

# An Analytical Study of Beginning and End of Ramadan During Prophet Muhammad's (peace be upon him) Time

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## Abstract

*This paper investigates the important parameter values for Ramadan and Syawwal crescents during Prophet Muhammad's (peace be upon him) time in Medina. The investigation will be guided by two important factor: the number of 29 and 30 days Ramadan in the Medinan period, and the Prophet's (peace be upon him) companions who reported the hadith. The paper will then conclude with several suggestions.*

## 1. INTRODUCTION

Probably the only religion on Earth that still relies upon the sighting of the crescent as a basis for its lunar calendar is Islam. Although it has not been mentioned explicitly by any Quranic verses nor hadiths, it has been taken for granted by Muslims that all lunar months in an Islamic calendar must be based on crescent sighting, and not just the holy months of Ramadan, Syawwal and Zulhijjah, in which there are important religious festivals and rites for the Muslims.

The determination of the holy months of Ramadan and Syawwal by crescent sighting are mentioned in many authentic hadiths narrated by many hadith scholars such as Al-Imam Muhammad bin Ismail Al-Bukhari (194 - 256 H), Al-Imam Muslim bin Hajjaj (206 - 261 H), Abu Daud Sulaiman bin Ishaq (202 - 275 H), Abu Isa Muhammad bin Isa At-Tirmizi (200 - 279 H), Ahmad bin Syuaib An-Nasaa-i (215 - 303 H), Muhammad bin Yazid bin Majah (209 - 273 H) and many others. In fact it can safely said that not a single hadith compiler will not mention the hadiths on crescent sighting for Ramadan and Syawwal. Such is the importance attach to this noble activity. Examples of the hadiths are as follow:

إِذَا رَأَيْتُمُوهُ فَصُومُوا، وَإِذَا رَأَيْتُمُوهُ فَأَفْطِرُوا، فَإِنْ غُمَّ عَلَيْكُمْ فَأَقْدُرُوا لَهُ.

Meaning: If you sight the crescent then begin your fast (in Ramadan), and if you sight the crescent then break your fast (in Syawwal), and if it is cloudy (you can't see the crescent), then determine it.

صُومُوا لِرُؤْيَيْهِ، وَأَفْطِرُوا لِرُؤْيَيْهِ، فَإِنْ غُمِّيَ عَلَيْكُمْ فَأَكْمِلُوا الْعَدَدَ.

Meaning: Fast with crescent sighting, and break your fast with crescent sighting, and if it is cloudy (you can't see the crescent), then complete the month (30 days).

The fact the Muslims begin their lunar months with crescent sighting carries with it advantages and disadvantages. Among the many advantages is that it urges Muslims to perfect the art of crescent sighting. This directly forces Muslims to equip themselves and excel in the fields of Mathematics, Astronomy, Geography, Atmospheric Physics and Optics. These are the relevant fields required to determine with accepted accuracy the possibility of crescent sighting.

On the other hand, among the disadvantages is that it is almost impossible to have a one unified global Islamic calendar for all Muslims in the East and West. It also opens the path of disunity when Muslims do not attach the desired importance to the act of crescent sighting by disregarding other relevant fields of knowledge, the most important of all is Astronomy.

This disunity and confusions that arises from it, has its root in the absence of understanding, or the lack of it, in the following two hadiths:

### First Hadith

إِنَّا أُمَّةٌ أُمِّيَّةٌ لَا نَكْتُبُ وَلَا نَحْسِبُ، الشَّهْرُ هَكَذَا وَهَكَذَا يَعْنِي مَرَّةً تِسْعَةً وَعِشْرِينَ وَمَرَّةً ثَلَاثِينَ.

(Narrated by Al-Bukhari and Muslim from Ibn 'Umar)

Meaning: Verily we are illiterate people, we do not write nor do we count. Thus, the month is either 29 days or 30 days.

### Second Hadith

جاءَ أَعْرَابِيٌّ إِلَى النَّبِيِّ صَلَّى اللهُ عَلَيْهِ وَسَلَّمَ فَقَالَ: رَأَيْتُ الْهِلَالَ، فَقَالَ: أَتَشْهَدُ أَنْ لَا إِلَهَ إِلَّا اللهُ وَأَنَّ مُحَمَّدًا عَبْدُهُ وَرَسُولُهُ؟ قَالَ: نَعَمْ. فَنادَى النَّبِيُّ صَلَّى اللهُ عَلَيْهِ وَسَلَّمَ أَنْ صُومُوا.

(Narrated by Abu Daud, Tirmizi dan An-Nasaa-i, from Ibn 'Abbas)

Meaning: A Bedouin came to the Prophet (peace be upon him) and said to him: “I saw the crescent.” The Prophet (peace be upon him) then asked him: “Do you give the testimony that there is no god except Allah, and that Muhammad (peace be upon him) is His servant and messenger?” The Bedouin said: “Yes.” The Prophet (peace be upon him) then told the rest to start fasting.

The misunderstanding from the first hadith arises from the refusal of certain sections of the Islamic Ummah to accept the fact that the illiteracy mentioned in that hadith is confined to the time of the Prophet (peace be upon him), in which only a very fortunate few were able to read, write and count. The vast majority of Arabs during that time were not schooled in reading, writing and counting. But that hadith is not a curse upon Muslims to be illiterate forever. The evidence being that in less than a century later, Muslims were able to discover and learn the sciences of the Greeks in the West and Hindus in the East, paving the way to greater heights in many fields including Astronomy and Mathematics. It is unfortunate today that those knowledge and discoveries are being disregarded, or worse, frowned upon, by certain uninformed ‘scholars’ of Islamic knowledge.

The Prophet (peace be upon him) was sent as a blessing for all. Allah says in Al-Quran (Al-Anbiya’: 107)

وَمَا أَرْسَلْنَاكَ إِلَّا رَحْمَةً لِّلْعَالَمِينَ

Meaning: And We have sent you (O Muhammad) not but as a mercy for the 'Alamîn (mankind, jinns and all that exists).

Hence, the Prophet (peace be upon him) gave the ummah a very basic principle for determination of Islamic months: the month should be 30 days long if you cannot sight the crescent, but if you can see it, then the month is 29 days long. This a blessing for the ummah for they are not burdened (*taklif*) to master the

fields of Astronomy and Mathematics before they can begin to fast. However, in no way does the Prophet (peace be upon him) hinder the ummah and put a limit to learning Astronomy and other relevant fields. Thus, the Shari'ah does not stop us from applying modern knowledge, skills and technologies to determine the visibility of the crescent through unaided eye.

The second hadith is more of lack of understanding. The reliance upon just one observer for crescent sighting, and the complacency to counter check that claim, has been taken as a *de rigueur* in accepting crescent sighting testimony by certain group of ulama.

## 2. RESEARCH LIMITATIONS

This paper will have the following limitations:

- a) The calculations will be done from the second year of Hijrah to the tenth year of Hijrah. These are the nine years during which the Prophet (peace be upon him) fasted with his companions during the month of Ramadan. Fasting in Ramadan was made compulsory by the revelation of verse 183 in Surah Al-Baqarah towards the end of Sha'ban in the second year of Hijrah. The tenth year of Hijrah was the last year the Prophet (peace be upon him) fasted with his companions before being invited to be with his Lord on Rabi' Al-Awwal of the following year.
- b) All calculations will be based at Medina, with the following coordinates:
  - Latitude = 24° 33' North
  - Longitude = 39° 43' East
  - Time Zone = +3 hours GMT
  - Elevation = 0 meter
- c) The calculations used the software Accurate Times 5.1.11 by Mohammad Odeh (downloadable for free at [www.icoproject.org/accut.html#dow](http://www.icoproject.org/accut.html#dow)) and are Topocentric except for Moon Conjunction date and time, which is Geocentric.

- d) The main criteria to determine the possibility of crescent sighting is Odeh's Criteria developed by Mohammad Odeh, the creator of Accurate Times. However, supplementary criteria will be given as and when necessary.

### 3. RESEARCH GUIDELINES

The determination of when the months of Ramadan started and ended during the time of Prophet (peace be upon him) in Medina is based on the following three guidelines:

A) The following authentic hadith narrated by Imam Ahmad and Tirmizi on the authority of Abdullah bin Mas'ud:

مَا صُومْتُ مَعَ النَّبِيِّ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ تِسْعًا وَعِشْرِينَ أَكْثَرَ مِمَّا صُومْنَا ثَلَاثِينَ.

Meaning: I fasted with the Prophet (peace be upon him) for 29 days more than I fasted with him for 30 days.

B) The following accepted hadith narrated by Ibn Majah on the authority of Abu Hurairah:

حَدَّثَنَا مُجَاهِدُ بْنُ مُوسَى، حَدَّثَنَا الْقَاسِمُ بْنُ مَالِكِ الْمُزَنِيِّ، حَدَّثَنَا الْجُرَيْرِيُّ، عَنْ أَبِي نَضْرَةَ، عَنْ أَبِي هُرَيْرَةَ، قَالَ: مَا صُومْنَا عَلَى عَهْدِ رَسُولِ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ تِسْعًا وَعِشْرِينَ أَكْثَرَ مِمَّا صُومْنَا ثَلَاثِينَ.

Meaning: Mujahid bin Musa reported to us (he said): Qasim bin Malik Al-Muzani reported to us (he said): Al-Jurairy reported to us (he said): From Nadrah: From Abu Hurairah he said: We fasted during the time of the Prophet (peace be upon him) 29 days more than 30 days.

This hadith is deemed as Hasan. Its chain of narrators are all reliable (thiqah), except for Al-Jurairy whom some experts in Hadith such as Abu Hatim Ar-Razi and Al-'Ajly said that he is reliable before his hadiths got mixed up at the end of his life. However, since there is no evidence that this hadith is narrated by him at the end of his life, we can consider this hadith as reliable. Especially when the next person after him in its chain of narrators is reliable (thiqah).

C) The number of Ramadans on which the Prophet (peace be upon him) fasted for 29 days and 30 days. This information can be found in the book Tuhfat Al-Ahwazi written by Al-Mubarakfuri, the original Arabic text as follow:

قَالَ الشَّيْخُ ابْنُ حَجَرٍ: قَالَ بَعْضُ الْحَقَّائِ: صَامَ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ تِسْعَ رَمَضَانَاتٍ، مِنْهَا رَمَضَانَانِ فَقَطُ ثَلَاثُونَ.<sup>1</sup>

Meaning: As-Sheikh Ibn Hajar<sup>2</sup> said: Some scholars of hadith said: The Prophet (peace be upon him) fasted for 9 Ramadans, but only two of them were 30 days long.

#### 4. CALCULATIONS

Calculations are done for each of possible start of Ramadan and Syawwal from year 2 AH to year 10 AH. The values of the calculated parameters can be found in Annex A.

For each year, I generated between two to three possible pairings out of the several crescent calculations for Ramadan and Shawwal of that year. I then proceed to select the best possible pairing for that year.

#### 5. FINDINGS

From the calculations done on all the nine months Ramadan and nine months of Shawwal during the time of Prophet Muhammad (peace be upon him), I found out that the years 5 AH to 9 AH have no problem in selecting the best possible pair which carry the Odeh's criteria of '*Easily Visible With Naked Eye*' for both start of Ramadan and Shawwal crescents. All other pairings are impossible since according to Odeh's criteria, the crescent is '*Not Visible Even With Optical Aid*'.

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<sup>1</sup> Al-Mubarakfuri, Muhammad bin Abdurrahman bin Abdurrahim, **Tuhfat Al-Ahwazi Sharh Sunan At-Tirmizi**, (Beirut: Darul Kutub Al-'Ilmiah), v.3, p.301.

<sup>2</sup> He was Ahmad bin Ali bin Hajar Al-'Asqalani, born 773 Hijrah and died in 852 Hijrah. He was a reknown Egyption scholar, and regarded by many as the last Imam in hadith. His treatise on Sahih Al-Bukhari, Fath Al-Bari, is regarded as the best hadith expounder ever.

However the years 2 AH, 3 AH, 4 AH and 10 AH have two possible pairings for the start of Ramadan and Shawwal for each of them, resulting in Ramadan for those years to be either 29-days long or 30-days long.

To overcome this problem, and to select the choice pairing for those four years, I did the following:

- a) Look at the five years in which there is no problem in selecting the choice pair (5 AH to 9 AH). From those five years, it is discovered that only year 6 AH has 30-days Ramadan. The rest have 29-days Ramadan.
- b) From Guideline C above, we know that the Prophet (peace be upon him) fasted 30-days Ramadan only twice. Hence, from the balance four problematic years (2 AH, 3 AH, 4 AH and 10 AH), we need to select one year and make it a 30-days Ramadan, and leave the rest 29-days Ramadan.
- c) To select which one of the four problematic years (2 AH, 3 AH, 4 AH and 10 AH) to be converted to 30-days Ramadan, I use Guideline B. The hadith was narrated by Ibn Majah on the authority of Abu Hurairah. Abu Hurairah arrived in Medina from Yemen and embraced Islam when the Prophet (peace be upon him) was in Khaibar. The Khaibar battle took place in the early months of 7 AH. Hence, Abu Hurairah managed to fast together with the Prophet (peace be upon him) till year 10 AH.

Since Ramadan 6 AH was already 30-days long, we have no choice but to select Ramadan 10 AH as the 30-days long Ramadan. Selecting 2 AH, 3 AH or 4 AH as 30-days Ramadan will contradict the report by Abu Hurairah, for it is certain he did not fast with the Prophet (peace be upon him) from year 2 AH to at least 5 AH.

Thus, the summary of my chosen pairs is as follow:

Hijric Year	Ramadan Date	Shawwal Date	Number of Days in Ramadan
2 AH	26 February 624 CE	26 March 624 CE	29 days
3 AH	15 February 625 CE	16 March 625 CE	29 days
4 AH	4 February 626 CE	5 March 626 CE	29 days
5 AH	25 January 627 CE	23 February 627 CE	29 days
6 AH	14 January 628 CE	13 February 628 CE	30 days
7 AH	3 January 629 CE	1 February 629 CE	29 days
8 AH	23 December 629 CE	21 January 630 CE	29 days
9 AH	12 December 630 CE	10 January 631 CE	29 days
10 AH	1 December 631 CE	31 December 631 CE	30 days

From the 18 selected crescent calculations for the first nine years of Islamic Calendar, we discover that the lowest parameter values are for the Shawwal crescent of 4 AH. Those values are:

**Moon lag time** : 40 minutes  
**Moon's age during sunset** : 16H 27M  
**Relative altitude** : 8° 39'  
**Elongation** : 9° 48'

These minimum values are well above records set by contemporary authentic crescent observations. The elongation of 9° 48' is above the Danjon Limit. In terms of age, again it is more than sufficient for crescent observation. It was reported in Royal Astronomical Society of Canada, Vol 83/3, Pages 34-36, Newsletter/Bulletin, June 1989:

*The YOUNGEST naked-eye CRESCENT MOON of 13 hours and 24 minutes was sighted on Friday 5 May 1989 at Houston, Texas, USA by two separate groups of people thus making a NEW WORLD RECORD. The previous record was of 14 hours and 30 minutes on 2 May 1916 at Scarborough, Yorkshire, England. The first of the two groups consisted of FIVE people who sighted the Crescent Moon and the second of the two groups, located at a different place, comprised of THREE people.*

*The first group who sighted the Crescent Moon consisted of the BADAT family: Mr. Mohammed Iqbal Badat, Mrs. Famida*



*Iqbal Badat, Mr. Mohammed Hanif Badat, Mr. Abdul Qadir Badat, and Miss Fatima Badat. The second group comprised of Mr. Saleh Al-Thani, Mr. Nasir Al-Qaouq, and Mr. Aymen Qadorah.*

*This Crescent Moon sighting will henceforth be referred to as the BADAT AND AL-THANI SIGHTING.*

It is noteworthy to point out that with such parameter values which certainly enable crescents to be easily visible to the naked eyes, there are no report that crescent sighting reports during the time of Prophet Muhammad (peace be upon him) were challenged or even counter checked.

## 6. RECOMMENDATIONS

From the findings above, I would like to recommend the following:

### 1) Adoption of Imam As-Subki's Fatwa

Sighting reports for crescents with parameters with at least the minimum values achieved during the Prophet's time need not be counter checked.

However, for young crescents, an observer's testimony is not sufficient. It is proposed that we study and adopt the fatwa by Imam Taqiyuddin As-Subki<sup>3</sup>, the Arabic text as follow:

وَحَقُّ عَلَى الْقَاضِي التِّيَقُّظُ لِذَلِكَ، وَأَنْ لَا يَتَسَرَّعَ إِلَى قَبُولِ قَوْلِ الشَّاهِدَيْنِ حَتَّى يَفْحَصَ  
عَنْ حَالِ مَا شَهِدَا بِهِ مِنْ الْإِمْكَانِ وَعَدَمِهِ وَمَرَاتِبِ الْإِمْكَانِ فِيهِ، وَهَلْ بَصَرُهُمَا يَقْتَضِي ذَلِكَ  
أَوْ لَا، وَهَلْ هُمَا مِمَّنْ يُشْتَبَهُ عَلَيْهِمَا أَوْ لَا.<sup>4</sup>

Meaning: The judge must be fully aware of (the factors that effect crescent sighting report). He should not be quick to accept the testimony of two persons until he has investigated the probability of their sighting, and whether the power of their eyesight enables them to observe the crescent, and whether they can be easily deceived with what they thought as crescent.

<sup>3</sup> A prominent scholar and jurist in the Shafi'i Mazhab. Born in Egypt in 683 AH. Died in 752 AH.

<sup>4</sup> Taqiyuddin Ali bin Al-Kafi As-Subki, Fatawa As-Subki, (Beirut: Darul Ma'rifat), v.1, p.208.

In other words, the judge or parties entrusted to officialize the start of Islamic lunar month, must have some knowledge of Islamic astronomy and the science of the crescent sighting, so as to avoid committing mistakes in accepting false or wrong testimonies of crescent sighting

## 2) Medina as reference coordinate for crescent calculations

The modus operandi currently is to use Mecca as reference coordinate to calculate the beginning of Islamic lunar months. However, there is no basis in Islamic Shrai'ah to use Mecca as reference coordinate. Furthermore, the Prophet (peace be upon him) never fasted Ramadan in Mecca during his lifetime.

On the other hand, there is nothing in Islamic Shari'ah that hinder us from using Medina as the reference coordinate for our Islamic Calendar. Furthermore, using Medina as the reference coordinate has the added advantage of having the minimum values for crescent observation derived from the Prophet's time. The values are:

<b>Moon lag time</b>	: 40 minutes
<b>Moon's age during sunset</b>	: 16H 27M
<b>Relative altitude</b>	: 8° 39'
<b>Elongation</b>	: 9° 48'

We can name this calendar as Taqwim Madinah (Medina Calendar). And it can adopt the following rules:

- 1) The Medina Calendar is only applicable for Middle East and North African countries nearby such as Egypt, Sudan, Ethiopia, Djibouti and Somalia.
- 2) If calculation shows that the crescent is above those minimum values at Medina, then new Hijric months can be declared afore hand for those countries.
- 3) If calculation shows that the crescent is below those values at Medina, but there is a possibility of sighting the crescent with low power optical aids according to accepted criteria such as Odeh's and Yallop's, then

pronouncement of new Hijric month should wait for confirmed authentic sighting claims.

Needless to say that more research need to be done to find out the reference coordinates for other regions such as Central Asian countries, South-East Asian countries, the Far East, South Pacific countries, Central and South African countries, the European continent and North African countries bordering the Mediterranean, and the North and South American continents.

With Allah's permission, we can discover those reference coordinates and hence have a truly coordinated regional calendar, such as one being implemented by Indonesia, Malaysia, Brunei and Singapore.

***And Allah Knows Best***

## Calculations of Crescent Visibility During Rasulullah's Time in Medina

### Notes:

- a) Coordinates used:  $\Phi = 24^{\circ} 33' N$      $\lambda = 39^{\circ} 43' E$
- b) All calculations are from Accurate Times 5.1.11 by Mohammad Odeh
- c) All calculations are Topocentric except for Conjunction Date and Time
- d) All dates are observation dates and NOT the beginning of the month.

### CALCULATION RESULTS FOR 2<sup>ND</sup> YEAR HIJRAH

RAMADAN 02 HIJRAH							
Calculation 1							
Date	24/02/624 CE	Day	Friday	G. Conjunction	24/02/624 CE, 11:11 LT		
Sunset	18:24	Moonset	18:36	Lag Time	+00H 12M	Moon Age	+07H 13M
Relative Altitude	+02°:39'		Elongation	+05°:27'		Crescent Width	+00° 00' 04"
Odeh's Criteria	Not Visible Even With Optical Aid						
Calculation 2							
Date	25/02/624 CE	Day	Saturday	G. Conjunction	24/02/624 CE, 11:11 LT		
Sunset	18:24	Moonset	19:35	Lag Time	+01H 11M	Moon Age	+31H 13M
Relative Altitude	+15°:15'		Elongation	+16°:19'		Crescent Width	+00°:00':38"
Odeh's Criteria	Easily Visible By Naked Eye						

SHAWWAL 02 HIJRAH							
Calculation 3							
Date	25/03/624 CE	Day	Sunday	G. Conjunction	24/03/624 CE, 23:21 LT		
Sunset	18:35	Moonset	19:15	Lag Time	+00H 40M	Moon Age	+19H 14M
Relative Altitude	+08°:34'		Elongation	+09°:58'		Crescent Width	+00°:00':14"
Odeh's Criteria	Visible With Optical Aid, Could Be Seen By Naked Eye.						
Calculation 4							
Date	26/03/624 CE	Day	Monday	G. Conjunction	24/03/624 CE, 23:21 LT		
Sunset	18:36	Moonset	20:09	Lag Time	+01H 33M	Moon Age	+43H 25M
Relative Altitude	+20°:21'		Elongation	+21°:00'		Crescent Width	+00°:01':01"
Odeh's Criteria	Easily Visible By Naked Eye						

**Possible Pairings of Beginning of Ramadan and Syawal, and number of days in this Ramadan:**

- 1) Calculation 1 and Calculation 3 = 30 days Ramadan
- 2) Calculation 2 and Calculation 3 = 29 days Ramadan - **Choice pairing**
- 3) Calculation 2 and Calculation 4 = 30 days Ramadan

## CALCULATION RESULTS FOR 3<sup>RD</sup> YEAR HIJRAH

RAMADAN 03 HIJRAH							
Calculation 1							
<b>Date</b>	13/02/625 CE	<b>Day</b>	Wednesday	<b>G. Conjunction</b>	13/02/0625 CE, 00:49 LT		
<b>Sunset</b>	18:18	<b>Moonset</b>	19:00	<b>Lag Time</b>	+00H 42M	<b>Moon Age</b>	+17H 30M
<b>Relative Altitude</b>	+08°:46'		<b>Elongation</b>	+10°:32'		<b>Crescent Width</b>	+00°:00':17"
<b>Odeh's Criteria</b>	Visible With Optical Aid, Could Be Seen By Naked Eye						
Calculation 2							
<b>Date</b>	14/02/625 CE	<b>Day</b>	Thursday	<b>G. Conjunction</b>	13/02/0625 CE, 00:49 LT		
<b>Sunset</b>	18:19	<b>Moonset</b>	20:06	<b>Lag Time</b>	+01H 47M	<b>Moon Age</b>	+41H 30M
<b>Relative Altitude</b>	+22°:34'		<b>Elongation</b>	+23°:41'		<b>Crescent Width</b>	+00°:01':24"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

SHAWWAL 03 HIJRAH							
Calculation 3							
<b>Date</b>	14/03/625 CE	<b>Day</b>	Thursday	<b>G. Conjunction</b>	14/03/0625 CE, 10:20 LT		
<b>Sunset</b>	18:31	<b>Moonset</b>	18:48	<b>Lag Time</b>	+00H 16M	<b>Moon Age</b>	+08H 11M
<b>Relative Altitude</b>	+03°:32'		<b>Elongation</b>	+06°:01'		<b>Crescent Width</b>	+00°:00':05"
<b>Odeh's Criteria</b>	Not Visible Even With Optical Aid						
Calculation 4							
<b>Date</b>	15/03/625 CE	<b>Day</b>	Friday	<b>G. Conjunction</b>	14/03/0625 CE, 10:20 LT		
<b>Sunset</b>	18:32	<b>Moonset</b>	19:49	<b>Lag Time</b>	+01H 17M	<b>Moon Age</b>	+32H 11M
<b>Relative Altitude</b>	+16°:52'		<b>Elongation</b>	+17°:31'		<b>Crescent Width</b>	+00°:00':45"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

**Possible Pairings of Beginning of Ramadan and Syawal, and number of days in this Ramadan:**

- 1) Calculation 1 and Calculation 3 = 29 days Ramadan
- 2) Calculation 1 and Calculation 4 = 30 days Ramadan
- 3) Calculation 2 and Calculation 4 = 29 days Ramadan - **Choice pairing**

## CALCULATION RESULTS FOR 4<sup>th</sup> YEAR HIJRAH

RAMADAN 04 HIJRAH							
Calculation 1							
<b>Date</b>	02/02/626 CE	<b>Day</b>	Sunday	<b>G. Conjunction</b>	02/02/626 CE, 16:51 LT		
<b>Sunset</b>	18:12	<b>Moonset</b>	18:07	<b>Lag Time</b>	-00H 04M	<b>Moon Age</b>	+01H 20M
<b>Relative Altitude</b>	-00°:53'		<b>Elongation</b>	+05°:03'		<b>Crescent Width</b>	+00°:00':04"
<b>Odeh's Criteria</b>	Not Visible Even With Optical Aid						
Calculation 2							
<b>Date</b>	03/02/626 CE	<b>Day</b>	Monday	<b>G. Conjunction</b>	02/02/626 CE, 16:51 LT		
<b>Sunset</b>	18:12	<b>Moonset</b>	19:17	<b>Lag Time</b>	+01H 05M	<b>Moon Age</b>	+25H 21M
<b>Relative Altitude</b>	+13°:13'		<b>Elongation</b>	+14°:57'		<b>Crescent Width</b>	+00°:00':34"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

SHAWWAL 04 HIJRAH							
Calculation 3							
<b>Date</b>	04/03/626 CE	<b>Day</b>	Tuesday	<b>G. Conjunction</b>	04/03/626 CE, 02:00 LT		
<b>Sunset</b>	18:27	<b>Moonset</b>	19:08	<b>Lag Time</b>	+00H 40M	<b>Moon Age</b>	+16H 27M
<b>Relative Altitude</b>	+08°:39'		<b>Elongation</b>	+09°:48'		<b>Crescent Width</b>	+00°:00':15"
<b>Odeh's Criteria</b>	Visible With Optical Aid, Could Be Seen By Naked Eye						
Calculation 4							
<b>Date</b>	05/03/626 CE	<b>Day</b>	Wednesday	<b>G. Conjunction</b>	04/03/626 CE, 02:00 LT		
<b>Sunset</b>	18:28	<b>Moonset</b>	20:13	<b>Lag Time</b>	+01H 45M	<b>Moon Age</b>	+40H 23M
<b>Relative Altitude</b>	+22°:53'		<b>Elongation</b>	+23°:18'		<b>Crescent Width</b>	+00°:01':22"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

**Possible Pairings of Beginning of Ramadan and Syawal, and number of days in this Ramadan:**

- 1) Calculation 2 and Calculation 3 = 29 days Ramadan - **Choice pairing**
- 2) Calculation 2 and Calculation 4 = 30 days Ramadan

## CALCULATION RESULTS FOR 5<sup>th</sup> YEAR HIJRAH

RAMADAN 05 HIJRAH							
Calculation 1							
Date	23/01/627 CE	Day	Friday	G. Conjunction	23/01/0627 CE, 06:44 LT		
Sunset	18:05	Moonset	18:26	Lag Time	+00H 21M	Moon Age	+11H 21M
Relative Altitude	+04°:06'		Elongation	+07°:22'		Crescent Width	+00°:00':08"
Odeh's Criteria	Not Visible Even With Optical Aid						
Calculation 2							
Date	24/01/627 CE	Day	Saturday	G. Conjunction	23/01/0627 CE, 06:44 LT		
Sunset	18:05	Moonset	19:32	Lag Time	+01H 26M	Moon Age	+35H 22M
Relative Altitude	+17°:10'		Elongation	+19°:11'		Crescent Width	+00°:00':55"
Odeh's Criteria	Easily Visible By Naked Eye						

SHAWWAL 05 HIJRAH							
Calculation 3							
Date	21/02/627 CE	Day	Saturday	G. Conjunction	21/02/0627 CE, 17:55 LT		
Sunset	18:22	Moonset	18:18	Lag Time	-00H 05M	Moon Age	+00H 27M
Relative Altitude	-00°:58'		Elongation	+04°:31'		Crescent Width	+00°:00':03"
Odeh's Criteria	Not Visible Even With Optical Aid						
Calculation 4							
Date	22/02/627 CE	Day	Sunday	G. Conjunction	21/02/0627 CE, 17:55 LT		
Sunset	18:23	Moonset	19:23	Lag Time	+01H 00M	Moon Age	+24H 27M
Relative Altitude	+12°:51'		Elongation	+13°:36'		Crescent Width	+00°:00':28"
Odeh's Criteria	Easily Visible By Naked Eye						

**Possible Pairings of Beginning of Ramadan and Syawal, and number of days in this Ramadan:**

- 1) Calculation 1 and Calculation 3 = 29 days Ramadan
- 2) Calculation 1 and Calculation 4 = 30 days Ramadan
- 3) Calculation 2 and Calculation 4 = 29 days Ramadan - **Choice pairing**

## CALCULATION RESULTS FOR 6<sup>th</sup> YEAR HIJRAH

RAMADAN 06 HIJRAH							
Calculation 1							
<b>Date</b>	12/01/628 CE	<b>Day</b>	Tuesday	<b>G. Conjunction</b>	12/01/0628 CE, 14:19 LT		
<b>Sunset</b>	17:57	<b>Moonset</b>	17:54	<b>Lag Time</b>	-00H 03M	<b>Moon Age</b>	+03H 38M
<b>Relative Altitude</b>	00°:34'		<b>Elongation</b>	+05°:16'		<b>Crescent Width</b>	+00°:00':04"
<b>Odeh's Criteria</b>	Not Visible Even With Optical Aid						
Calculation 2							
<b>Date</b>	13/01/628 CE	<b>Day</b>	Wednesday	<b>G. Conjunction</b>	12/01/0628 CE, 14:19 LT		
<b>Sunset</b>	17:57	<b>Moonset</b>	18:53	<b>Lag Time</b>	+00H 56M	<b>Moon Age</b>	+27H 38M
<b>Relative Altitude</b>	+10°:46'		<b>Elongation</b>	+13°:31'		<b>Crescent Width</b>	+00°:00':26"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

SHAWWAL 06 HIJRAH							
Calculation 3							
<b>Date</b>	11/02/628 CE	<b>Day</b>	Thursday	<b>G. Conjunction</b>	11/02/0628 CE, 05:32 LT		
<b>Sunset</b>	18:17	<b>Moonset</b>	18:42	<b>Lag Time</b>	+00H 25M	<b>Moon Age</b>	+12H 45M
<b>Relative Altitude</b>	+05°:13'		<b>Elongation</b>	+06°:43'		<b>Crescent Width</b>	+00°:00':07"
<b>Odeh's Criteria</b>	Not Visible Even With Optical Aid						
Calculation 4							
<b>Date</b>	12/02/628 CE	<b>Day</b>	Friday	<b>G. Conjunction</b>	11/02/0628 CE, 05:32 LT		
<b>Sunset</b>	18:17	<b>Moonset</b>	19:41	<b>Lag Time</b>	+01H 24M	<b>Moon Age</b>	+36H 45M
<b>Relative Altitude</b>	+17°:47'		<b>Elongation</b>	+18°:21'		<b>Crescent Width</b>	+00°:00':49"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

**Possible Pairings of Beginning of Ramadan and Syawal, and number of days in this Ramadan:**

- 1) Calculation 2 and Calculation 3 = 29 days Ramadan
- 2) Calculation 2 and Calculation 4 = 30 days Ramadan - **Choice pairing**



## CALCULATION RESULTS FOR 7<sup>th</sup> YEAR HIJRAH

RAMADAN 07 HIJRAH							
Calculation 1							
Date	31/12/628 CE	Day	Saturday	G. Conjunction	31/12/0628 CE, 15:03 LT		
Sunset	17:49	Moonset	17:41	Lag Time	-00H 08M	Moon Age	+02H 45M
Relative Altitude	-01°:26'	Elongation	+05°:10'	Crescent Width	+00°:00':04"		
Odeh's Criteria	Not Visible Even With Optical Aid						
Calculation 2							
Date	01/01/629 CE	Day	Sunday	G. Conjunction	31/12/0628 CE, 15:03 LT		
Sunset	17:49	Moonset	18:36	Lag Time	+00H 47M	Moon Age	+26H 46M
Relative Altitude	+08°:52'	Elongation	+12°:15'	Crescent Width	+00°:00':20"		
Odeh's Criteria	Visible With Optical Aid, Could Be Seen By Naked Eye						
Calculation 3							
Date	02/01/629 CE	Day	Monday	G. Conjunction	31/12/0628 CE, 15:03 LT		
Sunset	17:50	Moonset	19:32	Lag Time	+01H 42M	Moon Age	+50H 47M
Relative Altitude	+19°:18'	Elongation	+22°:38'	Crescent Width	+00°:01':09"		
Odeh's Criteria	Easily Visible By Naked Eye						

SHAWWAL 07 HIJRAH							
Calculation 4							
Date	30/01/629 CE	Day	Monday	G. Conjunction	30/01/0629 CE, 09:51 LT		
Sunset	18:10	Moonset	18:21	Lag Time	+00H 12M	Moon Age	+08H 19M
Relative Altitude	+02°:23'	Elongation	+04°:33'	Crescent Width	+00°:00':03"		
Odeh's Criteria	Not Visible Even With Optical Aid						
Calculation 5							
Date	31/01/629 CE	Day	Tuesday	G. Conjunction	30/01/0629 CE, 09:51 LT		
Sunset	18:10	Moonset	19:16	Lag Time	+01H 05M	Moon Age	+32H 20M
Relative Altitude	+13°:35'	Elongation	+14°:21'	Crescent Width	+00°:00':28"		
Odeh's Criteria	Easily Visible By Naked Eye						

According to Odeh's Criteria, the first day of Sya'ban 7 AH fell on 4 December 628 CE. Hence, only Calculation 3 can be considered since it corresponds to 29 Sya'ban 7 AH.

**Possible Pairing of Beginning of Ramadan and Syawwal, and number of days in this Ramadan:**

Calculation 3 and Calculation 5 = 29 days Ramadan - **Choice pairing**

## CALCULATION RESULTS FOR 8<sup>th</sup> YEAR HIJRAH

RAMADAN 08 HIJRAH							
<b>Calculation 1</b>							
<b>Date</b>	20/12/629 CE	<b>Day</b>	Wednesday	<b>G. Conjunction</b>	20/12/0629 CE, 14:43 LT		
<b>Sunset</b>	17:42	<b>Moonset</b>	17:33	<b>Lag Time</b>	-00H 09M	<b>Moon Age</b>	+02H 58M
<b>Relative Altitude</b>	-01°:40'		<b>Elongation</b>	+05°:05'		<b>Crescent Width</b>	+00°:00':04"
<b>Odeh's Criteria</b>	Not Visible Even With Optical Aid						
<b>Calculation 2</b>							
<b>Date</b>	21/12/629 CE	<b>Day</b>	Thursday	<b>G. Conjunction</b>	20/12/0629 CE, 14:43 LT		
<b>Sunset</b>	17:42	<b>Moonset</b>	18:29	<b>Lag Time</b>	+00H 47M	<b>Moon Age</b>	+26H 59M
<b>Relative Altitude</b>	+08°:38'		<b>Elongation</b>	+12°:37'		<b>Crescent Width</b>	+00°:00':22"
<b>Odeh's Criteria</b>	Visible With Optical Aid, Could Be Seen By Naked Eye						
<b>Calculation 3</b>							
<b>Date</b>	22/12/629 CE	<b>Day</b>	Friday	<b>G. Conjunction</b>	20/12/0629 CE, 14:43 LT		
<b>Sunset</b>	17:43	<b>Moonset</b>	19:25	<b>Lag Time</b>	+01H 42M	<b>Moon Age</b>	+51H 00M
<b>Relative Altitude</b>	+18°:53'		<b>Elongation</b>	23°:09'		<b>Crescent Width</b>	+00°:01':12"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

SHAWWAL 08 HIJRAH							
<b>Calculation 4</b>							
<b>Date</b>	19/01/630 CE	<b>Day</b>	Friday	<b>G. Conjunction</b>	19/01/0630 CE, 09:19 LT		
<b>Sunset</b>	18:02	<b>Moonset</b>	18:14	<b>Lag Time</b>	+00H 12M	<b>Moon Age</b>	+08H 43M
<b>Relative Altitude</b>	+02°:19'		<b>Elongation</b>	+04°:18'		<b>Crescent Width</b>	+00°:00':03"
<b>Odeh's Criteria</b>	Not Visible Even With Optical Aid						
<b>Calculation 5</b>							
<b>Date</b>	20/01/630 CE	<b>Day</b>	Saturday	<b>G. Conjunction</b>	19/01/0630 CE, 09:19 LT		
<b>Sunset</b>	18:03	<b>Moonset</b>	19:07	<b>Lag Time</b>	+01H 05M	<b>Moon Age</b>	+32H 44M
<b>Relative Altitude</b>	+13°:08'		<b>Elongation</b>	+14°:04'		<b>Crescent Width</b>	+00°:00':27"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

According to Odeh's Criteria, the first day of Sya'ban 8 AH fell on 23 November 629 CE. Hence, only Calculation 3 can be considered since it corresponds to 29 Sya'ban 8 AH.

**Possible Pairing of Beginning of Ramadan and Syawwal, and number of days in this Ramadan:**

Calculation 3 and Calculation 5 = 29 days Ramadan - **Choice pairing**

## CALCULATION RESULTS FOR 9<sup>th</sup> YEAR HIJRAH

RAMADAN 09 HIJRAH							
Calculation 1							
<b>Date</b>	10/12/630 CE	<b>Day</b>	Monday	<b>G. Conjunction</b>	09/12/0630 CE, 20:12 LT		
<b>Sunset</b>	17:37	<b>Moonset</b>	18:13	<b>Lag Time</b>	+00H 36M	<b>Moon Age</b>	+02H 58M
<b>Relative Altitude</b>	+06°:41'		<b>Elongation</b>	+11°:12'		<b>Crescent Width</b>	+00°:00':18"
<b>Odeh's Criteria</b>	Visible With Optical Aid Only						
Calculation 2							
<b>Date</b>	11/12/630 CE	<b>Day</b>	Tuesday	<b>G. Conjunction</b>	09/12/0630 CE, 20:12 LT		
<b>Sunset</b>	17:37	<b>Moonset</b>	19:15	<b>Lag Time</b>	+01H 37M	<b>Moon Age</b>	+45H 26M
<b>Relative Altitude</b>	+17°:36'		<b>Elongation</b>	+22°:49'		<b>Crescent Width</b>	+00°:01':13"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

SHAWWAL 09 HIJRAH							
Calculation 3							
<b>Date</b>	08/01/631 CE	<b>Day</b>	Tuesday	<b>G. Conjunction</b>	08/01/0631 CE, 11:20 LT		
<b>Sunset</b>	17:54	<b>Moonset</b>	18:01	<b>Lag Time</b>	+00H 07M	<b>Moon Age</b>	+06H 34M
<b>Relative Altitude</b>	+01°:26'		<b>Elongation</b>	+03°:31'		<b>Crescent Width</b>	+00°:00':02"
<b>Odeh's Criteria</b>	Not Visible Even With Optical Aid						
Calculation 4							
<b>Date</b>	09/01/631 CE	<b>Day</b>	Wednesday	<b>G. Conjunction</b>	08/01/0631 CE, 11:20 LT		
<b>Sunset</b>	17:55	<b>Moonset</b>	19:00	<b>Lag Time</b>	+01H 05M	<b>Moon Age</b>	+30H 35M
<b>Relative Altitude</b>	+12°:54'		<b>Elongation</b>	+14°:03'		<b>Crescent Width</b>	+00°:00':27"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

**Possible Pairings of Beginning of Ramadan and Syawal, and number of days in this Ramadan:**

- 1) Calculation 1 and Calculation 3 = 29 days Ramadan
- 2) Calculation 1 and Calculation 4 = 30 days Ramadan
- 3) Calculation 2 and Calculation 4 = 29 days Ramadan - **Choice pairing**

## CALCULATION RESULTS FOR 10<sup>th</sup> YEAR HIJRAH

RAMADAN 10 HIJRAH							
Calculation 1							
<b>Date</b>	29/11/631 CE	<b>Day</b>	Friday	<b>G. Conjunction</b>	29/11/0631 CE, 08:33 LT		
<b>Sunset</b>	17:35	<b>Moonset</b>	:1740	<b>Lag Time</b>	+00H 06M	<b>Moon Age</b>	+09H 02M
<b>Relative Altitude</b>	+01°:07'		<b>Elongation</b>	+06°:13'		<b>Crescent Width</b>	+00°:00':06"
<b>Odeh's Criteria</b>	Not Visible Even With Optical Aid						
Calculation 2							
<b>Date</b>	30/11/631 CE	<b>Day</b>	Saturday	<b>G. Conjunction</b>	29/11/0631 CE, 08:33 LT		
<b>Sunset</b>	17:35	<b>Moonset</b>	18:46	<b>Lag Time</b>	+01H 11M	<b>Moon Age</b>	+33H 02M
<b>Relative Altitude</b>	+12°:56'		<b>Elongation</b>	+18°:29'		<b>Crescent Width</b>	+00°:00':51"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

SHAWWAL 10 HIJRAH							
Calculation 3							
<b>Date</b>	29/12/631 CE	<b>Day</b>	Sunday	<b>G. Conjunction</b>	28/12/0631 CE, 20:28 LT		
<b>Sunset</b>	17:47	<b>Moonset</b>	18:36	<b>Lag Time</b>	+00H 49M	<b>Moon Age</b>	+21H 19M
<b>Relative Altitude</b>	+09°:30'		<b>Elongation</b>	+10°:50'		<b>Crescent Width</b>	+00°:00':17"
<b>Odeh's Criteria</b>	Visible With Optical Aid, Could Be Seen By Naked Eye						
Calculation 4							
<b>Date</b>	30/12/631 CE	<b>Day</b>	Monday	<b>G. Conjunction</b>	28/12/0631 CE, 20:28 LT		
<b>Sunset</b>	17:48	<b>Moonset</b>	19:40	<b>Lag Time</b>	+01H 53M	<b>Moon Age</b>	+45H 20M
<b>Relative Altitude</b>	+21°:56'		<b>Elongation</b>	+23°:38'		<b>Crescent Width</b>	+00°:01':21"
<b>Odeh's Criteria</b>	Easily Visible By Naked Eye						

**Possible Pairings of Beginning of Ramadan and Syawwal, and number of days in this Ramadan:**

- 1) Calculation 1 and Calculation 3 = 30 days Ramadan
- 2) Calculation 2 and Calculation 3 = 29 days Ramadan
- 3) Calculation 2 and Calculation 4 = 30 days Ramadan - **Choice pairing**