

## Determining the Beginning of Ramadan in Malaysia: Balancing Tradition, Astronomy, and Religious Principle

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### Abstract

This paper explores the process of determining the beginning of Ramadan in Malaysia, focusing on the integration of Islamic legal principles, traditional practices, and advances in astronomical science. It highlights the use of hisab rukyah, which combines astronomical calculations and physical moon sighting, ensuring that official decisions are both scientifically accurate and religiously valid. The paper examines the historical use of the MABIMS criteria, first introduced in 1995 and revised in 2021, and evaluates their effectiveness in improving the reliability of crescent sighting decisions. Using a mixed methodology—including data analysis, astronomical simulations, criteria comparisons, and field observations—the study identifies the strengths and challenges of Malaysia's current approach. It also compares the MABIMS criteria with international standards and emphasizes the need to address emerging issues such as telescopic observation and light pollution. Finally, the paper offers future recommendations, including the recognition of telescopic data, the development of more dynamic crescent visibility criteria, and enhanced public education efforts. These steps aim to strengthen Malaysia's position as a regional leader in Islamic astronomy and to promote unity within the Muslim community

## 1. Introduction

Ramadan is the ninth month in the Hijri (Islamic) calendar and holds a special status in Islam. It is the month in which Muslims are obligated to fast from dawn until sunset. Notably, this month is specifically mentioned in the Qur'an in Surah al-Baqarah, verse 185, as the month in which the Qur'an was revealed as guidance for mankind. Therefore, Ramadan is not only observed as a month of fasting but is also celebrated as a month of mercy, forgiveness, and deliverance from the fire of Hell (M. S. Faid, Nawawi, Saadon, et al., 2023).

Beyond fasting, Ramadan is a time that revives the spiritual and social spirit among Muslims. It strengthens the relationship with Allah through night prayers such as Tarawih and Qur'an recitation (tadarus), as well as relationships with fellow human beings through acts of charity and kindness towards those in need. The arrival of Ramadan also sparks a sense of reflection and self-accountability within the Muslim community, making it a highly anticipated month of spiritual transformation each year.

Due to the great significance of Ramadan, determining its beginning becomes a priority for every Muslim country. The date marking the start of fasting impacts not only individual worship but also has close ties to religious administration, education, the economy, and social affairs. Consistency in determining the start of Ramadan helps unify Muslims in a collective act of worship, while preserving the integrity and validity of the observance of this second pillar of Islam (M. S. Faid et al., 2022).

In Islam, the determination of the beginning of Ramadan is directly linked to rukyah (the sighting of the new moon), as stated in the words of the Prophet Muhammad (peace be upon him): "Fast when you see it (the crescent), and break your fast when you see it..." (Narrated by Bukhari and Muslim). This hadith serves as the main foundation in setting the start of fasting and Eid, and it is unanimously accepted as a key principle in the jurisprudence of worship. Therefore, from a legal perspective, the beginning of Ramadan is determined when the hilal (new moon crescent) can be sighted after sunset on the 29th night of Sha'ban.

However, scholars of Islamic jurisprudence (fiqh) have differing views regarding the use of hisab (astronomical calculation) in determining the start of the month. The Shafi'i school, which is the official school of thought in Malaysia, prioritizes rukyah but does not reject hisab as a supporting tool. In the modern context, these differing opinions are addressed with the wisdom of the ulil amri (those in authority), namely the religious authorities who have the mandate to determine the start of Ramadan based on a combination of scriptural evidence and valid astronomical data (M. S. B. Faid et al., 2024).

The legal ruling on determining the date of Ramadan is also part of the collective responsibility (mas'uliyah jama'iyah) of the Muslim community. It falls under masalih mursalah, meaning public interests recognized by Islamic law. Therefore, any official decision regarding the start of Ramadan must be made by an authoritative body to avoid confusion or division within the community. In Malaysia, this decision is announced by the Keeper of the Rulers' Seal (Penyimpan Mohor Besar Raja-raja), based on the guidance of the State Mufti Departments and JAKIM, making it a collectively binding decision for all Muslims in the country.

Traditionally, the method of determining Ramadan in Malaysia is based on rukyah, which is the physical observation of the new moon at specific officially designated locations. These are known as official observation sites and are managed by the State Mufti Departments in cooperation with Islamic astronomy institutions. Observers report the observation results to the religious authorities for verification. If the crescent is seen, the following day is set as the 1st of Ramadan. If not, the month of Sha'ban is completed to 30 days using the istikmal method.

With advancements in technology and modern astronomy (falak), the hisab method has increasingly been used as a complementary approach to rukyah. This method uses astronomical calculations based on the geometric positions of the Earth, moon, and sun to determine whether the new moon is in a position that allows it to be sighted. The type of hisab used in Malaysia is called hisab imkanur rukyah, which combines calculations and the criteria for crescent visibility. Since 1995, Malaysia has adopted the MABIMS criteria and revised the minimum values in 2021 to align with current scientific data.

In addition to rukyah and hisab, an integrative approach has now become the preferred method for determining Ramadan. This approach harmonizes rukyah and hisab, considering actual observation results confirmed by calculations. This not only improves accuracy but also maintains the legal validity required by Islamic law, which emphasizes crescent sighting as the basis. Therefore, the determination of Ramadan in Malaysia today is not merely a literal or traditional decision but one made through a systematic, scientific, and Shari'ah-compliant process to safeguard the welfare of the Muslim community as a whole (M. S. Faid, Nawawi, et al., 2024)

MABIMS, or the Informal Meeting of Religious Ministers of Brunei Darussalam, Indonesia, Malaysia, and Singapore, was established in 1989 as a regional cooperation platform on religious and social issues. One of MABIMS's main focuses is to coordinate the approach to determining the start of Hijri months, particularly Ramadan and Shawwal, to ensure uniformity across Southeast Asia. This cooperation emerged from the awareness that differences in determining the start of months can create confusion among Muslims living in this region.

Through a series of conferences and meetings, MABIMS has brought together astronomy experts, scholars, and religious administrators to formulate a common set of criteria. These discussions are not only technical but also emphasize Shari'ah values, local traditions, and social suitability. With MABIMS, member countries can share observation data, calculation methods, and best practices in determining the Islamic calendar, including addressing contemporary issues such as the use of telescopes and light pollution.

Malaysia plays an important role in MABIMS as a bridge between the scientific field of astronomy and religious administration. Through JAKIM and the State Mufti Departments, Malaysia represents the voice of the local Muslim community to ensure that the formulated criteria are not only scientific but also socially acceptable. This role strengthens Malaysia's position as a regional reference center for Islamic astronomy and helps foster unity among Muslims in Southeast Asia (Mufid & Djameluddin, 2023).

The first MABIMS criteria were officially introduced in 1995 as a result of joint discussions between astronomy experts and scholars from the four member countries. These criteria stipulated that the crescent is

considered visible if it has a minimum altitude of  $2^\circ$  above the horizon at sunset and a minimum angular separation or elongation of  $3^\circ$  from the sun. These two conditions aimed to ensure that crescent sighting reports were scientifically valid and accountable under Islamic law.

The 1995 criteria brought major reforms to traditional practices that previously relied entirely on naked-eye observation without scientific guidelines. With these criteria, religious authorities in Malaysia were able to make more consistent decisions and avoid discrepancies between states. These criteria also facilitated the synchronization of the Hijri calendar with neighboring countries, reducing potential confusion in the observance of fasting, zakat, and Eid celebrations.

However, field studies over the following two decades showed that the 1995 criteria had some shortcomings. For example, they did not adequately distinguish between valid and false sightings under non-ideal atmospheric conditions or when observations were aided by optical instruments. Advances in observation technology such as telescopes and CCD cameras also began to challenge the accuracy of these criteria. As a result, there was a need to review and improve the criteria to align with scientific and technological developments (M. S. Faid, Shariff, et al., 2024).

In response to the shortcomings of the old criteria and current scientific advancements, MABIMS introduced new criteria in 2021. These criteria raised the minimum elongation value to  $6.4^\circ$  while maintaining the moon's minimum altitude at  $3^\circ$ . This change was based on the analysis of actual observation data collected over decades from member countries, which showed that a  $3^\circ$  elongation was too low to guarantee naked-eye visibility of the crescent.

The 2021 criteria are more aligned with international standards, such as those used in Turkey (Istanbul Criteria), and reflect a new understanding of the factors influencing crescent visibility, including light refraction, atmospheric transparency, and human visual capacity. Malaysia adopted these criteria through a resolution of the National Fatwa Council, recognizing the need to balance scientific accuracy with religious requirements.

Although the new criteria are stricter, they bring several important benefits. Among them, they have successfully reduced the rate of negative discrepancies to around 6.8%, meaning that there are now almost no reports of naked-eye sightings below the criteria threshold. Additionally, these criteria open new discussions on the recognition of telescopic observations, which has the potential to further improve the accuracy of determining the start of Ramadan and Shawwal in the future (Mohd Nawawi et al., 2024).

## 2. Methodology

This study uses a combined approach that includes data analysis of moon sighting records, astronomical simulations, criteria comparisons, and field observations. First, the crescent observation data collected from Malaysia were analyzed based on their visibility status — whether the crescent was visible or not. This data was obtained from official observation records, including reports submitted to JAKIM and MABIMS. Each record was examined against astronomical parameters such as the moon's age, lag time, altitude, elongation (arc of light), and azimuth difference.

Second, astronomical simulations were carried out using the Skyfield Python software, renowned for its astrometric precision of up to 1 arcsecond. These simulations were crucial to ensure that parameter calculations were done topocentrically (from the observer's actual location), taking into account atmospheric refraction. Additionally, the HilalPy software was used to conduct regression analysis to evaluate how well the existing criteria separate visible from non-visible observations.

Third, contradiction rate analysis was used to identify how well the MABIMS criteria align with actual observation data. This method measures the positive contradiction rate (cases where the crescent was sighted but fell below the criteria) and the negative contradiction rate (cases where the crescent was not sighted but was above the criteria). This analysis enables the strengths and weaknesses of each criterion to be statistically assessed.

Fourth, the study compared the performance of the MABIMS criteria with other international criteria such as the Istanbul and Yallop criteria. This comparison is important to assess whether Malaysia should adapt new elements, such as telescopic criteria, to stay aligned with advances in observational technology. The selection of criteria depends not only on astronomical accuracy but also on social suitability and public understanding.

Finally, fieldwork was conducted through direct observation of moon sighting processes at several official locations in Malaysia, including both naked-eye and telescopic observations. These observations provided practical insights into on-the-ground challenges, such as weather disturbances, light pollution, and observer competency. The results of these observations help strengthen recommendations to improve the MABIMS criteria, making them more practical — not only from an astronomical perspective but also from a religious administration standpoint.

### 3. Result and Discussion

#### 3.1 Method of Determining the Beginning of Ramadan in Malaysia

The determination of Ramadan in Malaysia combines two main approaches: rukyah (physical moon sighting) and hisab (astronomical calculation). Moon sighting is officially carried out at over 30 observation sites nationwide, designated by the State Mufti Departments as strategic locations with a clear western horizon and minimal light pollution. This process involves religious officers, astronomy experts, and trained volunteers to ensure that the results obtained are valid and reliable (Syazwan Faid et al., 2025).

In addition to rukyah, Malaysia also uses hisab as a supplementary guide to support official decisions. Hisab is conducted using modern astronomical software that accounts for parameters such as the moon's age, altitude, elongation, and the azimuth difference between the moon and the sun. This calculation data serves as a preliminary check to determine whether the crescent is likely to be visible on the observation day, thus helping religious authorities prepare logistics and public communication.

The combination of these two methods reflects Malaysia's careful and inclusive approach to determining the start of Ramadan. Rukyah is implemented to adhere to the Prophet's sunnah, while hisab is employed to leverage scientific and technological advancements to enhance decision accuracy. The final decision is announced by the Keeper of the Rulers' Seal of Malaysia on the night of 29 Sha'ban, marking the start of Ramadan the next day if the crescent is seen or completing Sha'ban to 30 days if not (M. S. Faid et al., 2025).

#### 3.2 Definition of Hisab Rukyah in Determining the Start of Ramadan in Malaysia

Hisab rukyah refers to the combination of astronomical calculations and physical crescent observations used in determining the beginning of the Hijri months in Malaysia. Hisab is understood as the mathematical calculation of the moon's and sun's positions, while rukyah is the direct observation to confirm the crescent's presence on the western horizon after sunset. Both approaches complement each other to produce results that are religiously valid and publicly acceptable (Mustapha et al., 2024).

In Malaysian practice, hisab is used first to assess the likelihood of crescent visibility before conducting physical observations. If hisab results indicate that the crescent is likely visible, the observation proceeds. If bad weather prevents sighting, Sha'ban is completed to 30 days according to Islamic requirements. This approach demonstrates that hisab does not fully replace rukyah but serves as a support tool to improve observation efficiency and accuracy.

Malaysia's hisab rukyah approach is an important innovation because it balances tradition and scientific progress. It also reassures the public that the announced decisions are not solely based on calculations but have been validated through physical observation by authoritative bodies. This helps increase public trust in the Ramadan determination process and strengthens Muslim unity in Malaysia (M. S. Faid, Nawawi, Wahab, et al., 2023).

#### 3.3 Application of MABIMS 2021 and 1995 Criteria in Malaysia

Malaysia began applying the MABIMS criteria in 1995, setting a minimum moon altitude of  $2^\circ$  and elongation of  $3^\circ$ . These criteria aimed to ensure that only valid and acceptable observation reports were used in determining the start of Ramadan. Research shows that the 1995 criteria helped filter out unreliable reports, but some discrepancies remained due to weather changes and the increasing use of advanced optical aids.

In 2021, these criteria were revised to a minimum elongation of  $6.4^\circ$  and a minimum moon altitude of  $3^\circ$ , to align with scientific developments and empirical observation data collected over more than two decades. The new criteria demonstrated better performance, with a very low negative contradiction rate of around 6.8%. This means there were virtually no valid naked-eye sightings below the criteria threshold, thus increasing the credibility of decisions announced by religious authorities.

The main difference between the two criteria is the emphasis on elongation, now seen as a more important indicator of crescent visibility. Although telescopes and CCD cameras are increasingly used, Malaysia continues to prioritize naked-eye observations to maintain compliance with religious principles. However, studies suggest that in the future, MABIMS criteria may need to become more flexible by incorporating telescopic data to further enhance the accuracy and reliability of Ramadan determination.

### 4. Conclusion and Recommendation

The determination of the beginning of Ramadan in Malaysia is an important process that combines Islamic legal principles, tradition, and advances in astronomical science. Through the hisab rukyah method, Malaysia ensures

that official decisions are not only accurate from an astronomical perspective but also valid according to Islamic law. The use of the MABIMS criteria since 1995, which was later revised in 2021, demonstrates the country's commitment to continually improving this approach in line with scientific and technological developments. The main strength of Malaysia's approach lies in its balance between the use of modern technology and adherence to the Sunnah, maintaining naked-eye observation as the foundation in determining the start of the Hijri months. This approach has helped ensure the unity of Muslims in Malaysia in beginning the Ramadan fast collectively, while also strengthening regional ties through cooperation within MABIMS. However, the study found that new challenges have emerged, particularly related to the use of telescopes, CCD cameras, and the impact of light pollution at observation sites. Therefore, there is an urgent need for Malaysia to continue updating its crescent sighting criteria to remain relevant and effectively address contemporary challenges.

It is recommended that Malaysia conduct specialized research on the recognition of telescopic observations in determining the start of Ramadan. With the increasing use of telescopes among both professional and amateur astronomers, it would be appropriate for religious authorities to consider telescopic data as part of official reports, provided they meet Shari'ah requirements and are supervised by qualified officials. Second, the development of more dynamic criteria based on a combination of multiple parameters—such as altitude, elongation, azimuth, moon age, and moon brightness (moon width)—should be considered. The use of mathematical modeling methods such as logistic regression or big data analysis could help generate more precise criteria thresholds, thereby reducing positive and negative contradiction rates. Finally, efforts to educate the general public about the principles of hisab rukyah need to be strengthened through public education programs, workshops, and training courses. Better public understanding of the Ramadan determination process will help increase public trust in the decisions announced, avoid confusion, and strengthen Muslim unity in Malaysia. With these measures, Malaysia can not only maintain its role as a regional reference point but also become a pioneer in developing more advanced and inclusive practices in Islamic astronomy at the global level.

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## Conflict Of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

## Author Contribution

*The authors confirm contribution to the paper as follows: **study conception and design:** Mohd Abid Mohd Azhar;; **data collection:** Nurulhuda Ahmad Zaki; **analysis and interpretation of results:** Mohd Saiful Anwar Mohd Nawawi; **draft manuscript preparation:** Muhamad Syazwan Faid, Muhammad Ridzuan Hashim. All authors reviewed the results and approved the final version of the manuscript.*

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