Al-Muhajirin International Conference

Exploring the relationship of the Qur'an, Hadith, and gender determination

Muhammad Khafidz Razaq
Undergraduate Program in Biology, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, Depok, West Java 16424, Indonesia
muhammad.khafidz@ui.ac.id

Anom Bowolaksono
Cellular and Molecular Mechanisms in Biological Systems (CEMBIOS) Research Group, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, Depok, West Java 16424, Indonesia
alaksono@sci.ac.id

Astari Dwiranti
Cellular and Molecular Mechanisms in Biological Systems (CEMBIOS) Research Group, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, Depok, West Java 16424, Indonesia
astari.dwiranti@sci.ui.ac.id

Abstract
This review explores the intersection between the *Glorious Qur'an* and *Hadith* with contemporary scientific research on pH-based gender determination. The investigation begins by examining the physiological roles of pH levels in female reproductive organs and semen, particularly how these conditions affect sperm viability and motility. Studies show that the vaginal environment can favor either X- or Y-bearing sperm, influencing the likelihood of conceiving a male or female child. Y-bearing sperm are reported to have higher forward velocity but greater sensitivity to environmental changes compared to X-bearing sperm. Research also indicates that acidic conditions, high temperatures, or elevated reactive oxygen species (ROS) may increase the prevalence of X-bearing sperm. This review synthesizes these findings and connects them to relevant passages from the *Qur'an* and *Hadith*, aiming to foster interdisciplinary discourse between faith and science on the mechanisms of sex determination. Ultimately, the study suggests that pH-based approaches may have potential applications in reproductive planning and highlights the importance of further research in this field.

Keywords: pH; sperm; vagina; gender determination; Qur'an

Introduction

The desire to choose the sex of one's child has captivated parents for generations. In contemporary times, this is made possible through advanced medical technologies such as preimplantation genetic diagnosis (PGD). However, these modern techniques are often expensive, invasive, pose potential health risks, and raise significant ethical concerns. Consequently, natural methods have been considered as alternatives, even though many remain scientifically unproven and speculative. One such method involves timing intercourse around ovulation, which is believed to increase the likelihood of conceiving a child of a specific sex. This belief is based on the notion that sperm carrying the X or Y chromosome exhibit different behaviors, potentially influencing which sperm fertilizes the egg (Geraedts & De Wert, 2009).

From an Islamic perspective, the *Qur'an* and *Ḥadīth* emphasize that the creation of life and the determination of a child's sex lie ultimately in the will of Allah. The *Qur'an* explicitly acknowledges the role of both male and female in human reproduction:

يَا أَيُّهَا النَّاسُ إِنَّا خَلَقْنَاكُم مِّن ذَكَرٍ وَأُنثَىٰ

"O humanity! Indeed, We created you from a male and a female" (*Qur'an* 49:13).

This verse not only highlights the dual contribution in human creation but also underscores the divine wisdom in gender differentiation. Complementing this, the Prophet Muhammad ﷺ explained the biological aspect of sex determination in a well-known *ḥadīth*:

مَاءُ الرَّجُلِ أَبْيَضُ، وَمَاءُ الْمَرْأَةِ أَصْفَرُ، فَإِذَا اجْتَمَعَا فَعَلَا مَنِيُّ الرَّجُلِ مَنِيَّ الْمَرْأَةِ أَذْكَرَ بِإِذْنِ اللَّهِ، وَإِذَا عَلَا مَنِيُّ الْمَرْأَةِ مَنِيَّ الرَّجُلِ أَنْثَى بِإِذْنِ اللَّهِ

"The reproductive fluid of the man is white and that of the woman is yellow. When they have sexual intercourse and the male's substance prevails over the female's, it results in a male child by Allah's decree. But if the female's substance prevails, it results in a female child by Allah's decree." (*Ṣaḥīḥ Muslim*, ḥadīth no. 315).

This narration provides a theological insight that aligns with modern biological understanding, suggesting that the predominance of either male or female reproductive fluid may influence the outcome of the child's sex, though always by the will of Allah.

In the broader context of human life, the *Qur'an* affirms the intentional creation of both genders and their complementary roles. When paired with modern scientific studies, particularly on pH-based mechanisms in the reproductive system, these revelations provide a rich area of inquiry. Emerging research suggests that the vaginal environment's pH level can affect the viability of X- and Y-bearing sperm, potentially influencing the likelihood of conceiving a male or female offspring. This study seeks to bridge scientific findings with divine revelation by examining how physiological conditions described in empirical research may correspond with concepts articulated in the *Qur'an* and *Ḥadīth*. In doing so, it aims to foster a balanced discourse that respects both religious understanding and scientific evidence in the exploration of gender determination.

pH condition of the vagina and semen

The pH level within the human body reflects the concentration of free hydrogen ions in its aqueous fluids. In reproductive health, the vaginal environment is notably acidic, a condition essential for maintaining physiological balance and defending against pathogens. This low pH is closely associated with high estrogen levels in women of reproductive age, which promote the accumulation of glycogen in the vaginal epithelium. The metabolism of this glycogen by resident microbial populations—primarily *Lactobacillus* species—produces organic acids, predominantly lactic acid, thereby sustaining an acidic pH ranging from 4.0 to 4.5. Such conditions significantly inhibit the growth of many pathogenic organisms.

Over time, *Lactobacillus* species, particularly *Lactobacillus crispatus*, have been recognized as dominant and beneficial constituents of the vaginal microbiota. Their metabolic activity is central to maintaining vaginal acidity and protecting women of reproductive age from urogenital infections (Linhares et al., 2019; Hassan, 2005; Witkin, 2017). A comprehensive study on the vaginal microbiome identified that microbial

community types dominated by *L. crispatus*maintained the lowest median pH, approximately 4.0 ± 0.3 (Ravel et al., 2011).

Furthermore, significant ethnic variations have been observed in the composition and dominance of vaginal microbiota, indicating that genetic, environmental, and cultural factors influence microbial colonization. Studies have found that *Lactobacillus* species are more prevalent in Caucasian and Asian women, while Black and Hispanic women often present a more diverse microbiota with reduced *Lactobacillus* abundance and increased anaerobic bacteria. These differences are reflected in the median vaginal pH values: 5.0 ± 0.59 in Hispanic women and 4.7 ± 1.04 in Black women (Ravel et al., 2011; Zhou et al., 2007).

In contrast, seminal plasma—commonly referred to as semen—exhibits a more alkaline nature. It is primarily composed of secretions from the seminal vesicles (50–80%) and the prostate gland (13–30%), with minor contributions from the bulbourethral (Cowper's) and Littre glands. The pH of semen typically ranges between 7.2 and 7.8, a level crucial for sperm viability as it helps counterbalance the acidic environment of the vagina (World Health Organization [WHO], 2010). A pH below 7.2 may suggest an obstruction in the seminal vesicles, while a pH around 8.0 is often indicative of infection.

A study by Dhumal et al. (2021) reported an average semen pH of 8.2 across all analyzed samples, with only 48% falling within the WHO-defined normal range. Similarly, Haugen and Grotmol (1998) found higher average semen pH levels—8.2 using a pH meter and 8.4 using pH paper—among a cohort of young, healthy medical students. These findings suggest that while WHO guidelines offer a reference, individual and environmental factors may influence seminal pH.

This physiological opposition—acidic vaginal pH and alkaline seminal pH—creates a chemical interface that may differentially affect the survival and motility of X- and Y-bearing sperm, a concept explored further in subsequent sections.

X- or Y-bearing sperm in relation to various pH conditions

Spermatozoa are highly specialized, motile cells that carry either an X or Y chromosome, which ultimately determines the chromosomal sex of the fertilized oocyte (MacLaughlin & Donahoe, 2004). While the theoretical distribution of X- and Y-bearing sperm is approximately equal at a 1:1 ratio, empirical evidence suggests that this balance can be altered by various environmental stressors, including changes in pH levels and exposure to external toxins (Umehara et al., 2019).

Several studies have observed that Y-bearing sperm generally demonstrate greater forward motility compared to their X-bearing counterparts (Shettles & Rorvik, 2006). However, this higher motility is offset by their increased sensitivity to environmental stress. Y-chromosome-bearing sperm are more vulnerable to fluctuations in temperature, reactive oxygen species (ROS), and acidic conditions than X-bearing sperm, which exhibit greater structural resilience and adaptability (You et al., 2017).

Experimental studies in humans have shown that sperm incubated in environments characterized by elevated temperatures, acidic pH, or increased oxidative stress tend to yield a higher proportion of X-bearing sperm (Oyeyipo et al., 2017). These observations suggest that it may be possible to influence the sex ratio of sperm

populations through controlled manipulation of environmental factors—a practice known as sperm sexing.

The theory proposed by Shettles (1970), known as the Shettles Method, supports this view by asserting that X-bearing sperm are more tolerant to acidic environments and adverse physiological conditions. Later studies reinforced this theory, indicating that X-bearing sperm maintained greater viability across a wider pH range during incubation at 37°C over a 3–5 day period (You et al., 2017). These findings imply that in situations where fertilization does not occur immediately after intercourse, and sperm are required to survive longer within the female reproductive tract, the differential endurance of X- and Y-bearing sperm may influence the eventual chromosomal sex of the offspring.

This interplay between sperm chromosomal content and environmental conditions, particularly vaginal and seminal pH levels, serves as a foundational concept in natural approaches to gender selection. While the mechanism is not absolute and remains probabilistic, these biological insights offer a plausible explanation for the variability observed in natural conception outcomes.

Study of how X- and Y-bearing sperm respond to various pH conditions in sex determination

Recent scientific investigations have explored the relationship between vaginal pH and fetal sex determination, adding empirical depth to long-standing hypotheses about environmental influences on the success of X- and Y-bearing sperm. A study conducted by Gaber, Saleh, and Allam (2020) involved 20 women aged between 21 and 37 years. Researchers collected vaginal swab samples during the pre-ovulatory period to assess the pH levels of the vaginal environment.

The results revealed a statistically significant correlation between vaginal pH and fetal sex. Specifically, acidic vaginal conditions were predominantly associated with the conception of female fetuses, while alkaline environments correlated with a higher likelihood of conceiving male fetuses. These findings suggest a potential biological mechanism for preconception sex determination, wherein the vaginal pH selectively favors the survival and motility of either X- or Y-bearing sperm.

Interestingly, these scientific findings echo descriptions found in Islamic tradition. As mentioned previously, a *ḥadīth*recorded in *Ṣaḥīḥ Muslim* states:

مَاءُ الرَّجُلِ أَبْيَضُ، وَمَاءُ الْمَرْأَةِ أَصْفَرُ، فَإِذَا اجْتَمَعَا فَعَلَا مَنِيُّ الرَّجُلِ مَنِيَّ الْمَرْأَةِ أَذْكَرَ بِإِذْنِ اللَّهِ، وَإِذَا عَلَا مَنِيُّ الْمَرْأَةِ مَنِيَّ الرَّجُلِ أَنْثَى بِإِذْنِ اللَّهِ

"The reproductive fluid of the man is white and that of the woman is yellow. When they have sexual intercourse and the male's substance prevails over the female's, it results in a male child by Allah's decree. But if the female's substance prevails, it results in a female child by Allah's decree." (*Ṣaḥīḥ Muslim*, ḥadīth no. 315)

This narration can be interpreted in light of modern reproductive science, whereby the "predominance" of the woman's reproductive fluid may imply a more acidic vaginal environment. Under such conditions, Y-bearing sperm—being more fragile—are less likely to survive, thus increasing the probability that an X-bearing sperm fertilizes the egg, resulting in a female offspring (XX). Conversely, if the environment is more alkaline and less hostile to Y-bearing sperm, the chances of conceiving a male child (XY) may increase.

Nonetheless, the *ḥadīth* wisely concludes both scenarios with the phrase *"bi idhnillāh"* (by Allah's decree), underscoring that while biological mechanisms may influence probabilities, the final outcome is ultimately determined by divine will. This caveat highlights the limitations of relying solely on scientific methods for guaranteed outcomes in sex selection.

Therefore, while pH-based preconception strategies may offer a degree of influence, they cannot guarantee a particular result. Rather, they should be viewed as supplementary tools within the broader, divinely governed process of human creation.

Conclusion

The integration of verses from the *Glorious Qur'an* and narrations from the *Ḥadīth* with contemporary scientific findings reflects the magnificence of Allah's creation and the depth of divine wisdom. While sacred texts are not intended as scientific manuals, they often contain descriptions that resonate with modern empirical discoveries. In the context of sex determination, the *Qur'an* and *Ḥadīth* highlight the joint contribution of both male and female reproductive substances, while scientific research supports the notion that environmental conditions—particularly pH levels—within the female reproductive tract play a significant role in influencing which sperm reaches and fertilizes the oocyte.

This paper underscores the necessity of further research, particularly in simulating the journey of sperm through the female reproductive system under various physiological conditions. By conducting studies that replicate real-time fertilization processes, researchers may gain deeper insight into how specific vaginal environments affect the viability and motility of X- and Y-bearing sperm. Such studies could also refine our understanding of the mechanisms that lead to natural sex selection, while remaining grounded in the theological framework that acknowledges the ultimate authority of Allah in determining the outcome.

Ultimately, the intersection of divine revelation and empirical science does not suggest conflict, but rather a complementary relationship—one where scientific exploration can illuminate the signs of creation, and faith can provide ethical and philosophical context for that knowledge.

References

Dhumal, S. S., Naik, P., Dakshinamurthy, S., & Sullia, K. (2021). Semen pH and its correlation with motility and count: A study in subfertile men. *JBRA Assisted Reproduction, 25*(2), 281–286.

Gaber, M. A., Saleh, S. A., & Allam, N. H. (2020). Effect of vaginal pH in preconceptional fetal sex determination. *Menoufia Medical Journal, 33*(3), 1063–1067. https://doi.org/10.4103/mmj.mmj_107_20

Geraedts, J., & De Wert, G. (2009). Preimplantation genetic diagnosis. *Clinical Genetics, 76*(4), 315–325. https://doi.org/10.1111/j.1399-0004.2009.01257.x

Hassan, D. A. (2005). *Separation techniques for X and Y chromosome bearing human spermatozoa* (Doctoral dissertation, Tshwane University of Technology). http://tutvital.tut.ac.za:8080/vital/access/manager/Repository/tut:2585

Haugen, N., & Grotmol, T. (1998). pH of human semen. *International Journal of Andrology, 21*(2), 105–108. https://doi.org/10.1046/j.1365-2605.1998.00106.x

MacLaughlin, D. T., & Donahoe, P. K. (2004). Sex determination and differentiation. *The New England Journal of Medicine,* 350(4), 367–378. https://doi.org/10.1056/NEJMra022474

Oyeyipo, I. P., van der Linde, M., & du Plessis, S. S. (2017). Environmental exposure of sperm sex chromosomes: A gender selection technique. *Toxicological Research,* 33(4), 315–322. https://doi.org/10.5487/TR.2017.33.4.315

Ravel, J., Gajer, P., Abdo, Z., Schneider, G. M., Koenig, S. S. K., McCulle, S. L., Karlebach, S., Gorle, R., Russell, J., Tacket, C. O., Brotman, R. M., Davis, C. C., Ault, K., Peralta, L., & Forney, L. J. (2011). Vaginal microbiome of reproductive-age women. *Proceedings of the National Academy of Sciences of the United States of America, 108*(1), 4680–4687. https://doi.org/10.1073/pnas.1002611107

Shettles, L. B. (1970). Factors influencing sex ratios. *International Journal of Gynecology & Obstetrics, 8*(5P1), 643–647. https://doi.org/10.1002/j.1879-3479.1970.tb00287.x

Shettles, L. B., & Rorvik, D. M. (2006). *How to choose the sex of your baby* (Rev. & updated ed.). Broadway Books.

Ṣaḥīḥ Muslim. (n.d.). *Kitāb al-ḥayḍ, bāb bayān ṣifat maniyy al-rajul wa al-mar'ah wa anna al-walad makhlūq min mā'ihimā*. Ḥadīth no. 315. https://sunnah.com/muslim:315

The Glorious Qur'an, Chapter 49, Verse 13. (n.d.). https://quran.com/49/13

Umehara, T., Tsujita, N., & Shimada, M. (2019). Activation of Toll-like receptor 7/8 encoded by the X chromosome alters sperm motility and provides a novel simple technology for sexing sperm. *PLOS Biology,* 17(10), e3000398. https://doi.org/10.1371/journal.pbio.3000398

World Health Organization. (2010). *WHO laboratory manual for the examination and processing of human semen* (5th ed.). WHO Press. https://www.who.int/publications/i/item/9789241547789

You, Y. A., Kwon, W. S., Rahman, M. S., Park, Y. J., Kim, Y. J., & Pang, M. G. (2017). Sex chromosome-dependent differential viability of human spermatozoa during prolonged incubation. *Human Reproduction,* 32(6), 1183–1191. https://doi.org/10.1093/humrep/dex069

Zhou, X., Brown, C. J., Abdo, Z., Davis, C. C., Hansmann, M. A., Joyce, P., Foster, J. A., & Forney, L. J. (2007). Differences in the composition of vaginal microbial communities found in healthy Caucasian and Black women. *The ISME Journal,* 1(2), 121–133. https://doi.org/10.1038/ismej.2007.12