

Knowledge, Attitude, and Perception (KAP) among Muslim Patients Regarding Halal Pharmaceuticals in Hospital Besut

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Abstract

Background: Muslims are religiously obligated to ensure that the pharmaceutical products they use are Halal. As awareness of Halal healthcare grows, Muslim consumers are increasingly considering the Halal status of medicines in healthcare decisions.

Objectives: This study aims to assess the knowledge, attitudes, and perceptions (KAP) regarding halal pharmaceuticals among Muslim patients at Hospital Besut and to identify influencing factors.

Methods: A cross-sectional study using a validated, self-administered questionnaire was conducted in the outpatient pharmacy. KAP scores were calculated, with higher scores indicating a better understanding. Data were analyzed using descriptive statistics and independent t-tests.

Results: Out of 376 respondents, 58.2% were female, with a mean age of 35.2 years. Mean KAP scores were: knowledge 6.46 ± 2.13 (max 9), attitude 26.93 ± 6.09 (max 35), and perception 30.89 ± 4.78 (max 35). Knowledge scores were significantly associated with age group ($P < 0.001$), gender ($P = 0.003$), education level ($P < 0.001$), occupation ($P = 0.027$), and health status ($P = 0.005$). Higher knowledge correlated with purchasing decisions ($P = 0.016$). Attitudes and perceptions differed significantly across educational levels. A strong positive correlation was found between attitude and perception ($r = 0.734$, $P < 0.001$).

Conclusion: Muslim patients in Hospital Besut showed a high KAP regarding halal pharmaceuticals, strongly influenced by education level. Positive attitudes were linked with better perceptions, highlighting the importance of awareness in promoting halal pharmaceutical use.

Keywords: Knowledge, Attitude, Perception, Halal Pharmaceutical Products

1. Background

The concept of *Halal* extends beyond traditional industry sectors and transcends geographical, cultural, and religious boundaries. In Islamic law (Shariah), *Halal* refers to anything that is lawful or permissible. Traditionally associated with food products, the concept encompasses items free from prohibited (haram) substances or elements. In recent years, the terms *Halal* and *Haram* have gained prominence across various consumer products, including pharmaceuticals, to help individuals make informed decisions consistent with their religious beliefs and ethical values.¹

Items that are harmful to health or sourced from prohibited animals such as pigs or those not slaughtered according to Islamic principles are classified as haram. In contrast, halal encompasses permissible products, such as food, medicines, cosmetics, and personal care items. Islam places a strong emphasis on protecting health, identifying the preservation of life (*hifzu al-nafs*) as one of the principal objectives of Islamic jurisprudence

(*maqasid al-shariah*). Therefore, Muslims are encouraged to choose halal-certified pharmaceutical products to maintain their well-being in accordance with religious values.

Halal pharmaceuticals refer to medicinal products that are compliant with Islamic law, specifically being free from impurities (*najis*) and harmful substances. For a pharmaceutical product to be considered halal, it must not only avoid such contaminants but also be safe, non-toxic, and non-intoxicating when used as recommended. The entire production process, from preparation to distribution, must be free from cross-contamination with haram substances. This is achieved through the implementation of a Halal Management System (HMS), which integrates Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Point (HACCP) principles to ensure halal integrity and product safety.² Additionally, as the use of animal-derived ingredients poses challenges, especially when sourced from non-halal animals, ongoing research into halal alternatives such as bovine (from

ritually slaughtered animals), marine, and plant-based sources is vital for meeting both religious and pharmaceutical quality standards.³

Muslim patients have the right to access medications that are Halal and free from *najs* (impurities), to receive adequate information regarding their prescribed medicines, to participate in decisions regarding medication choices, and to provide informed consent when the use of non-Halal medications is considered necessary.⁴ The availability of Halal pharmaceuticals enables Muslim patients to make informed decisions when selecting medications that align with their religious beliefs. Consumer preferences for halal pharmaceutical products are influenced by religious beliefs, product quality, and health-related concerns.⁵

Knowledge, attitude, and perception (KAP) are important determinants of the acceptance and use of halal pharmaceutical products. Previous studies have reported that health sciences students at a Malaysian public university demonstrated high knowledge, together with positive attitudes and perceptions towards halal medicines. The study also showed that educational and demographic factors influenced KAP, highlighting the importance of education in promoting awareness and acceptance of halal pharmaceutical products.⁶ Consumer knowledge plays a fundamental role in the acceptance and use of halal products. Greater understanding of a product's characteristics, ingredients, and intended use is generally associated with increased consumer confidence and satisfaction. Conversely, inadequate knowledge remains a significant challenge in the halal sector, as limited awareness may hinder informed decision-making and reduce consumers' ability to distinguish between halal and non-halal products.⁷

Attitudes towards halal pharmaceuticals are shaped by individual beliefs and the perceived importance of aligning medical treatments with religious principles. Positive attitudes have been associated with increased willingness to seek and use halal-certified medications. However, gaps in knowledge can lead to misconceptions and hesitancy. A study assessing the KAP of healthcare providers in Jordan found that although there was general awareness of halal pharmaceuticals, detailed knowledge of specific ingredients and manufacturing processes was limited, which affected their confidence in recommending such products.⁸

Perception, influenced by both knowledge and attitude, determines how Muslim patients view the availability and necessity of halal pharmaceuticals. In regions where halal certification is prevalent, patients are more likely to perceive halal pharmaceuticals as essential and readily accessible. Conversely, in areas with limited halal-certified products, perceptions may lean towards skepticism about the feasibility of obtaining such medications. The same Jordanian study emphasized the

need for tailored educational interventions to enhance understanding and positively influence perceptions among healthcare providers, which, in turn, can impact patient perceptions.⁸

Enhancing the knowledge of Muslim patients and healthcare providers about halal pharmaceuticals is crucial. Educational initiatives should focus on clarifying misconceptions, highlighting the importance of halal compliance in medications, and ensuring that both patients and providers are informed about available halal-certified options. Thus, enhancing awareness and understanding of halal pharmaceuticals may support more informed healthcare decision-making and facilitate the delivery of culturally sensitive care that aligns with patients' religious beliefs.

2. Objectives

This study aims to determine the KAP of halal pharmaceuticals among Muslim patients at Hospital Besut, identify the association between sociodemographic factors and KAP, and examine the correlation between KAP.

3. Methods

3.1. Study Design and Setting

This was a cross-sectional study conducted using a structured, self-administered questionnaire. The instrument was adapted from a validated questionnaire by Sadeeqa et al.⁹ and translated into Malay, with confirmed validity. The study was carried out at Hospital Besut, as the inclusion criteria required recruitment of patients visiting the outpatient pharmacy.

3.2. Participant Recruitment

Participants were selected using a convenience sampling method based on the following:

Inclusion criteria:

- Muslim patients aged 18 years and above
- Able to read, write, and understand the Malay language
- Patients with or without chronic illness

Exclusion criteria:

- Patients with visual and hearing impairment
- Illiterate

Eligible patients were approached during their routine outpatient pharmacy visits. They were provided with an explanation of the study and invited to participate. Informed consent was obtained from the participants in both verbal and written forms. Participants who wished to consult their families were given an information sheet and allowed to provide consent at a later date.

3.3. Sample Size Calculation

The Raosoft sample size calculator was used to determine the minimum required sample size at a 95% confidence

level with a 5% margin of error. The calculated sample size was 376 patients, allowing for a 20% dropout rate.

3.4. Data Tools

A validated Malay version of a self-administered questionnaire, adapted from Sadeeqa et al.,⁹ was used as the primary data-collection tool to assess participants' knowledge, attitudes, and perceptions (KAP) regarding halal pharmaceuticals. Permission to use and adapt the questionnaire was obtained from the original author prior to data collection. The original questionnaire demonstrated acceptable internal consistency, with a minimum Cronbach's alpha value of 0.60.

The instrument consisted of four sections:

- i. **Demographic Information:** age, gender, ethnicity, education level, occupation, current health status or type of illness, and number of medications.
- ii. **Knowledge Assessment:** nine yes/no statements evaluating understanding of halal pharmaceuticals. Correct responses were scored as 1, incorrect as 0.
- iii. **Perception Assessment:** seven statements rated on a 5-point Likert scale (Strongly Agree = 5, Strongly Disagree = 1).
- iv. **Attitude Assessment:** seven Likert-scale items assessing attitudes toward the use of halal pharmaceuticals.

The knowledge section consisted of nine statements with "Yes" or "No" response options. A correct response ("Yes") was scored as one (1), and an incorrect response ("No") was scored as zero (0). Perception and attitude were assessed using a five-point Likert scale: strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1).

The scoring ranges for each domain were 0-9 for

knowledge, 7-35 for perception, and 7-35 for attitude, resulting in a maximum total KAP score of 79. A score of 50% or more in each respective domain was interpreted as a positive orientation toward halal pharmaceuticals.

3.5. Data Collection Procedure

Hardcopy questionnaires were distributed to patients who provided informed consent to participate in the study. Each participant was given clear instructions on how to complete the questionnaire. The estimated time required for completion was approximately 15 minutes. All responses were treated with strict confidentiality, and no identifying information was recorded to ensure participants' privacy and anonymity throughout the data collection process.

3.6. Data Analysis

Descriptive statistics, including frequencies and percentages, were used to summarize participants' demographic characteristics. To examine associations between patients' sociodemographic variables and their knowledge, attitude, and perception (KAP) scores, independent t-tests were conducted. The relationships among the KAP domains were further analyzed using Pearson correlation. All statistical analyses were performed using IBM SPSS Statistics Version 27. A *P*-value of less than 0.05 was considered statistically significant.

4. Results

This study included 376 Muslim patients as respondents, comprising 219 females (58.2%) and 157 males (41.8%). As outlined in Table 1, the mean age of the respondents was 35.2 years, with a standard deviation of 11.8 years, indicating a moderately wide age distribution.

Table 1. Respondents' Sociodemographic Characteristics (n = 376)

Characteristics	Demographic characteristics	Frequency, n (%) Mean $\pm$ SD
Age (years)	18-30 31-74	35.2 $\pm$ 11.8 170 (45.2) 206 (54.8)
Sex	Male Female	157 (41.8) 219 (58.2)
Occupation	Unemployed Employed	112 (29.8) 264 (70.2)
Educational level	No formal education/ Primary education/ secondary education College/ university/ post-graduation	117 (31.1) 259 (68.9)
Any Illness	Yes No	124 (33.0) 252 (67.0)
Purchasing medicine at pharmacy	Yes No	336 (89.4) 40 (10.6)

Based on Table 1, the proportion of female participants exceeded that of male participants by 16.4%, indicating a higher representation of women in the study population. Regarding employment status, 70.2% of respondents were employed, while the remaining 29.8% were

unemployed. Regarding educational background, the majority of respondents (68.9%) had completed education at the college or university level, whereas 31.1% had no formal education or had only completed primary or secondary schooling. Regarding health status, 252

respondents (67.0%) reported being healthy without any chronic illness, while the remaining 124 respondents (33.0%) reported having a chronic illness. Additionally, it was found that a large majority of respondents, 89.4% (n = 336), had experience purchasing medicine at a pharmacy, whereas 10.6% (n = 40) reported no such experience.

The respondents' levels of knowledge, attitude, and perception towards Halal pharmaceuticals are presented in Table 2, offering a clear overview of their awareness and perspectives. For the knowledge component, with a maximum possible score of 9, the mean score was 6.46 ± 2.13 , indicating a relatively high level of knowledge regarding halal pharmaceuticals. Approximately 80% (n = 301) of respondents achieved adequate knowledge

scores, suggesting that most respondents were well informed about halal pharmaceuticals, although some knowledge gaps remained. A previous study also reported a high level of knowledge among respondents, with average scores exceeding 80% in the knowledge domain.⁹ In terms of attitude, the respondents achieved a mean score of 26.93 ± 6.09 out of a maximum possible score of 35, suggesting a generally positive attitude towards halal pharmaceuticals. Perception was assessed using 7 statements, with a mean score of 30.89 ± 4.78 out of a maximum of 35. Respondents scoring more than 50% in each domain were considered to have good knowledge, a positive attitude, and a positive perception, indicating a generally favorable outlook towards halal pharmaceuticals among the majority of respondents.

Table 2. Comparison of Knowledge, Attitude and Perception Scores between Respondents (n = 376)

	Mean $\pm$ SD	Skor, N (%)	
		<50%	$\geq$ 50%
Knowledge	6.46 ± 2.13	75 (20)	301 (80)
Attitude	26.93 ± 6.09	24 (6)	352 (94)
Perception	30.89 ± 4.78	22 (6)	354 (94)

Table 3. Association between Sociodemographic Factors and KAP Scores

Demographic factors		Knowledge score (%)		Attitude score (%)		Perception score (%)	
		Mean $\pm$ SD	P-value	Mean $\pm$ SD	P-value	Mean $\pm$ SD	P-value
Age	18-30	6.90 ± 2.075	*<0.001	26.48 ± 6.589	*0.188	30.79 ± 5.071	*0.708
	31-74	6.11 ± 2.126		27.32 ± 5.643		30.98 ± 4.551	
Sex	Male	6.08 ± 2.240	*0.003	26.55 ± 6.372	*0.301	30.54 ± 4.953	*0.224
	Female	6.75 ± 2.017		27.21 ± 5.887		31.15 ± 4.660	
Occupation	Unemployed	6.11 ± 1.988	*0.027	27.54 ± 4.995	*0.217	31.66 ± 3.118	*0.014
	Employed	6.62 ± 2.182		26.69 ± 6.497		30.57 ± 5.313	
Educational level	No formal education/ Primary education/ secondary education	5.61 ± 2.093	*<0.001	25.40 ± 5.812	*0.001	29.91 ± 5.074	*0.007
	College/ university/ post-graduation	6.86 ± 2.044		27.63 ± 6.103		31.34 ± 4.593	
Any illness	Yes	6.02 ± 2.188	*0.005	25.92 ± 5.904	*0.023	30.50 ± 4.936	*0.261
	No	6.69 ± 2.080		27.44 ± 6.136		31.09 ± 4.710	
Purchasing medicine at pharmacy	Yes	6.56 ± 2.126	*0.016	26.89 ± 6.302	*0.498	30.85 ± 4.980	*0.622
	No	5.70 ± 2.090		27.38 ± 3.972		31.25 ± 2.687	

* P-values were calculated using an independent t-test.

Results from Table 3 showed that, among all the demographic factors analyzed, none demonstrated a strong association with knowledge, attitude, and perception (KAP) towards halal pharmaceuticals, except for the level of education, which was the only factor significantly associated with all three aspects of KAP. The significant

relationship between education level and KAP, particularly in terms of knowledge, aligns with the findings of a previous study,⁶ thereby reinforcing the credibility of this association. In the current study, it was observed that the majority of respondents possessed awareness regarding critical aspects such as the porcine origin of gelatine

capsules, the permissible limit of alcohol content in medicinal products, and the fatwa permitting the use of highly purified insulin derived from pigs during emergency situations, all of which were found to be significantly correlated with their level of education. This correlation is further substantiated by another study that showed a critical link between knowledge gaps and potential consequences for healthcare choices, thus highlighting the crucial role of education in enhancing understanding of halal pharmaceutical practices.¹⁰

As shown in Table 4, the correlation among knowledge, attitude, and perception was examined to assess the

interrelationships among these three variables. In this study, no significant association was found between knowledge and attitude ($P = 0.839$, $r = -0.010$), suggesting that greater knowledge about halal pharmaceuticals did not necessarily translate into more positive attitudes among the respondents. A statistically significant but very weak negative correlation was observed between knowledge and perception ($r = -0.119$, $P = 0.021$), indicating that higher knowledge scores were associated with only a slight decrease in perception scores. Despite reaching statistical significance, the strength of this relationship suggests limited practical association between the two variables.

Table 4. Correlation between Knowledge, Attitude and Perception of Halal Pharmaceuticals

Variables	No. of respondents (n)	P-value	Correlation (r)
Knowledge - Attitude	376	$P = 0.839$	$r = -0.010$
Knowledge - Perception	376	$P = 0.021$	$r = -0.119$
Attitude - Perception	376	$P = <0.001$	$r = 0.734$

* A P -value of less than 0.05 indicates statistical significance, calculated by Pearson Correlation Coefficient (r)

However, a strong positive correlation was observed between attitude and perception ($r = 0.734$, $P < 0.001$), indicating that respondents with more positive attitudes towards halal pharmaceuticals were more likely to hold favorable perceptions. Another study also reported that respondents with more positive attitudes toward halal medicines were more likely to exhibit favorable perceptions.¹⁰ Together, these findings suggest that cultivating positive attitudes may play an important role in strengthening public acceptance and perception of halal pharmaceutical products.

5. Discussion

The present study revealed that most respondents possessed good knowledge, a positive attitude, and a favorable perception towards halal pharmaceuticals. A previous study found that Malaysian healthcare science students demonstrated strong knowledge, positive attitudes, and favorable perceptions regarding halal medicines.¹⁰ The similarity between the findings may be attributed to the increasing awareness of halal-related healthcare issues and the growing emphasis on halal pharmaceutical education and public awareness in recent years. Furthermore, as the present study was conducted among Muslim patients, their religious beliefs and awareness of the importance of consuming halal products may have contributed to the generally positive attitudes and perceptions observed. Collectively, these findings suggest that respondents not only possess adequate knowledge regarding halal pharmaceuticals but also recognize their importance and demonstrate a favorable acceptance of their use, reflecting the growing awareness of halal considerations in contemporary healthcare.

Additionally, the results of the present study are

consistent with a recent study, which reported that respondents strongly supported patients' rights to obtain information regarding the halal status and ingredients of pharmaceutical products before making treatment decisions.¹¹ The study also highlighted the importance of clearly identifying halal pharmaceutical products to facilitate informed consumer choices and emphasized the collaborative roles of healthcare professionals and religious authorities in providing accurate halal-related information and promoting public awareness. These findings reinforced the importance of transparent communication and appropriate guidance to ensure that medication use aligns with both patients' healthcare needs and religious values.

Educational level was the only demographic characteristic significantly associated with all three domains of knowledge, attitude, and perception towards halal pharmaceuticals. This finding suggests that education plays a broader role than other demographic factors by influencing not only respondents' understanding of halal pharmaceutical concepts but also their attitudes and perceptions. Individuals with higher educational attainment are likely to have greater exposure to health-related information and a better ability to understand and evaluate such information, enabling them to develop more informed attitudes and perceptions. A previous study also demonstrated that respondents who had received education regarding halal medicines exhibited significantly higher knowledge, attitude, and perception scores.¹⁰ Similarly, another study reported that education level was a significant determinant of knowledge, attitudes, and practices toward halal pharmaceuticals and emphasized the importance of educational initiatives to improve public awareness.¹⁰

In contrast, although age, occupation, the presence of chronic illness, and previous experience purchasing

medicines from pharmacies were significantly associated with knowledge, these factors may primarily reflect greater healthcare exposure rather than influencing respondents' underlying beliefs or perceptions. Therefore, educational attainment appears to play a broader role in shaping respondents' overall awareness and acceptance of halal pharmaceuticals.

Furthermore, a strong positive correlation was observed between attitude and perception ($r = 0.734$, $P < 0.001$), indicating that respondents with more positive attitudes toward halal pharmaceuticals tended to have more favorable perceptions. However, this finding contrasts with another study, which found that knowledge of halal products significantly influenced the development of a positive attitude toward their consumption.¹¹ In their study, respondents with higher knowledge demonstrated more positive attitudes toward purchasing and using halal pharmaceutical products than those with limited knowledge. This relationship may be attributed to the essential role of knowledge in informing individuals about the differences between halal and non-halal products, a prerequisite for making any decision to consume pharmaceutical products. Thus, while the current study emphasizes the strong relationship between attitude and perception, another study found that knowledge plays a key role in shaping these attitudes.¹¹

A statistically significant but very weak negative correlation was observed between knowledge and perception ($r = -0.119$, $P = 0.021$). Although the association was statistically significant, the small correlation coefficient indicates that knowledge had little practical influence on respondents' perceptions of halal pharmaceuticals. This finding suggests that possessing greater knowledge about halal pharmaceuticals does not necessarily translate into more favorable perceptions. Perceptions may instead be shaped by other factors, such as personal religious beliefs, individual values, previous experiences, trust in healthcare professionals, or confidence in halal certification,¹² rather than knowledge alone. Previous studies have shown that perceptions are influenced by multiple factors beyond knowledge. There is a study reported that religiosity significantly influenced Muslim doctors' perceptions regarding halal drugs,¹³ while a related study found that demographic characteristics, including religion, significantly affected healthcare providers' attitudes and perceptions toward halal pharmaceuticals.⁹ Collectively, these findings suggest that perceptions may be shaped by religious and personal factors rather than factual knowledge alone.

Although greater exposure to healthcare through age, occupation, chronic illness, or prior pharmacy visits may enhance factual knowledge about halal pharmaceuticals, knowledge alone may not necessarily translate into more positive attitudes. Attitudes are shaped by a combination of personal beliefs, religious values, cultural influences,

and individual experiences, extending beyond mere factual understanding. As all respondents in the present study were Muslims, their shared religious beliefs may have contributed to the generally positive attitudes observed across demographic backgrounds. In contrast, educational attainment may have exerted a broader influence by enhancing respondents' ability to understand and interpret health-related information, thereby contributing to more informed attitudes and perceptions towards halal pharmaceuticals.

Research Highlights

What Is Already Known?

- Knowledge, attitudes, and perceptions (KAP) are important determinants of the acceptance and use of halal pharmaceuticals among Muslim populations.
- Previous studies have reported that educational level is associated with awareness and understanding of halal pharmaceutical products, while positive attitudes are generally linked to more favorable perceptions and acceptance of halal medicines.
- Most published studies have been conducted among healthcare professionals, university students, or urban populations, with limited evidence available among Muslim patients attending district hospitals in Malaysia.

What Does This Study Add?

- This study provides evidence on the knowledge, attitude, and perception (KAP) of halal pharmaceuticals among Muslim patients attending a district hospital in Malaysia, a population that has been underrepresented in previous research.
- The majority of respondents demonstrated good knowledge and positive attitudes and perceptions toward halal pharmaceuticals, indicating a generally favorable level of awareness and acceptance.
- Educational level was the only demographic factor significantly associated with all three KAP domains, highlighting the important role of education in shaping patients' understanding, attitudes, and perceptions of halal pharmaceuticals.
- A strong positive correlation was observed between attitude and perception, whereas knowledge showed only a very weak negative correlation with perception, suggesting that favorable perceptions towards halal pharmaceuticals may be influenced by factors beyond factual knowledge alone.
- The findings provide locally relevant evidence to support the development of targeted educational programs and culturally appropriate healthcare strategies, while highlighting the need for multicenter studies to determine whether these findings are consistent across other regions of Malaysia.

6. Conclusion

In conclusion, this study demonstrated that Muslim patients attending Hospital Besut generally possessed good knowledge and exhibited positive attitudes and perceptions towards halal pharmaceuticals. Educational level emerged as the only demographic factor significantly associated with all three KAP domains, highlighting the

important role of education in shaping individuals' understanding, attitudes, and perceptions of halal pharmaceutical products. Furthermore, a strong positive correlation was observed between attitude and perception, indicating that respondents with more positive attitudes were more likely to hold favorable perceptions toward halal pharmaceuticals. In contrast, the relationship between knowledge and perception, although statistically significant, was very weak, suggesting that knowledge alone may not be sufficient to influence perceptions. These findings underscore the importance of educational initiatives alongside strategies that address other factors influencing public perceptions of halal pharmaceuticals. As this study was conducted at a single healthcare institution, future multicenter studies involving diverse populations across different regions of Malaysia are recommended to provide a more representative understanding of the knowledge, attitudes, and perceptions of halal pharmaceuticals among the Malaysian Muslim population. Such evidence would facilitate the development of targeted educational and policy interventions to enhance awareness and promote informed acceptance of halal pharmaceutical products.

Author Contributions

RAR, NAS, and AHZ: designing the study; AHZ, NIII, NAAM, NAR, WNNWT, NII, NNMMA, NWK, NAMP, MSZ, and MSM: data collection and statistical analysis; RAR, NAS, AHZ, NIII, NNMMA, NWK, and NAMP: interpretation of results, discussion, and writing the first draft of the paper; AHZ, NAS, RAR: manuscript writing, review, and editing.

Declaration of Generative AI and AI-assisted technologies

During the preparation of this work the authors used Grammarly in order to improve the English language, grammar, and readability of the manuscript. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Conflict of Interest Disclosures

All authors declared that they have no conflict of interest.

Ethical Approval

Ethical approval was obtained from the Medical Research and Ethics Committee (MREC) under the Ministry of Health Malaysia (MOH) prior to the commencement of the study. All procedures adhered to the ethical standards outlined in the Declaration of Helsinki and the Malaysian Good Clinical Practice Guidelines.

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