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Fajr Prayer Times Review in Fiqh, Astronomy, and Modern Instruments

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ABSTRACT

The fuqaha agree that the Fajr prayer begins at the shadiq dawn (the second dawn) which is signed by the white light appearance that spreads and stretches across the eastern horizon and ends until the sun rises. In Indonesia, many Falak figures use the depth of the Sun, which ranges from -18 to -20 degrees and even up to -14 degrees below the horizon, for the beginning of the Fajr prayer. The assignment of the Sun depth is based on the scholar's opinion, astronomical perspectives, and the results of dawn observations using modern instruments. The diversity of standards in determining the Fajr prayer beginning, makes Falak figures re-examine the appearance of the shadiq dawn. The results show that there is a difference in the determination of the initial time of the Fajr prayer based on Fiqh studies, astronomical perspectives, and the results of research in the field using modern instruments.

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I. Introduction

Knowing the prayer time beginning is a necessity and obligation for Muslims in the world because prayer is a routine of a servant to Allah swt from the morning until the night.[1] Muslims had to carry out the prayer by the time that set based on the words of Allah swt, the guidance of the hadith of the Prophet, the explanation or ijtihad of the fuqaha, and

the results of research and thoughts of falak figure and astronomers.[2] The main foundation *(dalil)* in performing prayers *(maktubah)* according to the time, as Allah swt said in QS. an-Nisa'/4:103

إِنَّ ٱلصَّلَوٰةَ كَانَتۡ عَلَى ٱلۡمُؤۡمِنِينَ كِتَٰبٗا مَّوۡقُوتٗا

It means, "Indeed, prayer is an obligation that is determined in time for those who believe.". (QS. an-Nisa'/4:103).

In contemporary and modern studies, there is a difference in determining the beginning of prayer times due to the position and movement of the Sun so there is a difference in the starting time.[3] In the Fajr prayer, the sun's position is still below the true horizon with a certain depth value to provide room for difference among scientists, falak, and astronomers in determining the position of the Sun at the time of the shadiq dawn.[4] There are different opinions in determining the beginning of Fajr because of different understandings and interpretations of the height of the Sun at the time of the dawn.[5] The main verse in starting the Fajr prayer at the time of the dawn of Sadiq is stated by Allah SWT in the Qur'an.[6]

وكلوا واشربوا حتى يتبين لكم الخيط الابيض من الخيط السود من الفجر

It means, "And eat and drink until it is clear to you the white of the black thread, which is the dawn" (QS. al-Baqarah/2: 187).

The dawn intended in the verse above is to start fasting and the beginning of the Fajr prayer time. Meanwhile, the dawn is explained in a hadith and this hadith is also the basis or the main foundation of scholars, falak figures, and astronomers in understanding the dawn, namely the kadzib dawn and the shadiq dawn.[7]

وعن ابن عباس رضي الله عنهما قال: قال رسول الله صلى الله عليه وسلم الفجر فجران: فجر يحرم الطعام ويحل فيه الصلاة وفجر يحرم فيه الصلاة , أي صلاة الصبح, ويحل فيه الطعام. (رواه ابن خزيمة والحاكم وصححاه)

It means "From Ibn Abbas radhiyallahu'anhu, He said that the Prophet said: The dawn is two (type): the dawn that prohibits eating and allowing prayer and the dawn that is not allowed to pray (Fajr) and eating (suhoor)". (HR. Ibnu Khuzaimah al-Hakim and both of them saheed it).

Based on the hadith above, the scholars agreed to divide the dawn into two (2), which

are the kadzib dawn and the shadiq dawn.[8] The kadzib dawn is a visible light on the Eastern horizon that rises upwards like Wolf's tail or in astronomy referred to as the zodiac light.[9] Kadzib dawn appears due to the scattering of sunlight by interplanetary dust. In astronomical view, the upward light is the result of the reflection of the Sun's light by the particles of the sky scattered among the planets in the solar system.[10] The emergence of the kadzib dawn has nothing to do with or relate to the determination of Islamic sharia laws.

Second, the shadiq dawn is a white light that spreads and stretches across the Eastern horizon that appears after the disappearance of the kadzib dawn.[11] The appearance of shadiq dawn is very closely related to the determination of worship times, such as fasting and the beginning of the Fajr prayer. The dawn light of the shadiq that appears on the eastern horizon will gradually continue to brighten until the rising of the sun. Scholars and falak figures agree that the Fajr prayer time begins when the shadiq dawn or the true dawn rises and ends until sunrise.[12]

Astronomy only recognizes the shadiq dawn because the light that has been seen will not return to darkness. The visible light will continue to process towards the distribution point by forming a larger angle. Fajar *(morning twilight)* in astronomical review is divided into three categories: (1) *civil twilight* is when the Sun is at an altitude of 6 degrees below the horizon, (2) *nautical twilight* is when the Sun is at an altitude of 12 degrees below the horizon, and (3) *astronomical twilight* is when the Sun is at an altitude of 18 degrees below the horizon.

In Indonesia, the Ministry of Religion (Kemenag RI) sets the beginning of the Fajr prayer time based on the dawn paradigm of shadiq, which is when the Sun is at 20 degrees below the horizon and the determination is considered to be by sharia and based on the research. However, falak figures, astronomers, and astronomy activists have conducted a lot of research in the field using modern instruments and provided data on research results that are quite varied, ranging from 19 to 14 degrees below the horizon. Thus, the initial determination of the dawn time among astronomers who make observations in the field using modern tools also still gives different results that are quite varied.

Looking back, the problem of the beginning of the Fajr time began when Shaykh Mamduh Farhan al-Bukhairi and the *Islamic Science Research Network team* of the University of Muhammadiyah Prof. HAMKA (ISRN UHAMKA) through writing and research results showed that the Fajr prayer time was too early, around 24 minutes from the scheduled

time.[13] The study results show that the depth of the Sun is between 17 to 14 degrees below the horizon.[14] This result is very different when compared to the Fajr time criterion based on the Ministry of Religion Republic of Indonesia which uses 20 degrees below the horizon.[15] This becomes a very serious problem among Muslims because Muslims carry out the Fajr prayer before entering the time.

The use of optical tools and other digital imagers in detecting the appearance of shadiq dawn is also still under debate because the results of one tool and the results of another tool get varying results. Meanwhile, the tools used in detecting the emergence of the shadiq dawn that are currently developing in Indonesia such as the *Sky Quality Meter (SQM)*, *All Sky Camera (ASC)*, *Sistem Otomatisasi Observasi Fajar (SOOF), Portable Twilight Meter (PTM),* etc.

With a variety of instruments used in detecting the appearance of the shadiq dawn, it also indirectly gives varying results related to the position of the Sun at the time of the appearance of the shadiq dawn. In addition, the use of modern instruments in detecting the appearance of shadiq dawn is still general, meaning that there is a general standard in the instruments and data processing systems used. The absence of this standard is also the reason for the difference in determining the height of the Sun at the time of the shadiq dawn.

II. Method

This research is qualitative research with a *literature* study. The data is summarized in a qualitative context, which does not carry out the calculation process. However, it does not mean ignoring data in the form of numbers, such as the figures of the sun's height at the shadiq dawn from the results of research of various countries.[16] The research data is obtained from various previous studies such as journals, books, recent research results using modern instruments, and others related to the research topic.

III. Results and Discussion

Dawn (Fajr) in Fiqh and Astronomy Review

The scholars agree that the time for the Fajr prayer begins when the second dawn (shadiq dawn) rises. Linguistically, dawn *(al-fajr)* is the dark illumination of the night from the morning light.[17] The scholars agreed to divide the dawn into two, namely the kadzib dawn and the shadiq dawn as shown in Figure 1 as the hadith of the Prophet saw.

وَعَنْ اِبْنِ عَبَّاسٍ رَضِيَ ٱللَّهُ عَنْهُمَا قَالَ: قَالَ رَسُولُ ٱللَّهِ صلى الله عليه وسلم ٱلْفَجْرُ فَجْرَانِ: فَجْرٌ يُحَرِّمُ اَلطَّعَامَ وَيُحِلُّ فِيهِ اَلصَّلَاةَ وَفَجْرٌ

تَرْكُ فِيهِ اَلصَّلَاةَ , أَيْ صَلَاةُ اَلصُّبْحِ, وَيَحِلُّ فِيهِ اَلطَّعَامُ. (رَوَاهُ اِبْنُ خُزَيْمَةَ وَالْحَاكِمُ وَصَحَّحَاهُ)

It means "And from Ibn Abbas (may Allah be pleased with him), he said that the Prophet said: the dawn is two: the dawn that prohibits eating and allowing prayer and the dawn that is not allowed to pray (Fajr) and it is permissible to eat (suhoor)". (HR. Ibn Khuzaimah al-Hakim and both of them saheeh it).

Figure 1. Illustration of the difference between the shadiq dawn (right) and the kadzib dawn (left)

The term dawn in the Qur'an is "*al-khaith al-abyadh*" (white thread) as the shadiq dawn and "*al-khaith al-aswad*" (black thread) as the kadzib dawn. Both terms can be seen in the words of Allah in the Quran.

وكلوا واشربوا حتى يتبين لكم الخيط الابيض من الخيط الاسود من الفجر

It means "And eat and drink until it is clear to you (the difference) between the white thread and the black thread, which is the dawn". (Q.S. al-Baqarah 187)

The verse explains the time of the Fajr prayer which is marked by the appearance of dawn and also gives the parable of the white thread *(al-khaith al-abyadh)* and the black thread *(al-khaith al-aswad).* The verse does not mention in detail the time of the Fajr prayer, but only a general description of the time of the Fajr prayer, namely the light of dawn. The verse above also provides a different interpretation among scholars regarding the time to perform the Fajr prayer.

Scholars differ on the start of Fajr prayer, whether when the sky is still in a state of *ghalas* (the darkness of the night that has been mixed with the presence of dawn) or when it is

already in the condition *of isfar*.[18] *Ghalas* is interpreted as an atmosphere that is still dark, so the companions at that time still did not recognize the faces of other companions. Meanwhile, *isfar* is interpreted when the companions have recognized each other's faces.[9] Some scholars are of the view that the time of the Fajr prayer is more important to be done at the time of *ghalas* than at the time of *isfar,* this is the opinion expressed by Imam Malik, Shafi'i, Ishaq, and others. As the hadith of the Prophet.

عن ابن شِهابٍ قال أخبرني عروةُ بنُ الزُبَيرِ أن عائشة أخبرته أن نِساء المؤمناتِ يشهدن مع رسول ا للهِ صلى ا للهُ عليهِ وسلم صلاة الفجر متلفِعاتٍ برُوطِهِن ثُم ينقلِبن إلى بُيوتِهِن حِين يقضي الصلاة لا يعرفهن أحد مِن الغلس

It means "Ibn Shuhab said, I have reported to 'Urwah bin Az Zubair that 'Aisyah reported to her, she said, We, the women of the Believers, used to pray the dawn prayer with the Rasulullah by covering their faces with a veil, then returned to their respective houses after the prayer was completed without anyone knowing because of the time of ghalas (the rest of the night)." (HR. Bukhari and Muslim).

The hadith explains those who come out after performing the Fajr prayer still do not recognize each other, which means that the dawn that appears is not so strong that the light emitted to the human eye is not so strong. Meanwhile, the argument related to carrying out the Fajr prayer at *the time of isfar,* as in the hadith of Rafi' bin Khadij.

عن رافِع بن خدِيج قال سمِعت رسول ا للهِ صلى ا للهُ عليهِ وسلم يقول أسفِروا بِالفجر فإنه أعظم لِلأجر

It means "From Rafi' bin Khadij he said, "I heard the Rasulullah say, Pray Fajr when it is a little noon because it is more rewarding". (HR. An-Nasa'i)

From the hadith, various interpretations create different comprehension of the primacy of Fajr prayer time. I*sfar* followers think that the purpose of the above hadith is to better

ensure the rise of the dawn itself. The meaning of "more rewards" is simply to show the validity of the prayer performed before *isfar* but the reward is less.

In astronomical review, the dawn of the shadiq is also called the true dawn where the sun's rays have hit the Earth's *atmospheric* layers, especially the thickest and lowest layer *(troposphere).* Thus the light component is scattered downwards to illuminate *the lower* troposphere layer.[19] While Kadzib's dawn is completely untouched by Earth's atmosphere, it is reflected by the *dust particles of the zodiac* in space. Based on astronomy, the phenomenon of Fajr time is almost the same as the time of Isha. The beginning of the time of Isha was marked by the appearance of stars in the sky due to the change of the sky from light to dark. The time of dawn is marked by the beginning of the dimming of the light of the stars in the sky due to the increasing brightness of the sunlight on the eastern horizon which indicates a change from dark to bright.

Astronomers divide dawn into two types, namely dawn in the morning and dawn at dusk.[20] The dawn at dusk is more widely known as shafaq[21]. Astronomically, morning *twilight* is divided into three types based on the height of the Sun below the horizon[22] as shown in Figure 2.

a. Astronomical twilight is a sign of the end of the night which is marked by the beginning of dimming the light of the stars in the sky, due to the beginning of the scattering of the Sun's light reflected by the Earth's *atmosphere*. Astronomical dawn can only be seen in certain places that are free from light pollution disturbances, both man-made light pollution and natural light pollution coming from celestial bodies such as the Moon.[23] Astronomical twilight occurs when the Sun is at an altitude of 18° below the horizon.
b. Nautical twilight *is a* dimmer sky condition than at civil dawn. The condition of the eastern sky has begun to be identified even though it still needs lighting assistance. Nautical dawn is the dawn that reveals the conditions of the horizon for sailors when the Sun is at an altitude of 12° below the horizon.
c. Civil twilight *is* when the sun has not yet risen but the sky conditions are bright enough that the horizon (in all directions)
d. can be easily identified. Objects around the horizon can also be easily recognized without the need for lighting assistance. The beginning of civil dawn can be recognized anywhere

as long as the sky is clear. Civil dawn occurs when the Sun is at an altitude of 6° below the horizon.

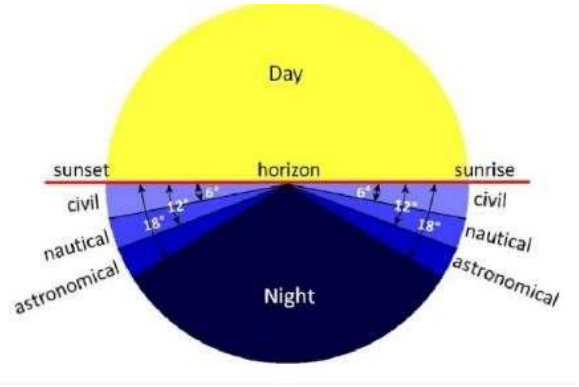

Figure 2. Astronomical division of dawn by height The sun is below the horizon.

The shadiq dawn in astronomy is understood as *astronomical twilight*,[24] The light begins to appear on the eastern horizon just before sunrise when the Sun is at about 18° below the horizon or equivalent to the Sun's zenith distance of 108°.[25] Another opinion is that the dawn of the Shadiq appears when the position of the Sun is at an altitude of 20° below the horizon or zenith distance of the Sun 110º.[3] In addition, some think based on the results of research conducted in the field that the shadiq dawn appeared at an altitude of 13° below the horizon.[18] Various interpretations and opinions on the position of the Sun at the time of the shadiq dawn in starting the Fajr prayer time. This is because the position of the Sun at the time of the shadiq dawn is still below the horizon, so it provides its difficulties in determining and identifying the position of the height of the Sun.

The scholars of hisab and rukyat have formulated the height of the Sun below the horizon according to the results of ijtihad and previous observations by setting the height of the Sun in the range of 16° to 20° below the horizon. Meanwhile, Indonesia through the Ministry of Religion of the Republic of Indonesia stipulates that the time of Fajr prayer begins when the height of the Sun is at 20° below the horizon.[26] This has been considered following sharia and strong research results.

The 20° standard for the time of Fajr is the idea of one of the Indonesian falak figures, Saadoe'ddin Djambek, who is also referred to as *mujaddid al-Hisab* (reformer of hisab thought). According to him, the time of Fajr begins with the appearance of the second dawn (Shadiq) next to the eastern horizon and ends with the rising of the Sun. The visibility of the shadiq dawn is defined by the position of the sun at 20° below the horizon. Abdur Rachim

said that the time of Fajr began when dawn was visible and at that time the height of the Sun was 20° below the horizon.[27]

Looking back, the use of the 20° standard for dawn time has not reached uniformity in Indonesia itself and in several countries and organizations around the world. Here are some of the standards for the height of the Sun used in determining the beginning of the Fajr and Isha prayers:

Table 1. Use of the Sun's depth angle for the time of Fajr and Isha in several countries in the world.[10]

Organization		Isya	Dawn
Islamic Society of North America (ISNA)		-15°	-17.5°
Muslim World League		-17°	-18°
Umm al-Qura University		-22.5°	-18.5°
Egyptian General Authority of Survey		-17.5°	-19.5°
University of Islamic Science, Karachi Malaysia Indonesia		-18° -18° -18°	-18° -18° -20° -18°

The table above shows that the depth of the Sun used in determining the beginning of Isha and Dawn starts from 15 to 20 below the horizon, of which the *limits* of 18 and 17 are the most dominant. This means that the observations of previous scientists and scholars still have alignment or similarity with the results of the latest research that has used modern

instruments that have obtained results ranging from 13 to 20 degrees below the horizon.

In this era, the determination of the dawn time (dawn observation process) has used and utilized optical instruments such as *Sky Quality Meter* (SQM), *Digital Single Lens Reflex* (DSLR), *All Sky Camera* (ASC), *Dawn Observation Automation System* (SOOF), PTM *(Portable Twilight Meter*), and other optical instruments. With the variety of instruments used in observing the shadiq dawn, differences in determining the beginning of the Fajr prayer time are also inevitable. Here are some studies of the shadiq dawn using modern instruments:

First, research was conducted by Tono Saksono which was published in a book entitled "*Evaluation of the Initial Time of Dawn & Isha Perspectives of Science, Technology, and Sharia*". The research used *Sky Quality Meter* (SQM) and *All Sky Camera* (ASC) sensors. The average research results obtained are that the shadiq dawn appears at an altitude of 13.4 degrees below the horizon.[9]

Second, a study conducted by Niswatul Kariimah entitled "*Edge Detection Application* to Determine the Dawn of Sadiq as an Early Determination of Dawn Time Using *the Matlab GUI*". This research was carried out in Dampit Village, a location of rice fields that still have minimal man-made light pollution, the research used the Canon EOS 1200D DSLR Camera instrument. The results of the study indicated that the Sun was at an altitude of 17 to 20 degrees below the horizon at the time of the shadiq dawn.[28]

Third, the author's research entitled "Observation of Shadiq Dawn Using *All Sky Camera* in Medan City". This research was conducted in the suburbs of Medan City where there is still minimal man-made light pollution (Patumbak, a suburb of Medan). The study found that the Sun was between 13 and 15 degrees below the horizon.[29]

Fourth, the research was conducted by the Astronomical Observatory team of the University of Muhammadiyah North Sumatra (OIF UMSU). The study was conducted at three locations in North Sumatra, namely Medan (UMSU Postgraduate Building on the 7th floor), Serdang Bedagai (Cermin Beach), and Barus, Central Tapanuli. In the study, the lowest Sun altitude was obtained which was 16.48 degrees below the horizon.

Fifth, the Center for Astronomy Studies at Ahmad Dahlan University (UAD) conducted the research. The research was conducted in Bantul, Yogyakarta using SQM instruments. In the study, the lowest Sun altitude was 15.75 degrees below the horizon.[30]

From the research, it is concluded that the use of modern instruments also provides room for differences in determining the height of the Sun at the time of the shadiq dawn, it is evidenced by the differences in the height of the Sun obtained in the field. So the use of modern instruments in observing the shadiq dawn has also not yet found a common point, meaning that it still provides room for differences in determining the beginning of the shadiq dawn so that the difference in starting the Fajr prayer is also still different. To realize a comprehensive study on the beginning of the shadiq dawn, a *standard operating procedure* (SOP) is needed both in terms of the use of instruments and the data processing system used so that there is uniformity in observing the appearance of the shadiq dawn.

IV. Conclusion

The scholars agree that the Fajr prayer begins at dawn and ends when the Sun rises. Getting a visual image of the early appearance of the shadiq dawn by the instrument is needed so that one can record the light of dawn even though the Sun is still below the horizon. The use of modern instruments in observing the appearance of the shadiq dawn yields different results because the results obtained with various instruments differ. For this reason, a *Standard Operating Procedure (*SOP) is needed to observe the appearance of the shadiq dawn so that the observations made adhere to the agreed standards.

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