An Analysis of Takwim Hijriah Khairiah in the Context of Historical Development of the Malaysian Hijri Calendar

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Abstract

The evolving use of various criteria in the Malaysian Hijri calendar reflects its historical development and dynamism. A prominent local Islamic astronomer, Md Khair Md Taib has contributed significantly to this development, particularly through his seminal work, *Takwim Hijriah Khairiah* (THK). This study analyses his contributions by evaluating the methodologies employed in THK, focusing on Hijri-Gregorian date synchronization, and examining his approach in balancing traditional Islamic astronomical practices with contemporary precision standards. A comparative analysis assessed the accuracy of Md Khair Md Taib's methods against modern computation using Accurate Time software. The findings highlight key contributions, such as the creation of user-friendly astronomical tables and the adaptation of the *Istilahi* method, which bridges traditional Islamic astronomy with practical applications for the Muslim community. The study also emphasizes the ongoing relevance of THK as a technical resource and a cultural milestone in the historical development of the Malaysian Hijri calendar. By integrating traditional and modern practices, Md Khair Md Taib's work remains an invaluable reference for researchers, policymakers, and the broader Muslim community. This review underscores the importance of revisiting foundational texts like THK to preserve and advance the intellectual heritage of Islamic astronomy in Malaysia and beyond.

Keywords: Taqwim, Calendar, Hijri, Hisab, Falak, Islamic astronomy, Islamic computation

Introduction

Islamic astronomy plays a crucial part in the Muslim community. It is important for determining the Qibla direction, prayer schedules, Islamic calendars, and religiously significant events, such as determining the dates of Ramadan, Shawwal, and Zulhijjah.[1] Islamic astronomy, one of the oldest sciences in the Islamic heritage, is fundamentally linked to the practical requirements of Muslim society.[2] There are several calculation methodologies in Islamic astronomy. These methodologies employ different routines, almanacs, and ephemerides, which result in varying calculation outcomes.[3] The different outcomes resulting from Islamic astronomy calculations could lead to disagreements concerning Qibla direction, prayer schedules, and Islamic calendars.[4] Currently, research in Islamic astronomy has enhanced the precision of calculating the Hijri calendar.[5]

In response to this topic, Md Khair Md Taib has authored a book titled "Takwim Hijriah Khairiah" (TKH). This book presents introductory content on determining the new Hijri month. It includes a discussion of the philosophy and calculation methodology involved in determining the new Hijri

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[1] Nazhatulshima Ahmad et al., "Analysis Data of the 22 Years of Observations on the Young Crescent Moon at Telok Kemang Observatory in Relation to the Imkanur Rukyah Criteria 1995," *Sains Malaysiana* 51, no. 10 (2022): 3415–22.
[2] Muhamad Syazwan Faid et al., "Confirmation Methodology for a Lunar Crescent Sighting Report," *New Astronomy* 103 (2023): 102063–102063.
[3] Muhamad Syazwan Faid et al., "Islamic Historical Review on Middle Age Lunar Crescent Visibility Criterion," *Journal of Al-Tamaddun* 17, no. 1 (2022): 109–25.
[4] Mohammaddin Abdul Niri Niri et al., "Astronomy Development since Antiquity to Islamic Civilization from the Perspective of Islamic Historiography," *Journal of Al-Tamaddun* 18, no. 1 (2023): 169–77.
[5] Nazhatulshima Ahmad et al., "A New Crescent Moon Visibility Criteria Using Circular Regression Model : A Case Study of Teluk Kemang , Malaysia," *Sains Malaysiana* 49, no. 4 (2020): 859–70.

month.[6] This book is one of the most prominent works of Islamic astronomy in Malaysia,[7] following the publications of local Malay scholars like Syeikh Tahir Jalaluddin in 1901 and Syeikh Ahmad Khatib Minangkabawi in 1898.[8] However, despite Md Khair Md Taib's impact on the field of Islamic astronomy calculations and study in Malaysia, his work, TKH, has not been examined critically by any scholars previously and published in any indexed journal. Thus, this study aims to further analyze Md Khair Md Taib's TKH.

Methodology

This study employs a documentation method for data collection, while computational and thematic analysis method was used for data analysis.[9] The computational analysis involves a comparison of the calculation routine employed by Md Khair Md Taib with modern computation using Accurate Time software. This comparison enables the tracking of the fundamentals of the calculation routine employed by Md Khair Md Taib, and the thematic analysis provides a historical lineage of the calculation methodology and Md Khair Md Taib's contribution. The analysis also enables this study to understand the depth of knowledge and worldview of Md Khair Md Taib on the issue of determining the new Hijri month and its correlation in an astronomical context.[10] It also provides an understanding of the cultural background of Md Khair Md Taib's methodology towards the issue of determining the new Hijri month, in contrast to the situation of government bodies and Muslim communities during his time.[11]

The snowball sampling technique is used to locate any additional literature or keywords related to the topic. The specified keywords were searched in various academic databases and archives. These comprised Scopus, ScienceDirect, JSTOR, and specialist platforms such as the Islamic Crescent Observation Project (ICOP) and Jurufalak Syarie (JUFAS). A total of 98 pertinent articles and resources were initially identified through this procedure. During this step, the collection of 98 identified articles was located and filtered. The filtration ensured that the content of the literature could be used in the comparative methodology between Md Khair Md Taib's book. Literature that does not have any comparative value is excluded from the analysis. This thorough process resulted in selecting 35 papers considered directly pertinent to the study.

Analysis and Results

In 1982, while serving as a Guest Scholar in the field of Islamic astronomy (Falak Sharii) at the Faculty of Islamic Studies, Universiti Kebangsaan Malaysia, Md Khair Md Taib was requested to compile a comprehensive Hijri calendar, spanning from the birth year of the Prophet Muhammad (PBUH) to the 15th Hijri century. This request was made by the late Tan Sri Dato' Seri Diraja Haji Azizan Abdul Razak, the 10th Menteri Besar of Kedah, who at the time was the Head of the Shariah Department, Faculty of Islamic Studies, Universiti Kebangsaan Malaysia. He understood the challenges of this request, as the exact date of the Prophet's migration (Hijrah) from Mecca to Medina is difficult to determine.

Nonetheless, Md Khair Md Taib openly accepted the request, recognizing the need for a reference on the formation of the Islamic calendar and its calculation methods, which could benefit the public and researchers alike. To fulfill this purpose, he incorporated the history of calendar formation from the era of Greek civilization, the issues surrounding calendars, the evolution and changes in calendar calculations, and ultimately, the determination of the Hijri calendar.[12] The writing on this calendar is divided into eleven chapters, forming a book titled *Takwim Hijriah Khairiah* (TKH), published in 1987. In the introduction of his writing, he began with a verse from the Qur'an, Surah At-Taubah, which

[6] Mohd Saiful Anwar Mohd Nawawi et al., "Sejarah Kriteria Kenampakan Anak Bulan Di Malaysia," *Journal of Al-Tamaddun* 10, no. 2 (2015): 61–75.
[7] Aizan Ali Mat et al., "History and Factor of Islamic Astronomy Development in Malaysia: An Analysis," *Journal of Al-Tamaddun* 10, no. 1 (2015): 1-18.
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[9] Mohd Amirul Solehin Mohd Paid et al., "Descriptive Analysis of Kitab Kaifiyyah Mengadakan Wakaf Muslimin Authored by Syeikh Junid Tola (D. 1948)," *Jurnal Fiqh* 21, no. 2 (2024): 177-208.
[10] M.S. Faid, M.S.A. Mohd Nawawi, and M.H. Mohd Saadon, "Analysis Tool for Lunar Crescent Visibility Criterion Based on Integrated Lunar Crescent Database," *Astronomy and Computing* 45 (2023): 100752–100752; Raihana Abdul Wahab et al,. "Death of Stars from Quranic Perspective and its Correlation to the Astronomical Context," *Middle-East Journal of Scientific Research* 12, no. 1 (2012): 119-123.
[11] Muhamad Syazwan Faid, et al., "Methods in Determining New Hijri Month: A Thematic Review from Islamic Jurisprudence Perspective," *Malaysian Journal of Syariah and Law* 13, no. 1 (2025): 75-99.
[12] Haji Md. Khair Haji Md. Taib, *Takwim Hijriah Khairiah* (Malaysia: Universiti Kebangsaan Malaysia, 1987).

mentions the number of months in a year. This verse is followed by a Hadith from Sahih Bukhari explaining that the number of days in each Hijri month is either 29 or 30. Md Khair Md Taib prioritized these Qur'anic and Hadith texts to establish the foundation of the Hijri calendar, emphasizing that it consists of twelve months in a year, with each month having either 29 or 30 days. He then introduced the Hijri calendar, discussing its starting date and the cycle of the Hijri calendar, which is based on both days and years. The content of the book consists of:

1. Basics of the Calendar
2. The Islamic Calendar
3. The Gregorian Calendar
4. Seasonal Calendars
5. Other Calendars
6. The Global Calendar
7. Methods of Calendar Calculation
8. Synchronization of Julian and Gregorian Calendars
9. Seasonal Date Tables
10. Time
11. Prayer Time

Essentially, Md Khair Md Taib discussed the issue of aligning the Hijri calendar with the Gregorian calendar in the first chapter of TKH. This chapter also covers the meaning of the Gregorian calendar, including the number of days and its cycles, as well as the relationship between months and years. He notes that historians of his time were still debating how to synchronize the Hijri and Gregorian calendars. One of the reasons for this disagreement is the adjustments made to the Gregorian calendar during the eras of Pope Gregory and Julius Caesar. Then, Md Khair Md Taib establishes the following principles for alignment:

a. The date 1 Muharram, 1 Hijri, falls on Friday, July 11, 622 CE.
b. A 30-year Hijri cycle consists of 10,681 days, while a 28-year Hijri cycle has 10,227 days.
c. Days are used as a tool to align the Hijri and Gregorian calendars.

Furthermore, he developed a concise table to determine the days for the first five days of each Hijri month, presented as Tables 1 and 2 in his book. The corresponding Gregorian days and dates in the year 01 Hijri can be determined using these tables. For example, 1 Muharram, 1 Hijri, falls on Friday, July 16, 622, while 5 Shawwal, 1 Hijri, falls on Tuesday, April 12, 623. Md Khair Md Taib only provides tables for the first five days of the Islamic months in the year 01 Hijri, although he also gives examples for the years 1340 Hijri and 1921 CE. Based on our analysis, the tables Md Khair Md Taib used are highly accurate and align with the calculations of Jean Meeus and the more recent *Accurate Times*.[13]

Table 1: Alignment of Hijri-Gregorian Calendar for the First Five Days in Hijri 1 / Gregorian 622-623

Date	Muh	Saf	R.Aw	R.Ak	J.Aw	J.Ak	Rej	Syb	Ram	Syw	Z.Ka	Z.Hi
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
622	623											
1	J16	A15	I13	R13	K11	S11	A9	T8	R9	J8	S7	I6
2	S17	I16	T14	K14	J12	A12	I10	R9	K10	S9	A8	T7
3	A18	S17	R15	J15	S13	I13	S11	K10	J11	A10	I9	R8
4	I19	R18	K16	S16	A14	S14	R12	J11	S12	I11	S10	K9
5	S20	K19	J17	A17	I15	R15	K13	S12	A13	S12	R11	J10

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[13] Muhamad Syazwan Faid et al., "Assessment and Review of Modern Lunar Crescent Visibility Criterion," *Icarus* 412 (2024): 115970; M. Ilyas, "Lunar Crescent Visibility Criterion and Islamic Calendar," *Quarterly Journal of Royal Astronomical Society* 35 (1994): 425–61; Jean Meeus, *Astronomical Algorithms* (Willmann-Bell, 1991); Mohammad Odeh, "New Criterion for Lunar Crescent Visibility," *Experimental Astronomy* 18, no. 2004 (2004): 39–64.

For the method of Hijri calendar calculation, Md Khair Md Taib used the Istilahi method. The method for determining the day for a Hijri date, according to Khair Md Taib, is as follows:

Determining the Day for the Date 12 Rabiulawal 1401 Hijri:
A. Take the year value from the specified date, which is 1401. Find the largest value less than 1401 in the "Year Group 210" column from Table 15, which is 1260. Subtract 1260 from 1401:
   $1401 - 1260 = 141$.
B. In Table 15, under the "Year Subgroup 30" column, find the largest value less than 141, which is 120.
   This means the date falls in Column 5. Subtract 120 from 141:
   $141 - 120 = 21$.
C. Refer to Table 16. Match Column 5 and the sub-year value 21. The result is A.
   This indicates that the first day of 1401 Hijri falls on a Sunday.
D. Refer to Table 17. Match result A with the month of Rabiulawal. The result is R.
   This indicates that 1 Rabiulawal 1401 Hijri falls on a Wednesday.
E. Refer to Table 18. Match the day 12th with the result R. The result is A.

This indicates that 12 Rabiulawal 1401 Hijri falls on a Sunday, and the result aligns with the calculations made using Accurate Times.

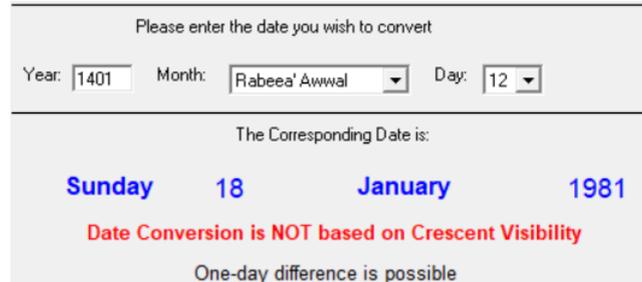**Figure 1: Calculation results from Accurate Times for 12 Rabiulawal 1401**

Table 2: Names of days in the Istilahi Hijri Calendar (Between Years 01 to 4200 H)

Year Group 210	Year Subgroup 30	Column
0	1470, 2940, 4410	0 = Column 1
210	1680, 3150, 4620	30 = Column 2
420	1890, 3360, 4830	60 = Column 3
630	2100, 3570, 5040	90 = Column 4
840	2310, 3780, 5250	120 = Column 5
1050	2520, 3990, 5460	150 = Column 6
1260	2730, 4200, 5670	180 = Column 7

Table 3: Names of days in the Istilahi Hijri calendar (*A=Sunday, I=Monday, T=Tuesday, R=Wednesday, K=Thursday, J=Friday, S=Saturday*)

Year Subgroup 30						Column							Qamariah Months
						1	4	7	3	6	2	5	
1	9	17		25		J	S	A	I	T	R	K	Muharam - Syawal
2	10	18		26		T	R	K	J	S	A	I	Syaaban
3	11	19	24	27		A	I	T	R	K	J	S	Safar - Rejab
4	12	20		28		K	J	S	A	I	T	R	Jamadilawal
5	13	21	16	29	8	I	T	R	K	J	S	A	Rabiulawal Zulhijah
6	14	22				S	A	I	T	R	K	J	Jamadilakhir - Zulkaedah
7	15	23				R	K	J	S	A	I	T	Ramadan - R. Akhir
						Day of Month							
						1	2	3	4	5	6	7	
						8	9	10	11	12	13	14	
						15	16	17	18	19	20	21	
						22	23	24	25	26	27	28	
						29	30						

Table 4: Start days of Qamariah months

Qamariah Months	A	I	T	R	K	J	S
Muharam	A	I	T	R	K	J	S
Safar	T	R	K	J	S	A	I
Rabiulawal	R	K	J	S	A	I	T
Rabiulakhir	J	S	A	I	T	R	K
Jamadilawal	S	A	I	T	R	K	J
Jamadilakhir	I	T	R	K	J	S	A
Rejab	T	R	K	J	S	A	I
Syaaban	K	J	S	A	I	T	R
Ramadan	J	S	A	I	T	R	K
Syawal	A	I	T	R	K	J	S
Zulkaedah	I	T	R	K	J	S	A
Zulhijah	R	K	J	S	A	I	T

This table illustrates the starting days for each Qamariah month based on the *Istilahi method*, with corresponding codes (A, I, T, R, K, J, S) representing the specific days.

Table 5: Names of days within Qamariah Months

Day of Month					A	I	S	R	K	J	S
1	8	15	22	29	A	I	T	R	K	J	S
2	9	16	23	30	I	T	R	K	J	S	A
3	10	17	24	-	T	R	K	J	S	A	I
4	11	18	25	-	R	K	J	S	A	I	T
5	12	19	26	-	K	J	S	A	I	T	R
6	13	20	27	-	J	S	K	J	S	A	K
7	14	21	28	-	S	A	I	T	R	K	J

Md Khair Md Taib performed calculations to determine the total number of days from 1 Muharram 1 Hijri to the given date. This process is similar to the calculation of the Julian Day. For example, for the date 14 Muharram 1340 Hijri, the steps are as follows:

Step-by-Step Calculation for 14 Muharram 1340

1. Identify the Base Year
   - Take the year 1340 from the specified date.
   - Match the year in Table 19, under the Year Group 30 Qamariah column, and find the largest value before 1340.
     The value is 1320, and its corresponding value in the adjacent column is 467,764 days.
2. Calculate the Sub-Year
   - Subtract 1320 from 1340:
     $1340 - 1320 = 20$.
   - Match the value 20 in the Year Subgroup 30 column in Table 19. The result is 6,733 days.
3. Match the Month
   - For Muharram, the month value is 0.
4. Add the Days of the Month
   - Add the day value 14.
5. Total Days Calculation
   - Add all the values:
     $467{,}764 + 6{,}733 + 0 + 14 = 474{,}511$ days.
6. Determine the Day of the Week
   - Divide the total number of days by 7 to find the remainder:
     $474{,}511 \div 7 = 67{,}787$ remainder 2.
   - Refer to the Day Names Column in Table 19. A remainder of 2 corresponds to Saturday.

Thus, 14 Muharram 1340 Hijri falls on a Saturday. The calculation result matches with the Accurate Times software, confirming that 14 Muharram 1340 Hijri is indeed a Saturday.

Figure 2: Calculation results from Accurate Times for 14 Muharram 1340

Table 6: Total Hijri Days (Starting from 1 Muharram 1 Hijri)

Year Group 30 Qamariah						Year Subgroup 30	
30	10 631	930	329 561	1830	648 491	1	0
60	21 262	960	340 192	1860	659 122	2	354
90	31 893	990	350 823	1890	669 753	3	709
120	42 524	1020	361 454	1920	680 384	4	1 063
150	53 155	1050	372 85	1950	691 015	5	1417
180	63 786	1080	382 716	1980	701 646	6	1772
210	74 417	1110	393 347	2010	712 177	7	2 126
240	85 048	1140	403 978	2040	722 908	8	2 481
270	95 679	1170	414 609	2070	733 539	9	2 835
300	106 310	1200	425 240	2100	744 170	10	3 189
330	116 941	1230	435 871	2130	754 801	11	3 544
360	127 572	1260	446 502	2160	765 432	12	898
390	138 203	1290	457 133	2190	776 063	13	4 252
420	148 834	1320	467 764	2220	786 694	14	607
450	159 465	1350	478 395	2250	797 325	15	961
480	170 096	1380	489 26	2280	807 956	16	5 216
510	180 727	1410	499 657	2310	818 587	17	670
540	191 358	1440	510 288	2340	829 218	18	6 024
570	201 989	1470	520 919	2370	839 849	19	6 379
600	212 620	1500	531 550	2400	850 480	20	6 733
630	223 251	1530	542 181	2430	861 111	21	7807
660	233 882	1560	552 812	2460	871 742	22	442
690	244 513	1590	563 443	2490	882 373	23	7 796
720	255 144	1620	574 74	2520	893 004	24	8 150
750	265 755	1650	584 705	2550	903 635	25	8 505
780	276 406	1680	595 336	2580	914 266	26	8 859
810	287 037	1710	605 967	2610	924 897	27	9 214
840	297 668	1740	616 598	2640	935 528	28	9 568
870	309 299	1770	627 229	2670	946 159	29	9 922
900	318 930	1800	637 860	2700	956 790	30	10 277
Qamariah Month				**Name of Day**			
Muharam	0	Rejab	177		1	Jumaat	
Safar	30	Syaaban	207		2	Sabtu	
Rabiulawal	59	Ramadan	236		3	Ahad	
Rabiulakhir	89	Syawal	266		4	Isnin	
Jamadilawal	118	Zulkaedah	295		5	Selasa	
Jamadilakhir	148	Zulhijah	325		6	Rabu	
					7	Khamis	

When this book was written, discrepancies existed in the Hijri dates presented in modern English-language astronomy books. These discrepancies arose due to different calculation methods, namely *Istilahi, Ijtima' Hakiki,* and *Rukyatul Hilal.* According to Md Khair Md Taib, these differences were minor and would only have a significant impact over the next 2,500 Hijri years. He further opined that *Istilahi* is suitable for general use*, Ijtima' Hakiki* for daily religious observances, and *Rukyatul Hilal* for determining the months of Ramadhan and Syawal. This statement highlights Md Khair Md Taib's macro perspective on determining the Hijri calendar. In his book, the definition of the Hijri calendar based on *Rukyatul Hilal* adheres to the criteria established during the Conference on the Crescent Moon in Istanbul, 1978:

1. The conjunction (Ijtima') of the sun and moon must occur 8–10 hours before sunset on the day of the conjunction.
2. At the time of sunset:
   o The altitude of the moon above the horizon must exceed 5.5 degrees.
   o The elongation of the moon must exceed 7.5 degrees.[14]

According to Abd. Majid Abd. Hamid, Md Khair Md Taib added the 8-hour criterion based on the deliberations of the aforementioned conference. Interestingly, this book was written while Md Khair Md Taib served as a visiting scholar in Islamic astronomy (1981–1983). During this period, Perak and Johor states declared the start of Ramadan 1403 on 12 June 1983, whereas the national level declared it on 13 June 1983. Md Khair Md Taib played a pivotal role in resolving the confusion between the Perak state and the national authorities. This book stands as evidence that his opinions were heeded at both the state and national levels, especially in establishing criteria for crescent moon visibility.[15] Despite this, the book does not emphasize other existing criteria of the time, such as those proposed by Fotheringham, Maunder, Bruin, and Ilyas [16]. This omission is intentional, as the book was written for a general audience and did not aim to delve into technical discussions on crescent visibility criteria that could burden casual readers. Moreover, the discussion of such criteria had already been extensively covered by other researchers of that era.

Conclusion

Md Khair Md Taib's *Takwim Hijriah Khairiah* (TKH) stands as a significant work in the historical development of the Malaysian Hijri calendar, providing a comprehensive framework for understanding and calculating the Hijri calendar. TKH bridges the gap between traditional methods and modern astronomical practices, reflecting the unique challenges and solutions in adapting Islamic calendrical systems to contemporary needs. The methodologies employed by Md Khair Md Taib, including his approaches to crescent moon visibility and Hijri-Gregorian date synchronization, demonstrate his ability to balance calculation accuracy, ephemeris practicality, and accessibility to the public learning curve. Md Khair Md Taib's alignment with global Islamic scholarly efforts, such as the criteria established at the 1978 Istanbul conference, alongside his grounding in Malaysia's unique cultural and historical context, reflects a nuanced understanding of the role of Islamic astronomy in everyday life. This study sheds light on an overlooked yet pivotal contribution to Islamic astronomy, highlighting the enduring significance of TKH in both scholarly discourse and practical applications. By revisiting Md Khair Md Taib's work, this study underscores the importance of preserving and engaging with the intellectual heritage of Islamic astronomy, which continues to inspire in the modern era.

Aknowledgement

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