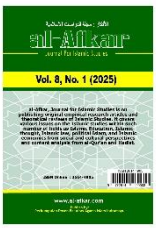

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Comparative Analysis of Embryological Stages in the Qur'an and Contemporary Science

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Comparative Analysis of Embryological Stages in the Qur'an and Contemporary Science

Abstract. This article analyzes the correspondence between the embryological stages described in the Qur'an and contemporary scientific findings through a comparative and analytical approach. The study focuses on the description of the stages of human creation in Surah Al-Mu'minun: 12–14, which includes the stages of nuthfah, 'alaqah, mudghah, and bone formation and flesh formation. This Qur'anic description is then examined by comparing it to the scientific classification of the processes of fertilization, implantation, somite formation, and organogenesis as described in modern embryology. This study attempts to demonstrate that although the Qur'an was not intended as a biological text, its step-by-step narrative has relevant conceptual correspondences with scientific

findings, particularly in describing the gradual transformation of embryonic growth. Furthermore, this study emphasizes that the dialogue between interpretation and science should not be directed at forcing literal similarities, but rather at finding epistemological common ground that can enrich understanding of the Qur'an's message and contribute to the development of scientific interpretation studies. The results of the study show that a proportional comparative approach can open up space for constructive integration between the text of revelation and modern science.

Keywoards: Qur'anic Embryology, Scientific Interpretation, Contemporary Science, Tafsir Ilmi

INTRODUCTION

The study of the relationship between the Qur'an and modern science is a continually evolving academic discourse, particularly when it concerns the process of human creation. In the Qur'an, in addition to explanations of beliefs (aqidah), rules, or moral messages, in the Qur'an there are also guidelines for gaining an understanding of the mysteries of the universe (Mummad Raffie, 2023). In this context, the verses on embryology in the Qur'an, particularly Surah Al-Mu'minun: 12–14, have attracted the attention of many scholars because they contain a step-by-step description of embryonic development. This discourse is not only of interest to commentators but also to biologists who see the potential for dialogue between the revealed text and contemporary empirical findings (Shalabi, 2018). As the study of scientific interpretation develops in the Islamic world and Indonesia, interest in integrating scientific and theological perspectives is growing. This approach attempts to reread the verses of the Quran using scientific tools without diminishing the authority of the religious text itself (Shihab, M. Quraish, 2019). However, this integration is never free from methodological polemics, particularly regarding the extent to which science can be used as a tool for interpreting Qur'anic verses. Some scholars warn of the dangers of scientific apologetics, namely the attempt to justify the Qur'an with changing scientific data (Guessoum, 2011).

In the context of Qur'anic embryology, the debate is even more complex. Some researchers, such as Maurice Bucaille, have attempted to demonstrate that the Qur'anic exposition is remarkably compatible with modern science, while others have criticized this approach for being too literal and failing to consider the context of classical Arabic (Bucaille, 1995). This criticism has sparked a new, more cautious approach: viewing the Qur'an not as a biological text, but as a text of guidance that uses a universal language that can be understood across time (Rahman, 2009). This approach places greater emphasis on conceptual correspondence than on precise anatomical identification.

The verses of QS. Al-Mu'minun: 12–14 contain a number of terms that sequentially describe the transformation of the embryo: nuthfah, 'alaqah, mudghah, up to the formation of bones and the wrapping of flesh. Many classical commentators such as al-Tabari, al-Razi, and Ibn Kathir interpreted these terms based on Arabic linguistic tools and the biological understanding of their time (Al-Tabari, 2001). Meanwhile, modern commentators such as Muhammad Abduh, Tantawi Jauhari, and Quraish Shihab try to connect the meaning of the verses with the development of

scientific knowledge, while maintaining the principle that science should not take over the authority of revelation (Jauhari, 2005). This difference in perspective makes comparative studies increasingly important to assess the extent to which correspondence between the two can be established proportionally.

Scientifically, modern embryology classifies embryonic development through several stages: fertilization, cell division, implantation, somite formation, organogenesis, and primary ossification (L. Moore, 2016). Each stage has specific biological characteristics that allow researchers to conceptually map the potential correspondence between the Qur'anic descriptions. This comparative research does not seek to find an identical match, but rather seeks to integrate two distinct epistemologies: revelation and empirical observation. Thus, the dialogue between the Qur'an and science is no longer understood as an attempt to prove one over the other, but rather as a means of expanding the horizons of human understanding.

Therefore, this study was conducted to provide an objective and proportionate comparative analysis of the stages of embryology in the Qur'an and contemporary science. Through an approach of interpretation, basic linguistics, and modern scientific analysis, this research is expected to contribute to the study of scientific interpretation in Indonesia, which still faces methodological challenges. This research also confirms that the integration of science and revelation is not only possible but also essential for building an adaptive and contextual Islamic scientific tradition.

RESEARCH METHODS

This study uses a comparative approach to examine the correspondence between the embryological stages in the Qur'an and contemporary scientific findings. This approach was chosen because it allows the researcher to place two authoritative sources religious texts and empirical scientific data in a proportional dialogue without negating each other. Through a structured comparison, this study not only maps the points of intersection (correspondence) between the two but also highlights points of difference (divergence) that can enrich epistemological understanding in both tafsir studies and biomedical science studies. A comparative approach in Islamic studies has been used by several modern scholars to critically and academically assess the relevance of revealed texts to the development of science (Armas, 2017).

The analysis was conducted through two main approaches: exegetical analysis and scientific analysis. The exegetical analysis involved exploring the lexical meaning of key terms nuthfah, ‘alaqah, and mudghah and their context in QS. Al-Mu’minun: 12–14 by referring to classical exegetical works such as Tafsir al-Tabari, al-Qurtubi, and Ibn Kathir, as well as modern exegetes such as Sayyid Qutb, M. Quraish Shihab, and Wahbah al-Zuhayli (And‘Far al-Tabari, 1998). The scientific analysis drew on modern embryology literature, particularly regarding the stages of fertilization, implantation, gastrulation, somite formation, and organogenesis (L. Moore, 2020). These two forms of analysis were combined to interpret the verse interdisciplinary while maintaining the methodological boundaries between the revealed text and empirical observation.

The research data sources consist of primary and secondary materials. Primary materials include the Qur'an and authoritative works of interpretation from various historical periods. Primary scientific materials include modern classic embryology books such as Keith L. Moore's *The Developing Human* and relevant scientific publications from medical and reproductive biology journals (Abdullah, 2003: 341–356). Meanwhile, secondary materials include articles, theses, encyclopedias, and previous studies related to scientific interpretation and the integration of Islam and science (Abdullah, 2003: 210–260).

The selection of materials was conducted purposively, selecting sources with academic authority, data reliability, and direct relevance to the research focus. The collected data were then analyzed qualitatively using textual and conceptual comparison techniques. The validity of the analysis was maintained through source triangulation, which involved comparing the exegetes' explanations with scientific theories and the interpretations of various contemporary researchers. Thus, this method provides a systematic basis for objectively assessing the correspondence and distinction between the Qur'anic narrative and modern embryology.

RESULTS AND DISCUSSION

The Concept of Embryology in the Qur'an

The discussion of embryology in the Qur'an generally centers on a series of verses in the Qur'an. Al-Mu'minun: 12–14, which presents a gradual description of the creation of man. These verses contain the sequence of events ranging from *nuthfah*, *'alaqah*, *mudghah*, bone formation (*'idham*), to bone dressing with flesh (*lahm*). This tiered narrative has been the basis of both classical and contemporary studies of the relationship between revelation and the life sciences. Al-Razi emphasized that the preparation of these stages shows the miracle *of order (nizham*) of human creation as well as God's power in the process of embryo growth (al-Razi, 1999). Ibn Katsir also interpreted this stage as a form of creation gradualism that shows the origin of human beings from small substances that then develop into complex structures (Katsir, 1997). Terminologically, *nuthfah* is understood by mufasir as "a little water" or "a drop of semen" which is the origin of human occurrences (Al-Tabari, 2001). Meanwhile, *'alaqah* is classically understood as "a clot of blood sticking" (Al-Zamakhsyari, 2006), while some modern mufasir such as Rashid Rida and Quraish Shihab see the term as referring not only to color or substance, but also to the nature of "sticking" to the walls of the womb (Shihab, 2005). The term *mudghah* is interpreted as "a lump of chewable meat", describing the structure of the embryo in the initial differentiation phase (Al-Alusi, 1995).

Contemporary studies tend to interpret these three terms not as literal biological definitions, but as a form of linguistic representation that the Qur'an uses to describe the gradual process of human development. Seyyed Hossein Nasr, for example, emphasized that the verses of human creation need to be understood within the framework of the spiritual cosmology of the Qur'an, not just a material description (Hossein Nasr, 1996). This approach allows for a more proportionate dialogue between the text of revelation and modern scientific description.

Embryology in Contemporary Science

In the study of modern science, embryology is a branch of developmental biology that studies the process of formation of organisms from fertilization to the fetal stage. This process begins with fertilization, which is the fusion of sperm and ovum cells that produce zygotes. This stage is in line with the concept of "initial substance" which in Qur'anic discourse is represented through the term *nuthfah (*Moore, 2003). After fertilization, the zygote undergoes a gradual *cleavage* and forms a morula, then develops into a blastocyst.

The next stage is implantation, which is the attachment of blastocysts to the uterine wall. At this point, the embryo begins to really "attach", which in modern embryology is called the process of adhesion and invasion of the trophoblast (Carlson, 2014). Some contemporary Muslim scholars associate this stage with the description of *'alaqah* as something that is attached and dependent, although the scientific explanation cannot be reconciled literally.

The next stage of development is the formation of somite, which is a block of mesodermal tissue that then develops into bones, muscles, and connective tissue (Sadler, 2015). This phase exhibits the structure of a "tugged lump of meat" which in some biological literature is often described as resembling a small piece of meat, so some Muslim writers associate it with the term *mudghah.*

Next, the process of organogenesis takes place when primary organs begin to form. During this time frame, osteogenesis occurs, which is the process of bone formation through two main mechanisms: *intramembranous ossification* and *endochondral ossification (*Schoenwolf, 2015). At this stage, the cartilage tissue gradually turns into bone, then is enveloped by layers of muscle and flesh, which is narratively in line with the Qur'anic verse about the formation of the bone and its dressing with meat. The growth and development of the fetus in general based on medical science is divided into 3 trimesters, namely the first trimester for the first 3 months, the second trimester for the next 3 months, and the last trimester for the last 3 months of pregnancy. In a matter of days, pregnancy is experienced for 280 days by going through three important periods, namely preimplantation, embryonic, and fetal period (Suryani, 2019).

Overall, modern embryology provides a detailed biological framework with which to engage dialogue to understand the Qur'anic description of human creation. However, the comparative approach must still maintain the epistemological boundaries of each discipline, so that the dialogue between revelation and science is not trapped in excessive conceptual equalization.

Comparative Analysis of the Stages of Embryology in the Qur'an and Contemporary Science

a. *Nuthfah* and Fertilization Stage

The level *of nuthfah* in QS. Al-Mu'minun: 12–13 refers to the early phase of human creation of a "drop of water" which linguistically refers to a very small volume of human reproductive fluids. Classical scholars such as al-Tabari interpret *nuthfah* as semen that is "collected in the womb" as the beginning of the process of human events (Al-Tabari, 2001). This interpretation was later deepened by al-Razi who

affirmed that *nuthfah* does not only mean sperm, but a mixed genetic element of males and females (Fakhr al-Din al-Razi, 1991). The term "nuthfah" which refers to semen can be associated with the fertilization process, in which the sperm and ovum meet to form a zygote that contains all the genetic information of the human being (Ahmad Turmudzi, 2025). This approach shows that the mufasir have understood *nuthfah* as a phase that involves the meeting of two biological elements.

In modern embryology, this phase is parallel to the fertilization process, which is the union of sperm cells and ovum cells that give birth to a zygote. Prenatal development occurs in three stages, namely germinal, embryonic and fetal. During this prenatal stage, the zygote that was initially just one cell then grows into an embryo that then becomes a fetus (Cindy et.al, 2023). This process involves genetic recombination, chromosomal formation, and cleavage) (Bruce M. Carlson, 2019). This stage is very much in line with the concept *of nuthfah amsyaj* (water mixture) in QS. Al-Insan: 2. Thus, there is a strong conceptual correspondence between the Qur'anic description of *nuthfah* and the process of fertilization in contemporary science.

b. The Stage *of 'Alaqah* and Implantation

The term *'alaqah* lexically means "a clot of blood", "something sticking", or "a small lee". Ibn Kathir emphasizes the meaning of "something that adheres to the wall of the uterus" (Ibn Kathir, 1999), while al-Qur'an tubi explains that *'alaqah* describes an embryo that depends on obtaining nutrients from the mother's body as a leech attaches itself to its host (Al-Qur'an tubi, 2006). This descriptive-contextual approach shows that *'alaqah* describes the embryonic phase after implantation.

In contemporary biology, the implantation process occurs when the blastosis attaches to the endometrium and begins to form nutrient relationships through the initial placenta (.W. Sadler, 2019). At this stage, the embryo undergoes a rapid transformation, attaches strongly, and enters into biological interaction with the mother's body a process that is conceptually similar to the *characteristics of 'alaqah* described in the Qur'an.

c. The *Mudghah Stage* and the Formation of Somite

The term *mudghah* in language means "a lump of chewable meat". Al-Tabari explains that the *mudghah* shape describes a small embryo that "does not have a perfect shape but has a protrusion pattern that will become a limb" (Al-Tabari,). This interpretation is very parallel to the development of somite in modern embryology, where embryos begin to show segmented protrusions (somite blocks) that later develop into muscles, spine, and other body tissues (Scott F. Gilbert, 2020).

Scientifically, this stage marks the beginning of organogenesis. The embryo undergoes the formation of the basic structure of the organ through cell differentiation and segmentation. Images of embryos in weeks 4 to 6 show a visual that is very similar to *the mudghah*'s description as "a lump that looks like a chewed mark" (Keith L. Moore, 2016). This finding shows consistency between the Qur'anic description and the somite phase.

d. Bone Formation and Primary Ossification

The Qur'an explains that after the *mudghah phase*, the embryo enters the stage of bone formation (*fakhalaqna al-mudghah 'izhaman*) and then the dressing of the bones with flesh (*fakasawna al-'izhama lahma*). Tafsir Ibn 'Ashur says that this stage

describes a gradual process that indicates the development of hard structures (bones) and soft tissues (muscles) (Ibn 'Ashur, 1984).

In modern embryology, this process is known as *primary ossification*. In this phase, bones begin to form through condrigification and ossification, then are lined by skeletal muscle tissue that develops from somite. Empirically, the biological stages that science has found are very coherent with the Qur'anic sequence: bone formation occurs first, followed by the development of muscle mass. According to Moore This suggests a correspondence between Qur'anic sequences and modern scientific observations.

The Epistemological Meeting Point of Embryology in the Qur'an and Contemporary Science

A comparative study of the Qur'anic embryological narrative and the findings of modern embryology shows a significant epistemological convergence. First, the structure of the Qur'anic delivery which explains the stages of nuthfah, 'alaqah, mudghah, to the formation of bones and flesh shows a pattern of *gradual development* as recognized in modern biology. Although the Qur'an uses descriptive and metaphorical language, the gradual pattern corresponds to the processes of fertilization, implantation, somite formation, and primary ossification described by contemporary embryological scientists (Keith L. Moore, 2020:45). This common ground is not identical, but conceptual that is, similarity in the grand idea of sequential transformations in embryos.

Second, both classical interpretation and scientific research emphasize the *accuracy of the sequence of development* as part of an orderly system of creation. The Qur'an describes the creation of man through several separate but interconnected phases, while science describes the biological stages that develop from the zygote to the embryo and fetus. Both describe developments that follow certain laws, thus opening up the possibility of an equal epistemological dialogue between the two domains of knowledge (Shihab, 2006).

Third, the integration between interpretation and science has methodological boundaries that are important to pay attention to. Interpretation should not be forced to follow scientific findings that are variable in nature, just as science cannot be used as a normative basis for the meaning of sentences. Scholars of scientific interpretation have emphasized that the relationship between the text of revelation and modern science is *complementary*, not *reductionist (*Zaghlul al-Najjar, 2010). Therefore, the ideal integration is a conceptual correspondence model, not a literal terminology match.

Fourth, this study affirms the principle of prudence in reading kauniyah verses. As al-Ghazali reminds us, rational and empirical approaches are not at odds with revelation as long as they are placed in the appropriate epistemological domain (Abu Hamid al-Ghazali). The integration of interpretation and science must avoid two extremes: scientism (forcing the verse to follow the scientist) and narrow literalism (rejecting science altogether). Thus, epistemological convergence points can be realized when the two domains are proportionally connected.

In the end, the epistemological meeting point between the Qur'an and science in the study of embryology is not intended to prove the scientific truth of the Qur'an, but rather to show the depth of the Qur'anic description and the richness of the scientific perspective in understanding the process of human creation. According to Permono (2018), states that the Qur'an implies science and commands humans to gain knowledge, but he firmly rejects the notion that the Qur'an contains science an sich or should be the basis of the laws of science (Baiki Al Iman, 2025). This approach provides a great opportunity for the development of a more critical, inclusive, and methodological interpretation of science in the Indonesian academic context.

CONCLUSION

This study concludes that between the embryological narrative of the Qur'an and modern embryology there is a significant conceptual correspondence, especially related to the structure of the stages of human development from the nuthfah phase to the formation of bones and flesh. Through comparative analysis, it can be seen that the Qur'an provides a gradual picture that is in harmony with the structure of biological development that contemporary science explains, albeit with a different style of language. These findings confirm that the Qur'an is not a biology book, but contains a universal description that can be re-understood through a scientific approach.

Nevertheless, the integration of interpretation and science must be placed in a proportionate epistemological corridor. Attempts to match the text of revelation with scientific theory should be avoided literally, while conceptual and methodological dialogue still needs to be developed. This approach allows for the enrichment of the understanding of kauniyah verses while strengthening the academic tradition of scientific interpretation in Indonesia. Thus, comparative research between the Qur'an and science can serve as a means of establishing a harmonious perspective between revelation and modern science.

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