day. The study found that 55.2% had good knowledge of Amlodipine, while 44.8% had poor knowledge. Statistically, there was no significant association between knowledge and demographic data. In terms of practice, 54% exhibited good practices, while 46% were poor. The only significant association identified was

between the use of handbooks or software programs and practice. Approximately 42.3% of participants used leaflets as a source of information to check Amlodipine side effects, compared to 28.8% who used books and 27.6% who referred to formularies and guidelines.

Conclusion: The study revealed that over half of community pharmacists demonstrated good knowledge and practice scores concerning Amlodipine's indications, dosage, side effects, combinations, and drug interactions. Despite this, notable gaps in practice were identified, indicating a potential need for targeted training programs, and highlight the importance of enhancing educational efforts to improve pharmacists' competence in managing Amlodipine therapy effectively.

Keywords: Amlodipine, Community pharmacists, Knowledge, Practice

1. Introduction

Amlodipine is a long-acting lipophilic, third-generation dihydropyridine (DHP) calcium channel blocker that functions by inhibiting the influx of calcium into vascular smooth muscle and myocardial cells. This mechanism results in a reduction of peripheral vascular resistance (PVR), making Amlodipine a first-line pharmacotherapy for hypertension (1). It can be prescribed as monotherapy or in conjunction with other antihypertensive agents, such as lisinopril and valsartan (2). Additionally, Amlodipine is the preferred treatment for confirmed and suspected vasospastic angina as well as chronic stable angina (3). Its therapeutic applications extend to diabetic nephropathy, Raynaud phenomenon, silent myocardial ischemia, and left ventricular hypertrophy. Furthermore, Amlodipine is indicated for patients suffering from pulmonary artery hypertension (4).

The 2023 American Heart Association/American College of Cardiology guidelines designate Amlodipine as a third-line option for microvascular angina in patients already receiving β-blocker therapy (5). In pediatric populations, Amlodipine is safe for use at a maximum dosage of 5 mg/day (6). Importantly, Amlodipine has been deemed safe for use during pregnancy, as it does not pose a risk of fetal malformations (7). However, clinicians should be cautious, as high doses of statins may lead to myopathy and rhabdomyolysis when administered concurrently with Amlodipine (8). Common adverse effects associated with Amlodipine include dizziness, flushing, and peripheral edema. The concurrent use of clarithromycin or erythromycin may also elevate the risks of hypotension and acute kidney injury (9).

Given the complexities associated with Amlodipine therapy, pharmacists must possess comprehensive knowledge of its indications, contraindications, and potential adverse effects to effectively counsel patients and prevent overdose (10). Initiating therapy with a low dose and

titrating appropriately is essential to mitigate the risk of severe hypotension (11). Continuous monitoring of patients on long-term Amlodipine is critical for optimal blood pressure management (12). During the COVID-19 pandemic, innovations such as smartphone-enabled remote precision dosing demonstrated efficacy in lowering blood pressure among individuals with primary hypertension (13).

Pharmacists play a pivotal role in verifying appropriate dosages, educating patients about potential adverse drug reactions, and communicating with prescribers regarding cases of Amlodipine overdose (14). Their extensive training in medication management is crucial for reducing morbidity and mortality associated with hypertension (15). Research highlights the positive impact of pharmacist-prescriber communication on patient outcomes, and follow-up care provided by pharmacists has been shown to identify and resolve drug-related issues, thereby enhancing blood pressure control and overall quality of life for patients (16-18).

As pharmacist-led care, both independently and in collaboration with other healthcare professionals, has great effectiveness on managing elevated blood pressure in outpatients compared to those receiving standard care and to one another (19), thus the community pharmacist should have good knowledge about antihypertensive drugs.This study aims to evaluate the knowledge and practices of community pharmacists concerning Amlodipine, focusing on its indications, dosage, side effects, drug combinations, and interactions. Additionally, this research seeks to identify gaps between pharmacists' knowledge and their clinical practice.

2. Methods

2.1. Study Design and Setting

This study utilized a descriptive cross-sectional questionnaire-based design. A quantitative method was chosen to target registered community pharmacists in the Karary locality, Khartoum state, Sudan, and conducted from March to July 2022.

2.2. Study Population and Sampling Procedure

The study targeted registered community pharmacists working in the Karary locality, and agreed to participate in this study. A simple random sampling method was employed, resulting in the inclusion of 163 community pharmacists out of a total of 282 pharmacies. This sample size was determined using Raosoft software for sample size calculation, with a 95% confidence interval and a 5% margin of error. The choice of 163 participants was based on a power analysis conducted prior to sampling, which indicated that this number would provide sufficient statistical power to detect meaningful differences and associations within the data. Additionally, the expected response rate among community pharmacists was taken into account, ensuring that the sample would adequately represent the population while minimizing non-response bias.

2.3. Data Collection Method

Data were collected through a validated structured self-administered questionnaire. The questionnaire was developed by the researchers, then reviewed by two experts in pharmacy practice field, then pretested in 10 community pharmacist to check the reliability (Cronbach alpha of 0.76).Following the pretest, minor adjustments were made to the wording of several questions to improve clarity and ensure that the items accurately captured the intended concepts. These modifications were informed by the feedback from the pharmacists, leading to a more refined and effective questionnaire for the main study. The instrument consisted of 25 questions

divided into three sections: socio-demographic characteristics (5 questions), knowledge (12 questions), and practice (6 questions).

2.4. Data Management and Analysis

A scoring system was implemented to provide a more comprehensive evaluation of overall knowledge. Each correct answer received 1 point, while incorrect answers received 0 points. For multiple-choice questions, 1 point was distributed among the correct answers, resulting in a total score range of 0 to 12. For the practice assessment, a Likert scale was utilized, assigning scores of 1, 0.5, and 0 for responses labeled as "Always," "Sometimes," and "Never," respectively. This created a total score range of 0 to 6. Since the scores for both knowledge and practice were not normally distributed, they were expressed as medians and subsequently categorized into two groups: "poor" (scores below the median) and "good" (scores at the median and above).

The collected data were entered into the SPSS version 24.0 (IBM SPSS Inc., Chicago, IL). Frequencies and percentages were applied to represent the descriptive statistics. Fisher's Exact Test was utilized to determine the association of knowledge and practice scores with socio-demographic characteristics. A p-value of <0.05 was considered statistically significant.

3. Results

3.1 Socio-Demographic and Professional Characteristics

The study sample comprised 163 community pharmacists, with a significant majority being female (72%) compared to male pharmacists (28%). The age distribution revealed that 48% of participants were aged 20-25 years, while 39% were in the 26-30 year age group. Most respondents held a bachelor's degree (85%), with 15% possessing a master's degree. Regarding years of practice, 80% of pharmacists reported 1-5 years of experience. In terms of working

hours, 59% worked 7-10 hours per day, and 53% reported using a handbook or software program to check for Amlodipine interactions. Participants identified various sources for checking Amlodipine side effects, with the most common being leaflets (42%) and smartphone applications (41%) (Table 1)

Table 1. Socio-demographic and other characteristics of the study sample (n=163)

Socio-demographic Characteristics		**N(%)**
Gender	Male	46(28)
	Female	117(72)
Age groups (years)	20-25	78(48)
	26-30	64(39)
	More than 30	21(13)
Academic Qualification	Bachelor	139(85)
	Master	24(15)
Years of Practice (years)	1-5	130(80)
	6-10	26(16)
	More than 10	7(4)
Working Hours per day	1-6	54(33)
	7-10	96(59)
	More than 10	15(9)
Using a hand book or software program	Yes	86(53)
	No	77(47)
Sources of information to check Amlodipine side effects	Leaflets	69(42)
	Smartphone applications	67(41)
	Books	47(29)
	Formularies and guidelines	46(28)
	Social media	16(10)
	Drug information center	13(8)
	Friends	11(7)

3.2 Knowledge Assessment

The knowledge assessment indicated a high level of awareness regarding Amlodipine's primary use for treating high blood pressure, with 96.3% of pharmacists correctly identifying it as a first-line treatment. Most participants (90.8%) accurately described Amlodipine's mechanism of action as a calcium channel blocker. However, knowledge gaps were evident, particularly regarding Amlodipine's pregnancy category; only 60.7% correctly identified it as Category C.

The understanding of Amlodipine's maximum pediatric dosage was also lacking, with 37.4% of pharmacists unaware of the correct dose. The most commonly recognized side effect was edema (77.9%), while a significant number (76.7%) did not know the relationship between Amlodipine and Schimberg's disease (Table 2). Overall, 55.2% of participants achieved a good knowledge score, while 44.8% had a poor score (Figure 1A).

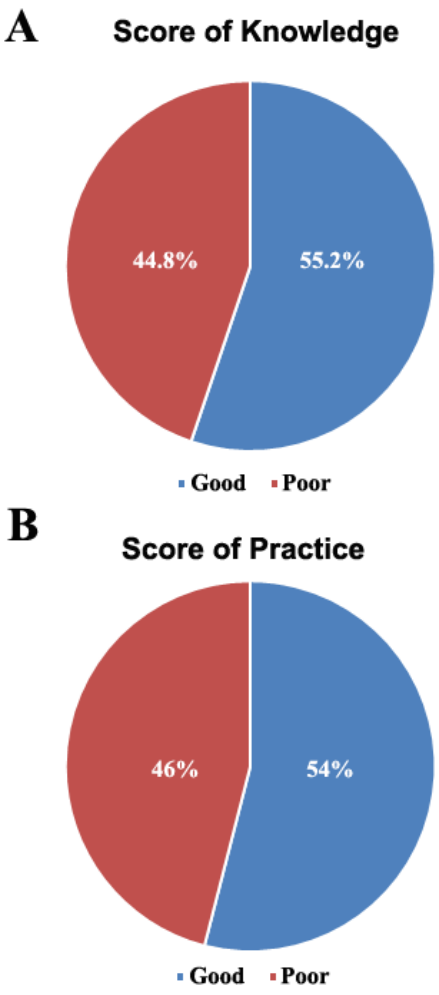

Figure 1. OverallKnowledge score (A) and practice score (B) of community pharmacists' regarding amlodipine.

Table 2. Knowledge of the studied community pharmacists regarding amlodipine (n=163)

Knowledge Question		**N(%)**
Amlodipine Use	Treat high blood pressure (First line)	157(96.3)
	Arrhythmia	3(1.8)
	Don't know	3(1.8)
Mechanism of action of Amlodipine	Calcium channel block inhibit influx of calcium ion into vascular smooth muscles and cardiac muscles	148(90.8)
	Angiotensin converting enzyme inhibitor	14(8.6)
	Don't know	1(0.6)
Amlodipine pregnancy category	Category A	0(0)
	Category B	0(0)
	Category C	99(60.7)
	Category D	0(0)
	Category X	35(21.5)
	Don't know	29(17.8)
Maximum dose of Amlodipine in treatment of pediatric hypertension	5mg	60(36.8)
	10mg	42(25.8)
	Don't know	61(37.4)
The most common side effects of Amlodipine	Diarrhea	19(11.7)
	Edema	127(77.9)
	Don't know	17(10.4)
Common side effect of Amlodipine	Dizziness	109(66.9)
	Cough	26(16)
	Don't know	28(17.2)
Relation between Amlodipine and Schimberg's disease	Yes	19(11.7)
	No	19(11.7)
	Don't know	125(76.7)
Thinking about patient takes Diltiazem with Amlodipine	Increase Amlodipine level in blood then increase side effects	83(50.9)
	Decrease Amlodipine level in blood then decrease side effects	24(14.7)
	Don't know	56(34.4)
Amlodipine and Sildenafil can be taken at the same time	Yes	37(22.7)
	No	106(65)
	Don't know	20(12.3)
Amlodipine and Atorvastatin (80mg) can be taken at the same time	Yes	89(54.6)
	No	48(29.4)
	I don't know	26(16)
Drugs, disease or foods worsen Amlodipine use	Raynaud's phenomenon	8(4.9)
	Lisinopril	20(12.3)
	Tacrolimus	24(14.7)
	Clarithromycin	41(25.2)
	Ketoconazole	57(35)
	Liver disease	65(39.9)

	Grapefruit	90(55.2)
	Don't know	12(7.4)
Amlodipine not used as combination therapy with	Valsartan	49(30.1)
	Diltiazem	89(54.6)
	Aliskiren and hydrochlorothiazide	25(15.3)

3.3 Practice Assessment

In terms of practice, 54% of the pharmacists demonstrated a good level of practice regarding Amlodipine use (Figure 1B). The results indicated variability in practices: 43.6% always advised patients about side effects, while a majority (60.7%) consistently informed patients on what to do in case of side effects. However, only 40.5% frequently educated patients about potential drug interactions. There was a notable engagement in discussing chronic diseases when dispensing Amlodipine, with 47.9% of pharmacists asking patients about other health conditions. Conversely, only 1.8% consistently educated patients on the appropriate dosage of Amlodipine (Table 3).

Table 3. Practice of the studied community pharmacists regarding amlodipine (n=163)

Practice question	**N(%)**		
	Always	**Sometimes**	**Never**
Advise the patients regarding side effects of Amlodipine	71(43.6)	15(9.2)	77(47.2)
Tell the patients what to do in case of Amlodipine side effects	99(60.7)	22(13.5)	42(25.8)
Educate the patients about Amlodipine drug interaction	66(40.5)	21(12.9)	76(46.6)
Ask the patients about prescription of Amlodipine, food supplements and herbal medication	68(41.7)	15(9.2)	80(49.1)
Ask the patients about other chronic disease when dispensing Amlodipine	78(47.9)	17(10.4)	68(41.7)
Educate the patients about Amlodipine dose	124(76.1)	36(22.1)	3(1.8)

3.4 Cross-Tabulation Analysis

Cross-tabulation analyses revealed no significant associations between knowledge and socio-demographic variables such as gender, age, academic qualification, years of practice, and working hours (Tables 4 and 5). However, a significant association was found between the use of

handbooks or software programs and practice scores, indicating that pharmacists who utilized these resources had better practice outcomes (P = 0.001).

Table 4. Cross tabulation between knowledge of community pharmacists toward amlodipine with socio-demographic and other characteristics

Variables		**Knowledge score**		**P value**
		Poor	**Good**	
Gender	Male	19(42.2)	26(57.8)	0.727
	Female	54(45.8)	64(52.2)	
Age groups (years)	20-25	39(50)	39(50)	0.070
	26-30	29(46)	34(54)	
	More than 30	5(22.7)	17(77.3)	
Academic qualification	Bachelor	64(46)	75(54)	0.509
	Master	9(37.5)	15(62.5)	
Years of practice (years)	1-5	61(46.9)	69(53.1)	0.535
	6-10	10(38.5)	16(61.5)	
	More than 10	2(28.6)	5(71.4)	
Working hours per day	1-6	25(47.2)	28(52.8)	0.239
	7-10	39(40.6)	57(59.4)	
	More than 10	9(64.3)	5(35.7)	
Using hand book or software program to check Amlodipine drug interactions before dispensing	Yes	42(48.3)	45(51.7)	0.349
	No	31(40.8)	45(59.2)	

Table 5. Cross tabulation between practice of community pharmacists toward amlodipine with socio-demographic and other characteristics

Variables		**Practice score**		**P value**
		Poor	**Good**	
Gender	Male	23(51.1)	22(48.9)	0.483
	Female	52(44.1)	66(55.9)	
Age groups (years)	20-25	39(50)	39(50)	0.514
	26-30	28(44.4)	35(55.6)	
	More than 30	8(36.4)	14(63.6)	
Academic qualification	Bachelor	64(46)	75(54)	0.582
	Master	11(45.8)	13(54.2)	
Years of practice (years)	1-5	62(47.7)	68(52.3)	0.568
	6-10	11(42.3)	15(57.7)	
	More than 10	2(28.6)	5(71.4)	
Working hours per day	1-6	22(41.5)	31(58.5)	0.127
	7-10	43(44.8)	53(55.2)	
	More than 10	10(71.4)	4(28.6)	

Using hand book or software program to check Amlodipine drug interactions before dispensing	Yes	26(29.9)	61(70.1)	0.001
	No	49(64.5)	27(35.5)	
Knowledge score	Poor	36(49.3)	37(50.7)	0.528
	Good	39(43.3)	51(56.7)	

4. Discussion

This study aimed to evaluate the socio-demographic and professional characteristics, knowledge, and practices of community pharmacists regarding Amlodipine, a widely used antihypertensive medication. The results reveal important insights into the competencies of community pharmacists and highlight areas for improvement. The majority of the participating pharmacists were female (72%), reflecting the gender distribution in the pharmacy profession in Sudan, as previously shown in many studies (20-22). The predominance of younger pharmacists (87% under the age of 30) and the high percentage holding a bachelor's degree (85%) indicate a relatively new workforce entering the field (23, 24). This could have implications for ongoing education and training needs, especially as 80% of the pharmacists reported having only 1-5 years of experience. Notably, the use of handbooks or software programs by over half of the respondents suggests a reliance on technological aids, which may enhance their practice but also indicates a potential gap in foundational knowledge (25, 26).

The high awareness of Amlodipine as a first-line treatment for hypertension (96.3%) and its mechanism of action (90.8%) is commendable. However, significant knowledge gaps remain, particularly regarding Amlodipine's pregnancy category, where only 60.7% correctly identified it as Category C, and the understanding of its pediatric dosing, where 37.4% were unaware of the correct dosage. These gaps could be critical, given the need for pharmacists to provide accurate information to patients and other healthcare providers (27, 28). The recognition of common side

effects was high, but the lack of knowledge regarding Amlodipine's association with Schimberg's disease (76.7% unaware) underscores the need for improved educational resources in this area.

The assessment of practice revealed that while a majority of pharmacists (54%) exhibited good practice regarding Amlodipine, there were notable deficiencies in patient education. For example, only 43.6% consistently advised patients about potential side effects, and even fewer (40.5%) educated patients about drug interactions. This is concerning, as comprehensive patient counseling is essential for medication safety and adherence (29). The high percentage (60.7%) of pharmacists informing patients about what to do in case of side effects suggests a proactive approach; however, the low rate of dosage education (1.8%) points to a significant area needing attention.

The lack of significant associations between socio-demographic factors and knowledge scores suggests that knowledge acquisition may be independent of age, gender, or years of practice. However, the significant association between the use of handbooks or software programs and better practice scores indicates that these resources can enhance pharmacists' performance (30). This finding highlights the importance of integrating technological aids into everyday practice, suggesting that further training on these tools could lead to improved patient care (31).

The current study has several limitations. Firstly, it was conducted solely in Karary locality, which means the findings may not be generalizable to all community pharmacists in Sudan. This geographic limitation could introduce selection bias, as the characteristics and practices of pharmacists in Karary may differ significantly from those in other regions of the country. Therefore, caution should be exercised when extrapolating the results to a broader population of community pharmacists.Secondly, the cross-sectional design does not allow for the

determination of causal relationships between the findings and other influencing factors. Additionally, the use of a closed questionnaire restricted community pharmacists' ability to fully express their thoughts on the research topic.Despite these limitations, our study is significant as it assessed community pharmacists' knowledge and practices regarding Amlodipine. It highlights the need for enhanced continuing education and training programs, particularly in areas where pharmacists exhibited knowledge gaps, such as drug interactions. Educational interventions should also focus on improving practical skills in patient counseling to ensure pharmacists can provide comprehensive information about medications like Amlodipine.

Conclusion

In conclusion, while community pharmacists showed a solid understanding of Amlodipine, significant knowledge gaps and inconsistencies in practice indicate a need for ongoing professional development. Stakeholders should implement targeted training programs to address these deficiencies, particularly in drug interactions and patient counseling. Future research should evaluate the effectiveness of these educational interventions in enhancing pharmacy practice and patient care.

Ethical Considerations and Consent

The study was conducted in accordance with the 1975 Declaration of Helsinki and received approval from the Ethical Committee of the Faculty of Pharmacy at the University of Khartoum (FPEC-37-2022). Written informed consent was secured from all participants, and confidentiality was upheld throughout the research process.

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