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KNOWLEDGE AND ATTITUDE REGARDING DRUG-DRUG INTERACTIONS AMONG THE MODERN MEDICAL PRACTITIONERS IN A TERTIARY CARE INSTITUTION IN NORTHERN KERALA

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ABSTRACT: Background: Drug–drug interactions (DDI's) are a common yet often preventable cause of adverse drug events, particularly in settings involving polypharmacy. Awareness and vigilance among prescribers are essential to minimize therapeutic failures and patient harm. Despite their clinical significance, knowledge and practices surrounding DDIs remain suboptimal in many healthcare environments. **Aims and Objectives:** To evaluate the knowledge and attitude of modern medical practitioners in a tertiary care center in Kerala regarding DDI's, and to identify the factors associated with their knowledge levels. **Methodology:** A hospital-based cross-sectional study was conducted among 200 consenting medical professionals including interns, residents, and consultants, and was selected through simple random sampling. A pretested semi-structured questionnaire assessing knowledge and attitude was administered to collect the responses and scoring systems were assigned to assess these parameters regarding drug-drug interactions. **Results:** Among respondents, even though 84% were aware of DDI's, only 6% demonstrated good knowledge. 50% and 44% had average and poor knowledge respectively. Good knowledge was significantly associated with higher qualifications, practice duration, government college background, CME participation, and self-learning. Attitudes were more favorable. 55% of the study participants have exhibited a good attitude with significant associations seen with gender, qualification, information sources, and type of training they received. **Conclusion:** Enhancing DDI awareness alone is insufficient; structured educational interventions and practical training are critical to foster both competence and conscientious prescribing.

INTRODUCTION: Drug-drug interactions (DDI's) arise when one medication either enhances or reduces the efficacy of another (known as pharmacodynamic interaction) or influences its, metabolism, absorption, excretion or distribution (referred to as pharmacokinetic interaction) [1].

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The most common avoidable cause of adverse drug reactions is drug interactions, which can lead to drug toxicity or poor therapeutic results, both of which can be harmful to patients [2]. Drug interactions may result in unintended, diminished, or desirable outcomes.

With every additional medication a patient takes, the chance of drug interactions increases. A meta-analysis indicates that the high rate of prescribed medications in elderly patients (with 65-year-olds typically taking an average of 5 drugs) raises the likelihood of drug interactions, leading to

hospitalizations in 7% of cases [3]. A true drug interaction only takes place when the combined outcomes of the involved drugs surpass or diminish the calculated sum of their respective actions. Many suspected drug interactions are simply overlapping or antagonistic effects of individual medications rather than true pharmacological interactions. Recognizing these significant interactions requires combining a solid grasp of drug mechanisms with awareness of vulnerable patient groups. When multiple drugs are prescribed together, the chance of interactions rises potentially weakening their intended therapeutic benefits [4].

In a study conducted by Sahayaraj *et al.* 43.5% of respondents exhibited a low level of knowledge regarding drug–drug interactions (DDI's). Online resources served as an as their primary source of reference for drug information [5]. A cross-sectional survey utilizing a self-administered online questionnaire was conducted among 618 physicians in China. They collected data on the physician's knowledge of drug pairs, sources of information and attitude toward the PDDI's. They concluded that less than half of the drug pairs were recognized, indicating unsatisfactory level of knowledge about the clinically significant drug interactions [3].

Another study was done where a US-based postal questionnaire was sent to 950 prescribers to assess their knowledge on drug interactions and common resources of Drug-drug interaction information. The accuracy of prescribers in correctly classifying specific drug pairs varied between 18.2% to 81.2%, with a mean classification rate of 42.7% for all combinations. This study suggests that prescriber's knowledge of potential clinically significant DDI's is generally poor [6]. Another study conducted among interns and nurses in Karnataka showed post-test improvements in knowledge, attitude, and practice domains for both groups, but no statistically significant differences were observed in post-test knowledge and attitude scores ($p > 0.05$), nurses achieved higher mean scores than interns in the practice of drug-drug interaction (DDI's) screening [7]. Another survey was conducted involving Pharmacists and ward physicians from a variety of specialized departments at Penang General Hospital in Malaysia and they were given questionnaires as part of the survey. These surveys focused about demographic information, attitudes toward preferable sources of drug information, knowledge and practice questions about potentially fatal DDI's. They concluded that all the houseman officers have low knowledge, 50% of the HCPs with 11–15 years of experience had high knowledge, 78.2% of HCPs without postgraduate studies had a low knowledge level [8]. Another study was conducted to evaluate drug–drug interactions (DDI's) through the review of prescriptions among inpatients at a South Indian teaching hospital. A total of 856 drug-drug interactions (DDI's) were found in 186 of the 204 prescriptions that were reviewed. This study aids in identifying drug–drug interactions (DDI's) characteristics, which could potentially ensure that future medication use is both safe and efficien [9]. A Descriptive cross-sectional study was conducted in Prince AbdulMohsin Hospital which found out that there was a good HCPs attitude about DDI's. However, the knowledge of DDI's by health care providers were poor [10]. Knowledge on drug interactions among medical practitioners play a vital role in prescribing optimum drug for obtaining maximum therapeutic advantage. There are only a limited number of studies conducted on this topic. Hence, we aim to find out the level of knowledge and attitude on drug-drug interactions among medical practitioners and the factors influencing them on drug interactions.

METHODOLOGY: This hospital-based cross-sectional study was conducted over a period of two months from October to November 2024 at MES Medical College, Perinthalmanna, a tertiary care institution located in Kerala, India. The target population included medical doctors actively engaged in clinical practice and prescription of medications within the institution. This encompassed interns (house surgeons), postgraduate residents, and consultants. Practitioners from the dental department and those who did not provide consent were excluded from participation. List of all doctors satisfying inclusion criteria were concluded anda sampling frame was constructed. Simple random sampling was adopted for collection of data.

Sample size was estimated using the formula:

$$N = 4PQ/ d^2$$

Where P is the proportion of good knowledge of DDI's from the previous studies, Q=100-P with relative error of 8%. The calculated sample size was 154, considering the 30 % non-responsive rate, we have included 200participants in our study.

A pretested semi-structured questionnaire was developed to assess both knowledge and attitude of medical practitioners regarding drug interactions. The questionnaire consisted of two sections, each comprising eight closed-ended items. For assessing knowledge and attitude, each correct response was awarded with one point. Scores in each domain were categorized into three levels. A score above 6 was interpreted as Good, a score between 4 and 6 as Satisfactory, and a score below 4 as Poor. The knowledge domain covered general principles of pharmacokinetics and pharmacodynamics relevant to drug interaction risks, while the attitude section assessed awareness of consequences, perceived importance of knowledge updates, and willingness to consult reliable sources during prescription.

Prior to data collection, verbal and written informed consent was obtained from all participants. Data were collected by the investigators themselves to ensure uniformity, minimize bias, and clarify any ambiguous responses in real-time. The use of a semi-structured questionnaire allowed for a balance between standardization and flexibility in collecting data. No digital tools or recording devices were used, maintaining confidentiality and reducing hesitancy among participants. As all investigators were members of the academic or clinical team, rapport with participants was well-established, further facilitating participation. Permission for conducting the study was obtained from the Institutional ethics committee from the MES medical college hospital (IEC/MES/INT19/2024).

Data Analysis: Data was entered using Microsoft excel and was analyzed in SPSS version 26. Quantitative data was expressed in mean, mean and in standard deviation. All qualitative variables were expressed in percentage or in proportions. Data normality was assessed using the Kolmogorov-Smirnov test, and appropriate parametric or non-parametric tests were applied accordingly. For qualitative data, the chi-square test or Fisher exact test was used to determine the association between different variables and the outcome variable.

RESULTS: The baseline characteristics of the study population are given in table number 1. Most respondents in this study are young medical professionals **Fig. 1**, with over 80% being under 30 years old and 78% having less than two years of practice. Among these the most being interns or junior doctors, predominantly from private medical colleges. While awareness of drug-drug interactions (DDI's) is relatively high (84%), practical exposure remains moderate, with 35% never encountering a DDI's in practice. This may be due to their limited clinical experience or underreporting. Additionally, while textbooks remain the primary source of information regarding drug-drug interactions (70.5%), interactive avenues like workshops and pharma outreach are the other sources of information on DDI's. Despite the majority having not attended any formal training on DDIs (64.5%), there's a promising trend of self-initiated learning, with 71% actively updating themselves. However, a significant minority (29%) remain disengaged from ongoing learning about DDI's.

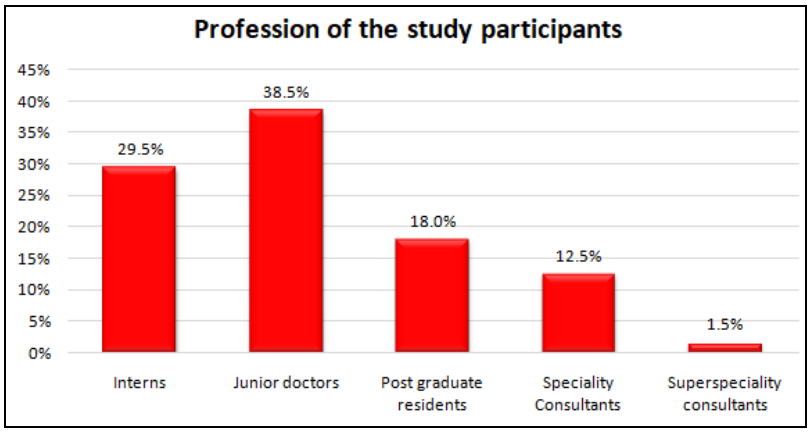

FIG. 1: SHOWING THE PROFESSION OF STUDY PARTICIPANTS

TABLE 1: SHOWING THE BASELINE CHARACTERISTICS OF THE STUDY POPULATION

Sl. no.	Variables		Frequency	Percentage
1	Age group	Less than 30	167	83.5
		31- 45 years	29	14.5
		More than 45 years	4	2
2	Sex	Male	99	49.5
		Female	101	50.5
3	Educational qualification	Interns	59	29.5
		Junior doctors	77	38.5
		Post graduate residents	36	18
		Speciality Consultants	25	12.5
		Superspeciality consultants	3	1.5
4	Type of college graduated from	Government medical college	33	16.5
		Private Medical College	167	83.5
5	Duration of Practice	Below 2 years	156	78
		2 to 5 years	27	13.5
		Greater than 5 years	17	8.5
6	Heard about drug-drug interactions	Yes	168	84
		No	32	16
7	Ever come across DDI's	Yes	130	65
		No	70	35
8	Source of information regarding DDI's	Textbooks	141	70.5
		Workshops	2	1
		Pharmaceutical companies	3	1.5
		Online Websites	45	22.5
		Others	9	4.5
9	Type of training programs attended on DDI's	Continuing Medical education	34	17
		Seminars/Workshops	22	11
		Other	15	7.5
		Not participated in any	129	64.5
10	Self-updating on DDI's	Yes	142	71
		No	58	29

Association between Different Variables with Knowledge Levels:

TABLE 2: SHOWING ASSOCIATION BETWEEN DIFFERENT VARIABLES AND KNOWLEDGE LEVELS

Sl. no.	Variables		Good Knowledge	Average Knowledge	Poor Knowledge	P value
1	Age group	Less than 30	11	78	78	
		31- 45 years	1	19	9	0.33
		More than 45 years	0	3	1	
2	Sex	Male	5	53	41	0.58
		Female	7	47	47	
3	Educational qualification	Interns	2	24	33	
		Junior doctors	7	31	39	
		Post graduate residents	1	25	10	
		Speciality Consultants	2	17	6	0.01
		Superspeciality consultants	0	3	0	
4	Type of college graduated from	Government medical college	7	82	53	
		Private Medical College	5	18	35	0.003
5	Duration of Practice	Below 2 years	10	68	78	
		2 to 5 years	2	19	6	0.01
		Greater than 5 years	0	13	4	
6	Heard about drug-drug interactions	Yes	11	93	64	
		No	1	7	24	0.001
7	Ever come across DDI's	Yes	10	69	51	
		No	2	31	37	0.1
8	Source of information regarding DDI's	Textbooks	9	70	62	
		Workshops	0	1	1	
		Pharmaceutical companies	0	1	2	

		Online Websites	2	24	19	
		Others	1	4	4	0.98
9	Type of training programs attended on DDI's	Continuing Medical education	0	26	8	
		Seminars/Workshops	3	11	8	0.01
		Other	1	8	6	
		Not participated in any	8	55	66	
10	Self-updating on DDI's	Yes	7	82	53	0.003
		No	5	18	350	

Half of the respondents (50%) fall into the average knowledge category regarding drug-drug interactions, and only a small fraction (6%) demonstrates good knowledge. While 44% possess poor knowledge, this highlights a crucial gap in clinical pharmacology awareness **Fig. 2.**

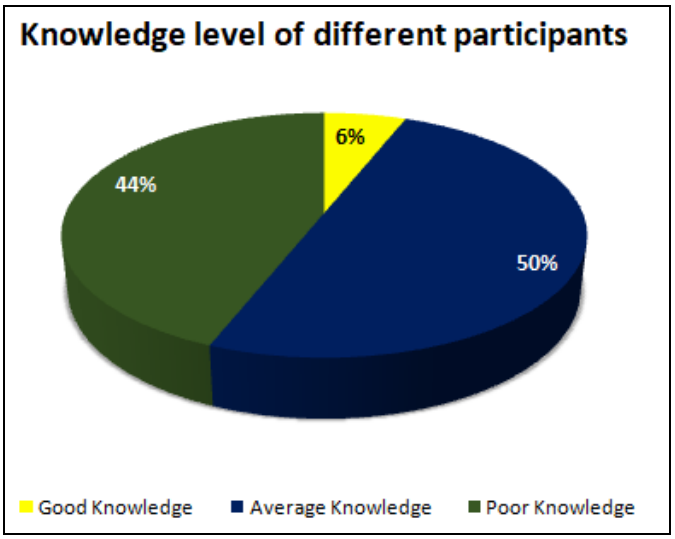

FIG. 2: SHOWING KNOWLEDGE LEVELS OF THE STUDY PARTICIPANTS REGARDING DDI'S

Association between different variables and knowledge levels are showed in **Table 3**. The results showed that good knowledge of drug-drug interactions (DDI's) is significantly associated with factors like educational qualification ($p = 0.01$), type of college ($p = 0.003$), years of clinical practice ($p = 0.01$), prior awareness of DDIs ($p = 0.001$), participation in training programs ($p = 0.01$), and self-updating behaviour ($p = 0.003$). Notably, postgraduate and specialty consultants demonstrated higher knowledge levels, while those from government medical colleges outperformed their private college peers. Similarly, professionals with over two years of practice and those who had attended CME/seminars or actively kept themselves updated showed better comprehension ($P < 0.05$). On the other hand, variables like age group, sex, prior DDI's encounters, and sources of DDI's information did not have a statistically significant association with knowledge levels. Interestingly, while textbooks were the most cited source for gaining DDI's, they didn't correlate with improved knowledge, suggesting that passive learning alone may be insufficient ($P > 0.05$). These findings highlight the need for structured, hands-on educational strategies and continuous professional development to enhance clinical competence in identifying and managing DDI's effectively

TABLE 3: ASSOCIATION BETWEEN DIFFERENT VARIABLES WITH ATTITUDE LEVELS

Sl. no.	Variables		Good Attitude	Average Attitude	Poor Attitude	P value
1	Age group	Less than 30	99	67	1	0.06
		31- 45 years	9	20	0	
		More than 45 years	2	2	0	
2	Sex	Male	46	52	1	0.02
		Female	64	37	0	
3	Educational qualification	Interns	42	17	0	
		Junior doctors	42	34	1	
		Post graduate residents	13	23	0	0.02
		Speciality Consultants	13	12	0	
		Superspeciality consultants	0	3	0	
4	Type of college graduated from	Government medical college	11	18	0	
		Private Medical College	99	71	1	0.18
5	Duration of Practice	Below 2 years	89	66	1	
		2 to 5 years	13	14	0	0.64
		Greater than 5 years	8	9	0	

6	Heard about drug-drug interactions	Yes	92	75	1	
		No	18	14	0	0.99
7	Ever come across DDI's	Yes	72	57	1	0.92
		No	38	32	0	
8	Source of information regarding DDI's	Textbooks	82	59	0	
		Workshops	0	2	0	
		Pharmaceutical companies	2	0	1	
		Online Websites	21	24	0	
		Others	5	4	0	0.01
9	Type of training programs attended on DDI's	Continuing Medical education	18	16	0	
		Seminars/Workshops	15	7	0	
		Other	5	9	1	
		Not participated in any	72	57	0	0.03
10	Self-updating on DDI's	Yes	77	64	1	0.91
		No	33	25	0	

Most (55%) of participants displayed a good attitude toward drug-drug interactions (DDI's), while 44.5% showed an average attitude. Only a negligible 0.5% exhibited a poor attitude **Fig. 3.**

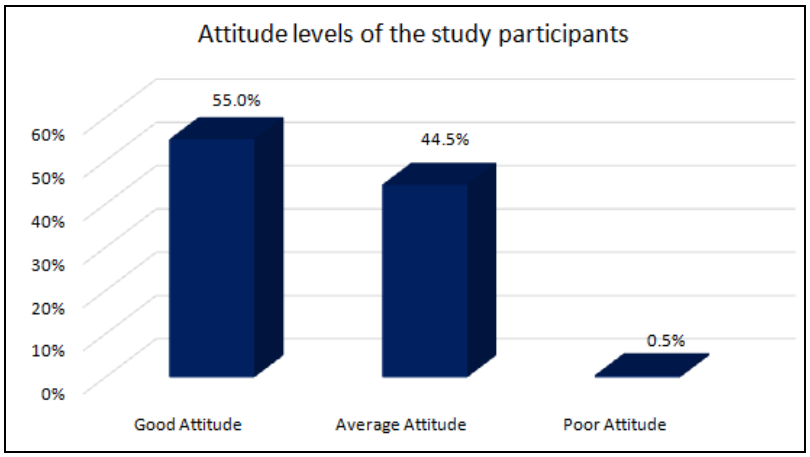

FIG. 3: SHOWING KNOWLEDGE LEVELS OF THE STUDY PARTICIPANTS REGARDING DDI'S

Association between different variables and attitude levels are showed in **Table 3**. Significant associations were found for sex ($p = 0.02$), educational qualification ($p = 0.02$), source of DDI's information ($p = 0.01$), and type of training attended ($p = 0.03$). Female participants demonstrated a more favourable attitude compared to males, and interns showed consistently good attitudes. Moreover, those who obtained DDI's information through textbooks or attended CMEs and workshops appeared more positively inclined, suggesting that early academic exposure and formal training shape professional outlooks effectively.

On the other hand, variables like age group, college type, years of practice, awareness, prior encounters with DDI's, and self-updating behaviour did not show statistically significant influence on attitude levels. Interestingly, while self-learning and exposure were expected to influence attitudes, their lack of significance here underscores the importance of structured training and institutional reinforcement in attitude formation. These findings advocate for integrating attitude-shaping components such as ethical prescribing modules, reflective practice, and case-based discussions within medical education to nurture a safer prescribing culture.

DISCUSSION: This hospital-based cross-sectional study conducted at MES Medical College assessed the knowledge and attitude of modern medical practitioners regarding drug–drug interactions (DDI's). Utilizing a semi-structured questionnaire and universal sampling, data were collected from interns, residents, and consultants over a two-month period. The present study conducted at MES Medical College revealed that while 84% of modern medical practitioners were aware of drug–drug interactions (DDI's), only 6% demonstrated good knowledge, with 50% showing average and 44% poor understanding.

These findings align with a cross-sectional study from a North Indian tertiary care hospital, where only half of the practitioners could correctly classify drug pairs, indicating a similarly low level of DDI's knowledge among clinicians. Both studies underscore the persistent gap between awareness and applied pharmacological competence, particularly among younger and less experienced practitioners [11].

In this study, the knowledge of drug–drug interactions (DDI's) among modern medical practitioners were found to be suboptimal, with only 6% demonstrating good knowledge and 44% falling into the poor category. This aligns closely with the findings from Penang General Hospital, Malaysia, where 100% of houseman officers had low knowledge, and 78.2% of healthcare providers without postgraduate education scored poorly. Both studies emphasize the critical role of postgraduate training and clinical experience in enhancing DDI's awareness [8].

The South Indian teaching hospital study, which analysed 856 DDI's across 186 prescriptions, highlighted the high prevalence of pharmacokinetic interactions and the correlation between polypharmacy and increased DDI's risk. In this study, although the focus was on practitioner knowledge rather than prescription analysis, the results similarly underscore the clinical relevance of DDI's and the need for prescribers to be equipped with practical tools and training to identify them [9].

The Prince Abdul Mohsin Hospital study found that while attitudes toward DDI's were generally positive, knowledge remained poor, especially among those without formal training. This mirrors the attitudinal trends in this study, where 55% of participants had a good attitude, but knowledge levels lagged. Both studies advocate for structured educational interventions, such as CME programs and interactive workshops, to bridge the gap between awareness and clinical competence [10]. In comparison, an observational study from a South Indian teaching hospital reported a 33% prevalence of DDI's in prescriptions, with polypharmacy being a major contributing factor. While that study focused on prescription analysis rather than practitioner knowledge, it reinforces the clinical relevance of DDI's and the need for prescriber vigilance [12]. Factors such as postgraduate qualification, government college background, and CME participation as statistically significant predictors of better DDI's knowledge. This complements findings from a Tamil Nadu-based study, which showed a strong correlation between the number of drugs prescribed and the likelihood of DDI's, especially in older adults and those with chronic conditions [13]. Attitude towards DDI's showed 55% of participants exhibiting a good attitude toward DDI's awareness. Similar were found from a 6-year observational study in North India, where clinicians acknowledged the importance of DDI's. Notably, your study found that female practitioners and interns had more positive attitudes, and that structured training significantly influenced outlook [14]. These insights collectively advocate for a shift toward interactive, case-based pharmacology education and continuous professional development to bridge the gap between perception and practice.

Strength and Limitations: This study's strengths include its inclusive universal sampling of medical practitioners across various roles, a well-structured questionnaire design, and multifactorial analysis that explored key educational and experiential factors affecting drug–drug interaction (DDI's) knowledge. However, a study relying on self-reported responses, its generalizability is limited, and findings may be influenced by response bias. Additionally, while the survey effectively gauged awareness and attitude, it did not assess clinical decision-making skills or practical competence in managing DDI's.

CONCLUSION: The study finding revealed that while general awareness of DDI's was high (84%), only 6% of respondents demonstrated good knowledge, with the majority falling into average (50%) or poor (44%) categories. Educational qualification, type of institution, duration of practice, participation in formal training programs, and self-directed learning were significantly associated with higher knowledge scores, underscoring the importance of structured education and ongoing professional development.

Attitudinal findings were comparatively favourable, with 55% of participants exhibiting a

good attitude toward DDI's awareness and safe prescribing practices. Factors such as sex, academic qualification, source of DDI's information, and training type were statistically linked to better attitudes, highlighting the positive impact of early exposure and formal instruction. However, variables like age, college type, and clinical exposure showed no significant influence, suggesting limitations of informal and passive learning environments. These results emphasize the need for integrating case-based pharmacology education and ethical prescribing modules into medical curricula, promoting both competence and conscientiousness in medication safety. Future interventions should build upon these findings to foster a prescribing culture rooted in evidence-based awareness and inter professional collaboration.

Recommendations: Based on the findings of this study, it is recommended that medical curricula incorporate interactive, case-based pharmacology modules that emphasize the identification and management of drug–drug interactions (DDI's). Regular training through CME sessions and workshops should be prioritized for junior practitioners, as structured learning significantly enhances both knowledge and attitude. Institutions should also promote active self-learning through reliable clinical platforms and decision-support tools, given the limited impact of passive sources like textbooks. Furthermore, integrating ethical prescribing practices and DDI's-alert systems within hospital protocols can support safer therapeutic decisions. Expanding similar research across multiple centres would help validate these findings and guide policy-level interventions for improving pharmacological competence among healthcare professionals.

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