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Pharmacist Readiness to Enter the Era of Mandatory Halal Drug Certification; Knowledge, Perceptions, Attitudes

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Abstract: Pharmaceutical practices include manufacturing including quality control of pharmaceutical preparations, security, procurement, storage and distribution of drugs, prescription drug services, drug information services, and the development of drugs, medicinal materials, and traditional medicines must be carried out by health personnel who have the expertise and authority by the provisions of laws and regulations, namely pharmacists. The study aims to determine the level and correlation of pharmacists' knowledge, perceptions, and attitudes toward readiness to enter the era of mandatory halal drug certification and influencing demographic factors. The cross-sectional study was conducted online using a questionnaire validated by experts and tested for validation and reliability beforehand. The study was conducted in January-February 2023 with 521 respondents from six provinces in Java Island, by purposive sampling with the inclusion criteria of having STRA, competency certificate, and practicing pharmacy. The results showed that the community had sufficient knowledge (mean 30.74 ± 1.70) from a maximum score of 38, sufficient perception (mean 53.65 ± 6.78) from a maximum score of 64, and sufficient attitude (mean 39.80 ± 5.33) from a maximum score of 48, towards halal medicine. The results of the Spearman test obtained a low correlation between knowledge perception (P value=0.318), a low correlation between knowledge-attitude (P value=0.255), and a very strong correlation between perception-attitude (P value=0.795). The results of the multiple correlation test obtained a value of P value = 0.00 (P-value <0.05), then knowledge-perception-attitude regarding halal medicines influence each other. The results of the Chi-square test obtained, the factors of workplace, position, and length of work affect knowledge, and the factors of age, workplace, position, and length of work affect perceptions and attitudes (all p-value <0.05) on pharmacists regarding halal medicines. It is concluded that pharmacists have sufficient knowledge, perceptions, and attitudes and influence each other, knowledge-perception is significant, knowledge-attitude is very weak and perception-attitude has a very strong correlation. Place of work, position, and length of work are related to pharmacists' knowledge, perceptions, and attitudes about halal medicines.

Keywords: *Drug, Halal, Knowledge of Attitude Perception, Pharmacist*

Introduction

*P*harmaceutical workers as the health workers providing health services to the community have an important role because they are directly related to the provision of services, especially pharmaceutical services [1]. Pharmacists are health workers who have an important role in improving the degree of public health [2] as stated in Law Number 36 of 2014 concerning health workers which states that health workers are everyone who devotes themselves to the field of health and has knowledge and/or skills through education in the field of health which for certain types requires authority to carry out health efforts [3]. Law No. 36 of 2009 Concerning Health states that pharmaceutical practices include production including quality control of pharmaceutical preparations, security, procurement, storage and distribution of drugs, prescription drug services, drug information services, and the development of drugs, medicinal materials, and traditional medicines, which must be carried out by health personnel who have the appropriate expertise and authority by the provisions of laws and regulations [4].

Pharmacists in the pharmaceutical industry have responsibility for planning production and controlling drug inventories, procuring materials needed for production including machinery, facilities, and production infrastructure, producing drugs that meet established standards and requirements for safety, quality, and benefits, conducting quality checks of all facilities, facilities, and infrastructure, starting materials, semi-finished and finished products and ensuring that all systems built in the production of pharmaceutical preparations run by the provisions [5]. According to the legislation, the provision of pharmaceutical care has changed from focusing only on the management of drugs (drug-oriented) to a complex approach that encompasses both drug and pharmaceutical care, with the aim of enhancing the patient's quality of life. [6]. Pharmacists must understand and realize the possibility of medication errors in the service process and identify, prevent, and overcome drug-related problems, pharmacy economic and socio-pharmacy economic problems [7]. Pharmacists

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must also be able to communicate with other health workers in determining therapy to support the rational use of drugs [8].

Halal assurance in Indonesia is officially recognized and supported by the state with the issuance of Law No. 33 of 2014 concerning Halal Product Guarantee (JPH) [9]. The enactment of this law implies that the state officially recognizes and guarantees Islamic law in the form of the obligation to consume halal and thoyib food. The execution of the law is stipulated in Government Regulation No. 31 of 2019 on the Implementing Regulations of Law Number 33 of 2014 concerning Halal Product Guarantee and its technicalities are regulated in Government Regulation No. 39 of 2021 regarding the Administration of the Halal Product Guarantee Field where items and / or solutions related to food, beverages, drugs, cosmetics, chemical products, biological products, genetically modified products, and usable goods consumed, used, or utilized by the public are obligatory halal certified [10]. Mandatory halal phase 1 applies October 17, 2019 (Food products, slaughter drinks, and slaughter services), and phase 2 applies October 17, 2021, for all products.

The term halal is known in Islamic teachings sourced from the Qur'an and hadith which implies something that is permitted by Islamic law covering various aspects of life, such as behavior, how to obtain sustenance, how to dress, and food or drink consumed [11]. Islam views health as a very important factor in human life, therefore the Prophet taught about healthy living procedures [12]. Specifically, the Prophet Muhammad SAW emphasized seeking treatment while cautioning not to seek treatment with the haram, as he said: "Allah has revealed disease and cure, and made a cure for every disease; therefore, seek treatment and do not treat with haraam objects" HR Abu Daud [13]. Halal medicines are medicinal products derived from permitted sources, namely animals, plants, and organic or inorganic materials that follow the methods of preparation, manufacture, and extraction that follow the rules in Islam [14]. Halal medicines must not only be free from haram substances but must be thoyib. In general, thoyib refers to a product that is clean, pure, and produced according to standardized processes and procedures [15]. Thus, pharmaceutical products must not only be halal but must be clean according to Islamic law.

The State of the Global Islamic Economy Report 2019/2020 reports that the amount of halal food and lifestyle spending by Muslims in the world reached USD 2.2 trillion in 2019 and is expected to continue to grow to USD 3 trillion by 2023 [16]. Based on Euromonitor Consumer Health in Indonesia Country Report, pharmaceutical market share growth has occurred in analgesic products, vitamins, dietary supplements, and herbal products. Vitamin and supplement products accounted for almost half of all health product sales [17]. Indonesia is currently in the 4th position as the country with the highest consumption of pharmaceutical products. The halal pharmaceutical industry sector continues to grow as more products are manufactured and ingredients are increasingly halal-certified [18]. Halal nutraceutical products are increasingly focusing on functionality, while new concepts in halal medicines have been developed by combining spiritual healing with halal-certified medicines [19].

Methods

Study design and setting

This research is a cross-sectional study conducted online using a questionnaire regarding the knowledge, perceptions, and attitudes of pharmacists towards understanding halal products, the ability of pharmacists to apply halal haram laws, pharmacists' knowledge of halal product assurance regulations, pharmacists' knowledge of halal medicines, pharmacists' knowledge of critical points of halal medicine, and the ability of pharmacists to choose halal alternative medicines. The research was conducted in the period January-February 2023.

Participants

The 521 respondents were spread across six provinces on the Indonesian island of Java, taken by purposive sampling with the inclusion criteria of having a certificate of competence, Pharmacist Registration Certificate (STRA), and carrying out the pharmaceutical practice. Respondents' demographic data included age, gender, place of work, length of service and position. The questionnaire was validated by experts and tested for validation and reliability before being distributed to respondents.

Instrument

The knowledge questionnaire used a Guttman scale where respondents were asked to choose the option "Yes (value 2)" or "No (value 1)" for as many as 19 statements, perception and attitude statements, using a four-point Likert scale ranging from "strongly agree (value 4)", "agree (value 3)", "disagree (value 2)", "strongly disagree (value 1)", perception 16 statements and attitude 12 statements. Knowledge, perception, and attitude questionnaires were validated by experts, and validity tests using Point Biserial for knowledge, and Pearson Product Moment for perception and attitude [20]. Reliability test of knowledge questionnaire using Split-Half technique with Guttman Split Half coefficient ≥ 0.6 perception and attitude questionnaire using Crombach's Alpha value ≥ 0.6.

Data sources

The questionnaire data was obtained online using Google Drive sent through the WhatsApp application, after the respondent stated that he was willing and filled in the demographic data, the respondent then filled in the questionnaire. Data collection was carried out in each province evenly.

Statistical methods

Assessment of the level of knowledge, perceptions, and attitudes is divided into three categories including the good category ($X \geq$ mean + 1.SD), moderate category (mean - 1.SD $\leq X \leq$ mean + 1.SD), and poor category ($X <$ mean - 1.SD) [21]. Knowledge-perception, knowledge-attitude, and perception-attitude correlations were conducted with the Spearman test, the relationship is very low if the coefficient interval is 0.0-0.19, low 0.2-0.39, moderate 0.4-0.59, strong 0.6-0.79, and very strong 0.8-1.0.

The correlation of knowledge-perception-attitude was done by multiple correlation tests, declared to have a relationship if the P value <0.05. Correlation of demographic data with knowledge, attitude, and perception scores was performed with the chi-square test, declared to have a relationship if the P value <0.05.

Results

Respondent demographics

From 521 respondents spread across six provinces on the island of Java in Indonesia, data was obtained based on age group, gender, place of work, length of service, and position.

Table 1. Classification of Respondents Based on Characteristics

Characteristics	Demographic Characteristics	Frequency (%)
Age	< 25 years	32
	25-35 years old	47
	36-45 years old	13
	45-55 years	6
	>56 years	2
Gender	Male	33
	Female	67
Workplace	Pharmacy	45
	Clinic	15
	Health Center	20
	Private Hospital	10
	Government Hospitals	4
	PBF	3
	Herbal Medicine and Cosmetic Industry	3
Position	Policymakers in the workplace	43
	Functional pharmacist	57
Length of Practice	<4 years	53
	4-8 years	32
	>8 years	15

Results validation questionnaire

The questionnaire on the knowledge domain about halal provisions added the definitions of halal, haram, and things that cause an item to become haram. The expert opinion is included in the questionnaire "*Halal* is what is allowed while haram is what is prohibited" and "*Najis* is all objects considered dirty by Islamic law such as carrion, blood, and animal feces" [26]. A question regarding the critical point of halalness of drugs was added to the indicator with the question "if an animal is slaughtered in an un-Islamic way, then all parts of its body cannot be eaten, including as raw materials for drugs" [27]. Questions regarding organizations authorized to issue halal certification and legislation guaranteeing halal products were proposed by one of the experts and included as additional information before the question on the guarantee of halal medicine by the government [9]. The result of content optimization by pharmaceutical experts, halal product experts, and experts in psychology obtained 19 knowledge questions, 16 perception statements, and 12 statements of public attitudes toward halal medicines.

Respondent's knowledge of halal medicine

The knowledge questionnaire uses a Gutman scale with yes and no answers, there are five indicators and 19 questions. The results of the online distribution to 521 respondents can be seen in **Table 2**.

Table 2. Pharmacists' knowledge about halal medicines (n = 521)

Knowledge Domain		Answer	
Indicator	Question	Yes	No
Pharmacists' understanding of halal law	1. Halal is what is "permitted", and haram is about what is "forbidden".	516	5
	2. Najis are anything that is deemed unclean by Islamic law, like corpses, bloody blood, and excrement.	518	3
	Mean score 1.99 ± 0.09		
The ability of pharmacists to apply halal haram laws	3. Drugs derived from haram materials in an emergency may be used if there is a MUI fatwa	485	36
	Mean score 1.93 ± 0.25		
Pharmacists are aware of halal product assurance regulations	4. Do you know Law No. 33 of 2014 concerning Halal Product Guarantee?	431	90
	5. Have medicines been included in previously mentioned products that are guaranteed to be halal by the Government?	506	15
	6. Will all medicines gradually have to be halal-certified	499	22
	Mean score 1.92 ± 0.27		
Pharmacists know halal medicine	7. Do you recognize the Halal Product Guarantee Agency (BPJPH) as an organization issuing halal certificates?	461	60
	8. Halal active ingredients and halal drug additives mustard must be procured from halal ingredients.	515	6
	9. Production of halal medicines must not mix and intersect with haram and unclean goods	518	3
	Mean score 1.96 ± 0.21		
Pharmacists know the the critical point of Halal medicine	10. Halal medicine production must have a halal assurance system	516	5
	11. Animals slaughtered not by Islamic law should not be eaten, including as ingredients for medicines.	509	12
	12. Cow blood used as a medium for making medicine makes the medicine haram.	481	40
	13. Lard used in the process of making medicine makes the medicine haram.	510	11
	14. Alcohols from the petrochemical industry and fermentation products may be used for drug production processes	475	46
	15. Did you know that some gelatin capsules are made from pork?	495	26
	16. Did you know that Elixir contains alcohol?	480	41
	Mean score 1.95 ± 0.22		
The ability of pharmacists to select halal alternative medicines	17. Hog bristle brushes must not be used in the production process of halal medicines	502	19
	18. Are you knowledgeable about the source and ingredients (active ingredients and excipients) of the medications you dispense to patients?	458	63
	19. Do you have the knowledge to choose halal alternative medicine?	477	44
	Mean score 1.92 ± 0.27		

Respondents' Perception of Halal Medicine

The halal medicine perception questionnaire uses a Likert scale with answers strongly agree, agree, disagree and strongly disagree. The questionnaire consists of 9 indicators and 16 questions, the questionnaire was distributed online to 521 respondents.

Table 3. Pharmacists' perceptions of halal medicines (n = 521)

Perception Domain		Answer			
Indicator	Question	SA	A	D	SD
Halal product quality	1. All products that are halal-certified are of high quality	258	253	10	0
	2. Halal-certified products are more expensive than similar products because the quality is better	185	269	65	2
	Mean score 3.35 ± 0.62				
Availability of halal products	3. Halal-certified products are easily available	204	259	54	4
	Mean score 3.27 ± 0.67				
The necessity of medicine as a halal product	4. Medicines are among the products that must be halal-certified	284	226	11	0
	Mean score 3.52 ± 0.54				
Government guarantee of halal medicine	5. The halal approval of pharmaceuticals is the duty of the Government	259	254	8	0
	6. Drugs that contain haram ingredients are allowed if there is a MUI fatwa	223	261	35	2
	Mean score 3.42 ± 0.58				
Patients are given the opportunity to obtain the right to be informed about the halalness of drugs	7. The patient has the right to ask the pharmacist for information about the source of ingredients for the medicine.	208	302	11	0
	8. Pharmaceutical companies have provided information on the halal status of the drugs they produce.	226	274	20	1
	Mean score 3.38 ± 0.55				
Patient's religion	9. The pharmacist has considered the patient's religious beliefs in the decision to dispense the medicine.	200	295	25	1
	10. Pharmacists have asked for consent from patients when handing over drugs containing prohibited ingredients	177	320	19	5
	Mean score 3.31 ± 0.58				
Halal medicine information	11. Pharmacists have provided information on the halalness of drugs prescribed by doctors to patients	187	304	28	2
	12. Pharmacists have provided halal drug information to doctors	162	337	22	0
	13. The government has taken responsibility for educating the public about halal medicines.	203	293	24	1
	Mean score 3.30 ± 0.56				
Choosing halal medicine	14. Pharmacists have selected halal-certified self-medication drugs for patients	212	291	18	0
	15. Pharmacists have been able to provide halal alternative medicines to drugs prescribed by doctors	179	315	27	0
	Mean score 3.33 ± 0.56				
Provision of halal medicine	16. Pharmacists have prioritized the provision of halal-certified medicines	206	301	14	0
	Mean score 3.37 ± 0.54				

SA=strongly agree; A=agree; D=disagree; SD=strongly disagree

Respondents' Attitudes About Halal Medicines

The halal medicine attitude questionnaire uses a Likert scale with answers strongly agree, agree, disagree and strongly disagree. The questionnaire consisted of 7 indicators and 12 questions, the questionnaire was distributed online to 521 respondents.

Table 4. Pharmacists' attitudes about halal medicines (n = 521)

Attitude Domain		Answer			
Indicator	Question	SA	A	D	SD
Health pharmacists gave favorable responses on halal status of products.	1. I try to get information about the halalness of medicine	275	235	9	2
	2. I try to provide halal medicine	227	290	4	0
	Mean score 3.47 ± 0.53				
Patient's religious considerations	3. The patient's religion is my consideration in serving medicine	212	263	46	0
	Mean score 3.32 ± 0.63				
Ensuring the halalness of the medicine	4. Every time I hand over medicine, Imake sure that it is halal-certified.	181	312	25	3
	5. Every time I hand over medicine, I make sure that the ingredients are halal.	159	329	29	4
	6. Every time I hand over medicine, I always make sure that the additional ingredients are halal.	159	331	28	3
	7. Every time I hand over medicine, I explain the halal status of the medicine to my patients.	158	326	34	3
	8. I choose halal-certified self-medication drugs for patients	183	314	23	1
	Mean score 3.26 ± 0.58				
Finding halal medicine alternatives	9. I try to find halal alternative medicine	185	325	11	0
	Mean score 3.33 ± 0.51				
Seeking patient consent	10. I have asked for the patient's consent when giving drugs that contain haram ingredients	170	322	20	19
	Mean score 3.25 ± 0.61				
Recognizing MUI fatwa	11. I follow MUI's fatwa that allows the use of haram drugs in emergencies	235	266	19	1
	Mean score 3.41 ± 0.57				
Informing halal medicine doctors	12. I informed the doctor about the halalness of the medicine	149	361	11	0
	Mean score 3.26 ± 0.49				

SA=strongly agree; A=agree; D=disagree; SD=strongly disagree

Respondents' Knowledge, Perception, and Attitude Levels

The assessment of knowledge level is divided into three categories including the good category according to the formula ($X \geq$ mean + 1.SD), the moderate category according to the formula (mean - 1.SD $\leq X \leq$ mean + 1.SD), and the poor category according to the formula ($X <$ mean - 1.SD).

Table 5. Knowledge scores of pharmacists' perceptions and attitudes about halal medicines

Domain	Value	Total	Criteria
Knowledge	$X \geq 32.67$	0	Good
	$29.27 \leq X < 32.67$	447	Moderate
	$X < 29.27$	74	Poor
Average	30.97 ± 1.70 (maximum score 38)	521	Moderate

Perception	$X \geq 60.43$	125	Good
	$46.87 \leq X < 60.43$	361	Moderate
	$X < 46.87$	35	Poor
Average	53.65 ± 6.78 (maximum score 64)	521	Moderate
Attitude	$X \geq 45.13$	124	Good
	$34.47 \leq X < 45.13$	366	Moderate
	$X < 34.47$	31	Poor
Average	39.80 ± 5.33 (maximum score 48)	521	Moderate

Correlation of Respondents' Knowledge, Attitude and Perception

To determine the relationship between knowledge, perceptions, and attitudes of respondents towards halal medicine, it was analyzed using the Spearman test. The relationship is very low when the coefficient interval is 0.0-0.19, low 0.2-0.39, medium 0.4-0.59, strong 0.6-0.79, and very strong 0.8-1.0. The results of the Knowledge-perception-attitude relationship test using the multiple correlation test obtained a P value of 0.00, (0.00 <0.05) meaning that there is a relationship between the three domains, knowledge-perception-attitude.

Table 6. Correlation between Pharmacist Domains on Halal Medicines

Domain	Domain	P value	Correlation
Knowledge	Perception	0.318	Low
Knowledge	Attitude	0.255	Low
Perception	Attitude	0.795	Very Strong

Relationship between Respondent Characteristics

In this study, the Chi-square test was conducted to determine the relationship between knowledge, perception, and attitude of respondents with demographic data, declared to be related if the P value <0.05.

Table 7. Relationship between Pharmacist Characteristics and Halal Medicine

Domain	Characteristics	P value	Description
Knowledge	Age	0.364	Not related
	Gender	0.089	Not related
	Place of work	0.008	Related
	Position	0.026	Related
	Length of employment	0,013	Related
Perception	Age	0.000	Related
	Gender	0.554	Not related
	Place of work	0.017	Related
	Position	0.000	Related
	Length of employment	0.000	Related
Attitude	Age	0.000	Related
	Gender	0.270	Not related
	Place of work	0.000	Related
	Position	0.041	Related
	Length of employment	0.000	Related

Discussion

Respondent demographics

Pharmacists who became respondents were dominated by the age group 25-35 years as much as 47% with a tenure of fewer than 4 years as much as 53%. Research conducted by Abdul Manan (2019) in Banyumas also drew the same pharmacist profile [22]. This is also supported by the method of distributing questionnaires, where ages under 40 years are among the generations

familiar with cell phones [23]. The majority of pharmacists who were respondents were female and worked in pharmacies. Pharmacist education is more attractive to women and almost all Pharmacy Universities are dominated by women, as well as pharmacy employment [24]. Likewise, the most needed, easily regulated and capital-affordable pharmaceutical jobs are in pharmacies [25].

Results validation questionnaire

The validation results of the domain of cognition questionnaire have questions that are invalid because r-calculated < r-table (0.077 < 0.088), namely the question "Do you know the halal logo?", these questions all have recounts 0.115-0.599 so they are declared valid. The results of the validation of the perception domain questionnaire have r-count 0.598-0.828 > r-table 0.088 so that all statements of the perception domain are declared valid. The results of the validation of the attitude domain questionnaire have an r-count of 0.634-0.869 > r-table 0.088 so that all attitude domain statements are declared valid. The reliability test results of the health knowledge questionnaire obtained an Alpha Crobach value of 0.672, the perception questionnaire obtained an Alpha Crobach value of 0.944 and the attitude questionnaire obtained an Alpha Crobach value of 0.944, meaning that the pharmacist's knowledge, perception, and attitude towards halal drugs are reliable because the Alpha Crobach value is > 0.6.

Respondent's knowledge of halal medicine

Respondents' knowledge is sufficient about halal medicines, where the indicator of pharmacists' understanding of halal law has the highest average, 1.99 (maximum value 2), the indicator of pharmacists' ability to choose halal alternative medicines and pharmacists knowing halal product assurance regulations has the lowest average of 1.92, where research conducted in Malang in 2021 also illustrates the same results [28]. Pharmacists must increase their knowledge about halal alternative medicines because buyers will increasingly look for halal products [18]. three respondents do not know that najis are all objects that are considered unclean by Islamic law, such as carrion, blood, and animal feces, but in the application of drug manufacturing, there are still 40 respondents who state that cow's blood used as a medium for making drugs causes the drug not to be haram, as well as other critical point questions for making drugs. This should be a concern, especially in the education system where the profession responsible for halal medicines is the pharmacist [29].

Many respondents do not know the legal rules for guaranteeing halal products and institutions that issue halal certification. Ninety respondents do not know that Law No. 33 of 2014 is about the Halal Product Guarantee, seeing that it was passed ten years ago, so the Government must socialize this law more. Likewise, with respondents' familiarity with the Halal Product Guarantee Agency (BPJPH) as an institution that issues halal certificates, before the existence of the Halal Product Guarantee Law, the leading role in certifying was performed by MUI through LPPOM (MUI Food, Drugs and Cosmetics Assessment Institute). This is voluntary certification at their request for entrepreneurs who want to have a halal certificate. MUI also monitors circulating products. But if there is a halal label mistake, MUI can not give sanction to the business actors. MUI can only provide admonitions and warnings. By establishing BPJPH, hopefully protection and certainty of law will guarantee the halalness of products circulating in Indonesia. Halal certification is not merely mandatory but also obligatory to support efforts to increase the consumption and manufacturing of halal products [30].

Respondents' Perception of Halal Medicine

Of the nine indicators, respondents' perception of the necessity of drugs as halal products had the highest score and only 2% disagreed, equivalent to respondents' perception that patients have the right to ask pharmacists for information about the source of drug ingredients [31]. The provision of halal medicines has been prioritized by respondents and only 2.6% disagree, this will increase the market opportunity for halal medicines because the public has made halal medicines their choice [32–34]. 54 respondents disagree and 4 strongly disagree with the perception that halal-certified products are easy to obtain, this is a challenge for the pharmaceutical industry to immediately produce halal medicines [35,36] and at the same time a challenge for BPJPH (Halal Product Guarantee Agency) to regulate the bureaucracy to make it easier for the pharmaceutical industry [37]. The perception that halal-certified products are more expensive than similar products because of better quality was disagreed by 65 respondents and 2 strongly disagreed. Halal medicines are produced by good manufacturing methods (CPOB) and according to Islamic law, so the product must be the same in quality and bring more blessings because it is halal [11,38].

Respondents' Attitudes About Halal Medicines

Table 4 shows that the respondents' attitude indicators for seeking patient consent, informing doctors about halal medicines, and ensuring the halalness of medicines are the lowest attitude indicators. This illustrates the respondents' lack of communication with buyers and other health workers [36]. Pharmacists giving favorable responses concerning the halal condition of products is the strongest indicator of respondents' attitudes, where respondents will

try to get information about the halalness of drugs and will try to provide halal drugs [39].

Respondents' Knowledge, Perception, and Attitude Levels

The average criteria for respondents' knowledge is sufficient and almost evenly distributed when viewed from the small standard deviation of the calculation results [26]. **Table 5** shows that there are no respondents who know with good criteria about halal drugs and 74 respondents have poor knowledge criteria. It is necessary to increase knowledge about halal medicine continuously both among academics and explanations from the pharmaceutical industry. The average perception and attitude of respondents towards halal medicine is better than their knowledge, this is in line with previous studies and is influenced by Muslims, the majority of whom are Muslims [31], and influenced by Muslims who are the majority [40].

Correlation of Respondents' Knowledge, Attitude and Perception

The results of the Spearman test show a very strong correlation between perception and attitude, a low correlation between knowledge and perception, and a low correlation between knowledge and attitude. Pharmacists' knowledge must continue to be improved in all indicators, starting from an understanding of halal, the application of halal and haram laws, applicable regulations, halal drugs that are available, critical points of drug halalness, selection of halal alternative drugs, and providing halal drug information to the public or other health workers [41].

Relationship between Respondent Characteristics

The Chi-square test results show that gender does not correlate with pharmacists' knowledge, perceptions, and attitudes about halal medicines, and age does not correlate with pharmacists' knowledge about halal medicines. Improving the knowledge, perceptions, and attitudes of pharmacists about halal medicine, can be done at work where positions and length of service influence the pharmacist's knowledge about halal medicine [42].

Conclusion

Pharmacists have sufficient knowledge, perceptions, and attitudes and influence each other, knowledge-perception is significant, knowledge-attitude is very weak and perception-attitude has a very strong correlation. Place of work, position, and length of work are related to pharmacists' knowledge, perceptions, and attitudes about halal medicines.

Ethics approval

Description of ethical approval “Ethical Approval” No.163/EC/FKUGJ/XI/2022 the research protocol proposed by Apt. Ahmad Azrul Zuniarto, M.Farm and UNIVERSITAS AHMAD DAHLAN, declared to be ethically in accordance to 7 (seven) WHO 2011 standards.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

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