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Learning From a Fly's Wing: Building a Dialogical Paradigm of Science and Islam in Science Education

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Abstract

The hadith narrative regarding flies—stating that one wing carries disease while the other carries an antidote—presents a contradiction that necessitates scientific study to support the integration of Islam and science in education. This experimental study employed a completely randomized design with four treatments and seven replicates to assess the inhibitory effect of housefly (Musca domestica) body parts on Salmonella typhi growth in vitro. The results demonstrated that fly wings provided significantly higher growth inhibition ($p < 0.05$) than other body parts and the control. However, no significant difference was found between the right and left wings ($p > 0.05$). These findings establish an epistemological framework for science education through a "two-language dialogical paradigm." This model bridges religious narrative with empirical facts, promoting synergy between Islamic teachings and scientific discovery, while advancing natural-based antimicrobial research and strengthening the integration of Islamic values in science learning.

Key words: antimicrobial, Musca domestica, Salmonella typhi, science education, science-Islam

INTRODUCTION

The intersection between empirical science and Islamic teachings often generates productive questions for science education, particularly when a religious narrative appears to describe a biological phenomenon. One widely discussed example is a hadith narrated in Sahih Bukhari, which states that "when a fly falls into a vessel, it should be fully dipped because one wing carries disease while the other carries a cure" (Mufid & Sattar, 2023).

From a biological perspective, houseflies (*Musca domestica*) are often reported as mechanical vectors of pathogens due to their habit of landing on decaying organic matter and waste, thereby transferring microorganisms to the human environment (Asrıl et al., 2022; Chen et al., 2020; Onwugamba et al., 2018). Meanwhile, several studies have also explored the antimicrobial properties of fly wings, raising empirical questions consistent with the dual claims in the hadith. Atta (2014) reported an inhibitory effect on right wing extracts but not on left wings, while Mustami & Masri (2017) reported antimicrobial content in several types of fly wings without distinguishing between the inhibitory effects of left and right wings. Claresta et al. (2020) also reported inhibition of *Escherichia coli* in contaminated beverages after the addition of one or more right wings of *M. domestica*, and Surya & Rachmawaty (2020) found that secondary metabolites from *M. domestica inhibited Staphylococcus aureus* more consistently at low concentrations than at high concentrations.

Empirical evidence based on several studies is currently limited and produces varying results, particularly regarding whether inhibitory activity is consistently associated with the left or right wing. In addition, many studies use pathogens that are not strongly associated with endemic diseases or diseases with a high burden on the community, such as typhoid fever caused by Salmonella typhi (S. typhi), which remains a significant public health problem in several regions of Indonesia (Andayani & Fibriana, 2018; Annisa & Rahmadani, 2022; Setiabudi & Madiapermana, 2016; Ulfa & Handayani, 2018). Therefore, research using more contextually relevant pathogens, such as *Salmonella typhi, the* cause of typhoid fever, is needed to strengthen the modern scientific evidence base and clarify the extent to which fly wings can inhibit pathogen growth in vitro.

Beyond empirical questions related to experimental results and textual hadiths about fly wings, this research process also provides an interpretive framework for the pattern of interaction between science and Islam that respects the dialogue between scientific and religious narratives, thereby avoiding a binary understanding of the relationship between science and religion. This pattern of interaction can be adopted as an epistemological framework for Islamic-based science education. In contemporary discourse, there are at least four patterns of interaction between science and Islam, namely: the Islamisation of science, the scientification of Islam, convergence, and the dialogical paradigm (Abdullah, 2015; Alhattab & Jamil, 2024; Dallal, 2017; Edis, 2007, 2023; Guessoum, 2015; Guessoum & Bigliardi, 2023; Gunagraha & Muttaqin, 2025; Iqbal, 2007; Nasr, 1969).

Thus, this study answers two interrelated questions: (1) do the wings of *Musca domestica* inhibit the growth of *Salmonella typhi* in vitro compared to other body parts, and (2) how can a dialogical paradigm between science and Islam be constructed from the meeting of hadith narratives and empirical findings to support science education?

The pattern of Islamisation of science attempts to interpret modern scientific findings within the framework of Islamic teachings. Meanwhile, the scientification of Islam seeks to explain Islamic teachings using scientific approaches and methods. The convergence pattern seeks to find common ground between science and Islam, while the dialogical paradigm emphasises the importance of open dialogue and mutual respect between the two fields (Adyaksa, 2025; Guessoum & Bigliardi, 2023; Hermawan, 2017; Ihsan et al., 2021; Seitakhmetova et al., 2021). The Islamisation of science and the scientification of Islam open up opportunities for change when scientific truths are updated, or new scientific findings invalidate their concepts and consistency, while the convergence pattern tends to link and connect things that are not actually related (Guessoum, 2015; Mahendra et al., 2024; Miftahudin, 2023; Mohammad Muslih et al., 2024; Muslih et al., 2021, 2021). Among these patterns, the dialogical paradigm is most relevant to science education because it emphasises open dialogue and mutual respect between religious narratives and scientific inquiry, so that both can enrich the learning process without forcing one to become a tool to justify the other (Abdullah, 2015; Dasrizal et al., 2024; Guessoum & Bigliardi, 2023; Miftahudin, 2023). Therefore, this study uses the dialogical paradigm as the primary lens of analysis, with empirical observations of the effects of Musca domestica wing immersion on Salmonella typhi growth in vitro as the basis for constructing an epistemological framework for integrating science and Islam in science education.

METHOD

This study aims to (1) present empirical evidence regarding the role of houseflies (*Musca domestica*) as pathogen vectors and as potential sources of antimicrobial activity, and (2) construct an epistemological framework for the interaction between science and Islam based on the study findings. Accordingly, the research design was aligned with the meaning of the Prophetic hadith concerning flies: "If a fly falls into one of your vessels, dip it in, for on one of its wings there is disease and on the other wing there is its cure."

A laboratory experimental approach was employed using a Completely Randomised Design (CRD), as the media and experimental conditions were homogeneous. Four treatments were tested to observe the in vitro growth of *Salmonella typhi*: (1) inoculation with the right wing of the fly, (2) inoculation with the left wing of the fly, (3) inoculation with the fly body without wings, and (4) a control condition with no fly-part inoculation (placebo). The initial sample size calculation yielded 24 experimental units. To anticipate potential loss of experimental units, a correction was applied using $1/(1-f)$, where f represents the proportion of units lost or not evaluable (15%) (Coppock, 2021; Supranto, 2000). This yielded 27.6 units, which was rounded up to 28, corresponding to four treatments with seven replicates each.

This research was conducted in the microbiology laboratory unit of the Bondowoso Regency Government Public Health Laboratory Centre for one month. All experiments involving *Salmonella typhi* (ATCC 14028) were conducted under Biosafety Level 2 (BSL-2) conditions in a certified microbiology laboratory. Standard BSL-2 practices were strictly followed: all manipulations were performed in a Class II biosafety cabinet (laminar airflow), personnel wore personal protective equipment (laboratory coats, disposable gloves, face shields), and waste materials were autoclaved before disposal. The institutional biosafety committee approved the bacterial strain and experimental protocols.

Data collection procedures were adapted from established methods for *Salmonella* isolation from foods and beverages (Cox, 1959; Silliker et al., 1964; Taylor & John H. Silliker, 1961). The procedures were conducted as follows:

1. Sterilisation of Equipment
   All equipment used in this study was thoroughly washed, then sterilised in an autoclave for 15 minutes at 121°C under 1 atm.
2. Preparation of culture media(Baker &

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Silverton, 1976)

- Nutrient Broth (NB): 3.25 g NB was dissolved in 250 ml of distilled water, heated for approximately 10 minutes until fully dissolved, and autoclaved for 15 minutes at 121°C.
- Nutrient Agar (NA): 7.25 g NA was dissolved in 250 ml of distilled water, heated for approximately 10 minutes until fully dissolved, and autoclaved for 15 minutes at 121°C.

3. Preparation of Pure Salmonella typhi Isolates on SS (Salmonella-Shigella) Agar Selective Medium

   The bacterial culture used in this study was a pure isolate of *Salmonella* sp. ATCC 14028, maintained on NA slants and refreshed every three weeks. Prior to testing, the isolate was propagated in NB and incubated for 24 hours at 37°C. The refreshed culture was then streaked onto SS (Salmonella–Shigella) agar and incubated at 37°C for 24 hours. After incubation, a single colony was suspended in 0.9% sterile NaCl, and a serial dilution from 10^{-1} to 10^{-10} was prepared for the preliminary test.

4. Fly Capture

   Flies were collected using meat bait and then captured using insect nets. The captured flies were placed in plastic bags for transport to the laboratory and treated aseptically.

5. Preliminary test (inoculum standardisation)

   Antimicrobial-effect testing requires a standardised, sub-lethal bacterial inoculum so that the control condition still shows measurable growth and any antimicrobial activity can be detected as a reduction in growth rather than an all-or-nothing outcome. For this preliminary test, each dilution ($10^{\wedge-1}$ to $10^{\wedge-10}$) of the *S. typhi* suspension was inoculated into 10 ml NB and incubated for 15 minutes to allow early adaptation (lag phase). Fly body parts were then added to the inoculated media and incubated at 37°C for 24 hours. Growth was assessed using turbidity as an indicator (Brooks et al., 2013; Jakob et al., 1989; Kim et al., 2016). The inoculum concentration selected for the main experiment was the dilution that produced clear and consistent growth in the Control while avoiding excessive growth that could mask inhibitory effects. Based on the preliminary test, the optimal inoculum for the main experiment was 10^{-10}.

6. Experimental procedure

A total of 28 Nutrient Broth media were prepared according to the experimental design, consisting of four treatments: 1) To observe the growth of S. typhi in invitro media inoculated with the right wing of the fly, 2) To observe the growth of S. typhi in invitro media inoculated with the left wing of the fly, 3) To observe the growth of S. typhi in invitro media inoculated with the body of the fly (without wings), 4) To observe the growth of S. typhi in in vitro media that was not inoculated with the fly's body as a control (placebo).

Each treatment was repeated seven times.

- Then, inoculation of the Salmonella typhi test suspension was carried out in Nutrient Broth media.
- Leave for 15 minutes.

- Inoculate the fly body parts into the Nutrient Broth medium.
- Incubate in an incubator at 37°C for 24 hours and observe for the growth of Salmonella typhi.

7. Confirmation test for the growth of Salmonella typhi
   - From each Nutrient Broth medium, take one loopful and streak it onto SS agar, incubate at 37°C for 24 hours, and observe for the presence of Salmonella typhi colonies as an indicator of growth (Taketani et al., 2023).
   - The number of Salmonella typhi colonies that grew was counted using a colony counter.

RESULT AND DISCISSION

Experimental Data and Observations

The results of inoculating fly body parts into an in vitro medium containing a 10^{-10} suspension of Salmonella typhi are described as follows.

a. NB Medium (Nutrient Broth)

- Inoculation of the Right Wing of the Fly (A)

The growth of Salmonella typhi on media inoculated with the right wing of a fly can be seen in Figure 1.

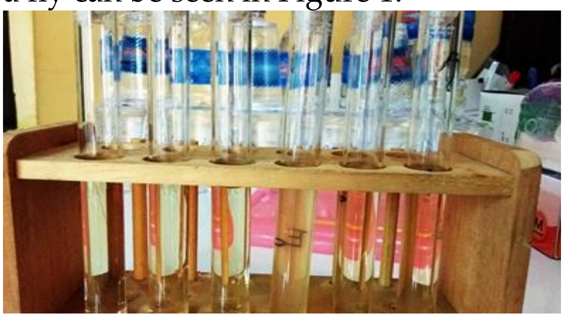

Figure 1 . Growth results of Salmonella typhi on media inoculated with the right wing of a fly (Musca domestica)

On Nutrient Broth media inoculated with the right wing of Musca domestica, the following results were obtained: *two media were cloudy, and five media were clear.* Next, streaking was performed on SS Agar media to identify whether the growth was indeed Salmonella typhi.

- Inoculation of the Left Wing of the Fly (B)

The growth of Salmonella typhi on media inoculated with the left wing of Musca domestica can be seen in Figure 2.

Figure 2. Growth results of Salmonella typhi on media inoculated with the left wing of the fly.

On Nutrient Broth media inoculated with the left wing of Musca domestica, the following results were obtained: three media showed turbidity with varying degrees of turbidity, and four media were clear. This was followed by streaking on SS Agar media to identify whether the growth was indeed Salmonella typhi.

- Inoculation of Fly Body/Without Wings (C)

The growth of Salmonella typhi on media inoculated with the body of Musca domestica (without wings) can be seen in Figure 3 below:

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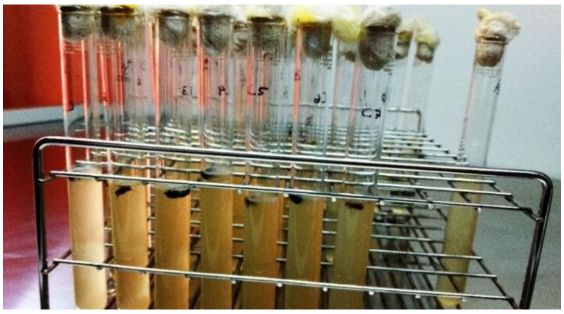

Figure 3. Growth results of Salmonella typhi on media inoculated with Musca domestica bodies (without wings)

On Nutrient Broth media inoculated with Musca domestica bodies (without wings), the following results were obtained. All media showed turbidity at nearly identical levels, followed by streaking on SS Agar to identify whether the growth was indeed Salmonella typhi.

- Placebo/Control (without inoculation of the fly body)

The results of Salmonella typhi growth on media without inoculation of Musca domestica body parts (placebo) can be seen in Figure 4 below:

Figure 4. Growth results of Salmonella typhi on media without inoculation of Musca domestica body parts (placebo)

In Nutrient Broth media without inoculation of Musca domestica body parts (placebo), the following results were obtained. All media showed high turbidity, followed by streaking on SS Agar to confirm Salmonella typhi.

b. Salmonella Shigella (SS) Agar medium

Results from all Nutrient Broth media were then taken using an ose and streaked onto SS Agar media, yielding the following results:

- Inoculation of the Right Wing of the Fly (A)

The results of the culture on Nutrient Broth media inoculated with the right wing of Musca domestica, followed by streaking on SS Agar media to determine whether the growth occurring on the Nutrient Broth media was Salmonella typhi, because the Salmonella colonies on the SS agar media appeared distinctive, convex, transparent, with black spots in the centre.

The colony results on SS Agar media from Nutrient Broth media inoculated with the right wing can be seen in Figure 5:

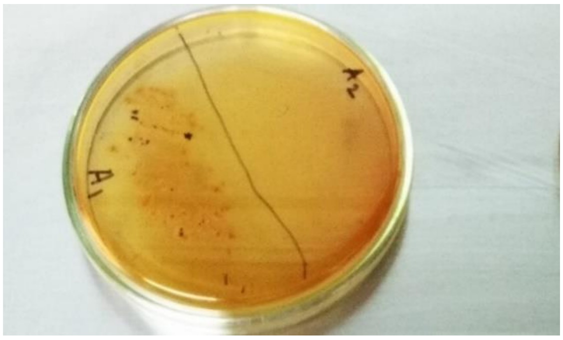

Figure 5. Growth results of Salmonella typhi on SS Agar medium inoculated with the right wing of a fly (Musca domestica)

The results of cultivation on SS Agar medium from Nutrient Broth inoculated with the right wing of Musca domestica are shown in Table 1.

Table 1. Number of Salmonella typhi colonies on SS Agar from the cultivation of Nutrient Broth inoculated with the right wing of Musca domestica.

No	Repeat	Number of Colonies
1	I	8
2	II	0
3	III	0
4	IV	0
5	V	0
6	VI	0
7	VII	10

- Inoculation of the left wing of the fly (B)

The results of the culture on Nutrient Broth media inoculated with the left wing of Musca domestica, followed by streaking on SS Agar media to determine whether the growth occurring on the Nutrient Broth media was Salmonella typhi, because the Salmonella colonies on the SS agar media appeared distinctive, convex, transparent, with black spots in the centre.

Figure 6. Growth results of Salmonella typhi on SS Agar media inoculated with the left wing of a fly (Musca domestica)

The colony results on the SS Agar medium from the Nutrient Broth medium inoculated with the left wing can be seen in Figure 6.

Table 2. Number of Salmonella typhi colonies on SS Agar from the cultivation of Nutrient Broth inoculated with the left wing of Musca domestica

No	Repeat	Number of Colonies
1	I	3
2	II	0
3	III	0
4	IV	0
5	V	0
6	VI	3
7	VII	6

- Inoculation of wingless flies (C)

The results of the culture on Nutrient Broth medium inoculated with Musca domestica (wingless) bodies, followed by streaking on SS Agar medium to determine whether the growth occurring on the Nutrient Broth medium was Salmonella typhi, as Salmonella colonies on SS agar medium appear distinctive, convex, transparent, with black spots in the centre.

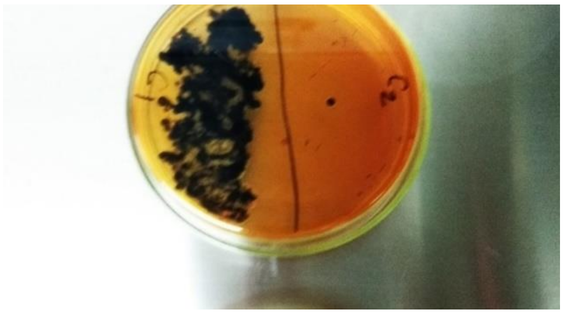

Figure 7. Growth results of Salmonella typhi on SS Agar medium that was inoculated with the body of Musca domestica (without wings)

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The colony results on SS Agar medium from Nutrient Broth medium inoculated with wingless Musca domestica bodies can be seen in Figure 7.

The results of cultivation on SS Agar medium from Nutrient Broth inoculated with the body of Musca domestica (without wings) are shown in Table 3:

Table 3. Number of Salmonella typhi colonies on SS Agar resulting from the cultivation of Nutrient Broth inoculated with Musca domesticus bodies

No	Repeat	Number of Colonies
1	I	75
2	II	13
3	III	36
4	IV	28
5	V	5
6	VI	23
7	VII	16

- Placebo/Control (without inoculation of fly body parts)

The culture on Nutrient Broth medium without inoculation of Musca domestica body parts was then streaked onto SS Agar medium to determine whether the growth observed on the Nutrient Broth medium was Salmonella typhi, as Salmonella colonies on SS Agar medium appear characteristic, convex, transparent, and with black spots in the centre.

The colony results on SS Agar medium from Nutrient Broth medium without inoculation of the Musca domestica body part can be seen in Figure 8.

The results of cultivation on SS Agar medium from Nutrient Broth without inoculation of Musca domestica body parts are shown in Table 4.

Figure 8. Growth results of Salmonella typhi on SS Agar medium without inoculation of Musca domestica body parts (placebo)

Table 4 . Number of Salmonella typhi colonies on SS Agar from Nutrient Broth without inoculation of Musca domestica body parts

No	Repeat	Number of Colonies
1	I	87
2	II	95
3	III	59
4	IV	78
5	V	65
6	VI	53
7	VII	66

The results of the colony count recapitulation on SS agar media are presented in Table 5. From Table 5, it can be seen that the number of Salmonella typhi colonies on SS Agar media differed from that in the control group across various treatments. Media inoculated with the right and left wings of flies produced almost the same number of colonies. In contrast, media inoculated with the body of flies (without wings)

Table 5. Results of the Counting of Colony Numbers on SS Agar Media

Repeat / Treatment	I	II	III	IV	V	VI	VII	Average
Right Wing	8	0	0	0	0	0	10	2.6
Left Wing	3	0	0	0	0	3	6	1.7
Fly body	75	13	36	28	5	23	16	28.0
Control	87	95	59	78	65	53	66	71.9

produced more colonies than media inoculated with the left and right wings.

After the data were collected, a normality test was performed on the colony count data using the Kolmogorov-Smirnov (KS) test, yielding $p = 0.001$. This indicates that the data are not normally distributed, so parametric statistical tests, such as a one-way ANOVA, cannot be applied. Next, to determine the difference in the growth of Salmonella typhi in in vitro media, a non-parametric test (Kruskal-Wallis) was used. The results of the Kruskal-Wallis test are shown in Table 6.

Table 6: Kruskal-Wallis Test Results for the Number of S. typhi Colonies

No	Treatment	N	Mean Rank	Statistic	Sig
1	Left-wing inoculation of flies	7	7.71	Chi-Square	21.28
2	Right-wing inoculation of flies	7	7.71	df	3
3	Inoculation of the fly body	7	18.14	Asymp. Sig.	0.000
4	Control	7	24.43		
	Total	28			

The Kruskal-Wallis test showed $p < 0.05$, indicating a significant difference in Salmonella typhi growth in the in vitro medium inoculated with fly body parts. Furthermore, to determine differences in Salmonella typhi growth across treatments, a Mann-Whitney post hoc analysis was performed. The results of the Mann-Whitney test for the various treatments are shown in Table 7.

Table 7. Results of the Mann-Whitney Post Hoc Test: Number of S. typhi Colonies

Treatment	Right Wing Inoculation	Left Wing Inoculation	Body Inoculation	Control
Right Wing Inoculation	-			
Left Wing Inoculation	1.0	-		
Body Inoculation	40.0*	47.0*	-	
Control	49.0	49.0	41.0	-

*There is a significant difference in the Mann-Whitney Post Hoc test

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From the results of the Mann-Whitney Post Hoc test, it is known that there is a significant difference in the growth of Salmonella typhi in in vitro media, between:

1. In vitro medium inoculated with the right wing of the fly, with in vitro medium inoculated with the body of the fly (without wings),
2. In vitro medium inoculated with the right wing of the fly, with in vitro medium without inoculation of the fly body (Control),
3. In vitro medium inoculated with the left wing of the fly, with in vitro medium inoculated with the body of the fly (without wings),
4. In vitro media inoculated with the left wing of the fly, with in vitro media without inoculating the body of the fly (Control),

Meanwhile, there was no significant difference between the in vitro medium inoculated with the right wing of the fly and the in vitro medium inoculated with the left wing of the fly, and the minimum inhibition produced by one wing of Musca domestica against Salmonella typhi was effective up to 10^3 per millilitre.

This experiment shows that inoculating (dipping/ghamasa) the wings of *Musca domestica* provides much better inhibition of *Salmonella typhi* growth than treating the fly body without wings or the control group, as reflected in the colony count pattern and statistical test results. This pattern supports the interpretation that the inhibitory factor is more strongly associated with wing material than with wingless bodies under the in vitro test conditions used. This is because growth is defined as an increase in the number, volume, and size of cells. In prokaryotic organisms such as Salmonella typhi, growth is characterised by an increase in cell volume and size, which also means an increase in the number of cells (An et al., 2022; Hilty et al., 2021; Hugo, 1972; Mueller et al., 2015). Macroscopically, growth activity in liquid media (Nutrient Broth) is characterised by the appearance of turbidity, while in agar media (SS agar) it is characterised by the formation of distinctive black *Salmonella typhi* colonies (Ali et al., 2024; Brooks et al., 2013; Jeanson et al., 2015; Kim et al., 2016).

The experiment did not show a significant difference between the right-wing and left-wing treatments, whereas both differed from the wingless body treatment and the Control. This is in accordance with the textual hadith, which does not specify which wing contains the disease and which wing contains the cure, as narrated by Bukhari: "If a fly falls into your vessel, dip it entirely, for one of its wings contains the disease and the other contains the cure" (Mufid & Sattar, 2023). These results suggest that inhibitory activity may be present in one wing or vary between individual flies. The presence of some tubes that remained cloudy in the wing treatment also suggests variability in inhibition, which differences may influence compound concentration, efficiency of compound release into the medium, or biological heterogeneity of the fly specimens (Niode et al., 2022).

At an empirical level, the hadith instruction to 'dip' the flies *(ghamasa)* can be understood as a reasonable mechanism for increasing the transfer of bioactive substances associated with the wings into the liquid (Claresta et al., 2020; Niode et al., 2022; O. et al., 2025; Surya & Rachmawaty, 2020). Complete immersion increases the contact between the liquid and the wings' surfaces and structures. It has the potential to facilitate the release and diffusion of metabolites or antimicrobial compounds into the medium, thereby interfering with bacterial growth. Conversely, limited contact (e.g., merely touching without dipping) is less likely to extract sufficient quantities of compounds to produce a measurable inhibitory effect, making the emphasis on the act of 'dipping' relevant when interpreting the hadith instruction (Baeshen et al., 2021).

These findings should not be framed as 'science proving the hadith,' as this expression reduces the metaphysical-religious narrative to a single empirical claim and risks exaggerating what can be confirmed by laboratory results. Instead, this research employs a dialogical paradigm, in which the hadith narrative and microbiological observations are positioned as two distinct 'languages' that can inform one another. Within this paradigm, experimental results can be interpreted as *consistent* with the narrative motif of duality (danger and antidote), while acknowledging that inhibition in the laboratory is conditional and context-dependent (e.g., inoculum level, medium type, exposure duration, and biological variability).

In the context of science education, these findings provide a concrete example of how empirical investigation and religious narratives can engage in constructive dialogue without reducing either to a mere tool for justifying the other. Students can be guided to view the hadith narrative as a meaningful context that raises testable questions (e.g., the mechanism of compound release during immersion, and the conditions that strengthen or weaken inhibition). At the same time, laboratory methods are understood as tools for systematically exploring these questions. This approach aligns with the research objective of developing a dialogical paradigm that bridges Islamic sources and scientific practices in learning.

The construction of a dialogical paradigm from the findings of this study presents a pattern of interaction between scientific and Islamic concepts that can be implemented in science education, particularly in learning contexts. In this case, Islamic concepts can be sourced from the Qur'an and hadith, which are recognised as authentic guides to scientific literacy. At the same time, science, through its methodology (observation and experimentation), provides the operationalisation. This can also apply in reverse, starting with science and its methodology, which will guide curiosity about the contradiction in empirical facts about flies: they are only vectors that cause disease. When the two are brought together, they will complement each other to produce antimicrobial materials that can serve as knowledge products. This aligns with the essence of science learning, namely,

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science as a process and as a product (Chiappetta, 2014).

The interaction between the concepts of science and Islam is mediated by creative imagination, or *Lita'lamu* in the author's language, which must be grounded in strong faith or belief in the truth of Islam (Abdullah, 2015). In this case, faith must precede knowledge because it is the starting point of a Muslim scientist's intellectual journey in the study of science (Averroës & Fath, 2004). Therefore, studying science can be part of a Muslim's worship. In the case of the dual biological function of fly wings, which is contradictory based on the hadith narrative and empirical facts, without a strong foundation of faith, it would certainly not lead to the process of creative imagination. Creative imagination is often associated with the effort to bring together two concepts that have different frameworks, followed by a synthesis process to form a new whole that may be completely different from the two initial concepts, so that new theories or products of knowledge often emerge from this creative imagination process (Abdullah, 2015). Schematically, the dialogical pattern presented in this study, as shown in Figure 9, adapts what is conveyed by (Peters, 2018) regarding ten models of interaction between science and religion, one of which is the two-language model, in accordance with the context of the dialogue paradigm that is closely related to language, so we call this dialogue paradigm the Two-Language Dialogue Paradigm.

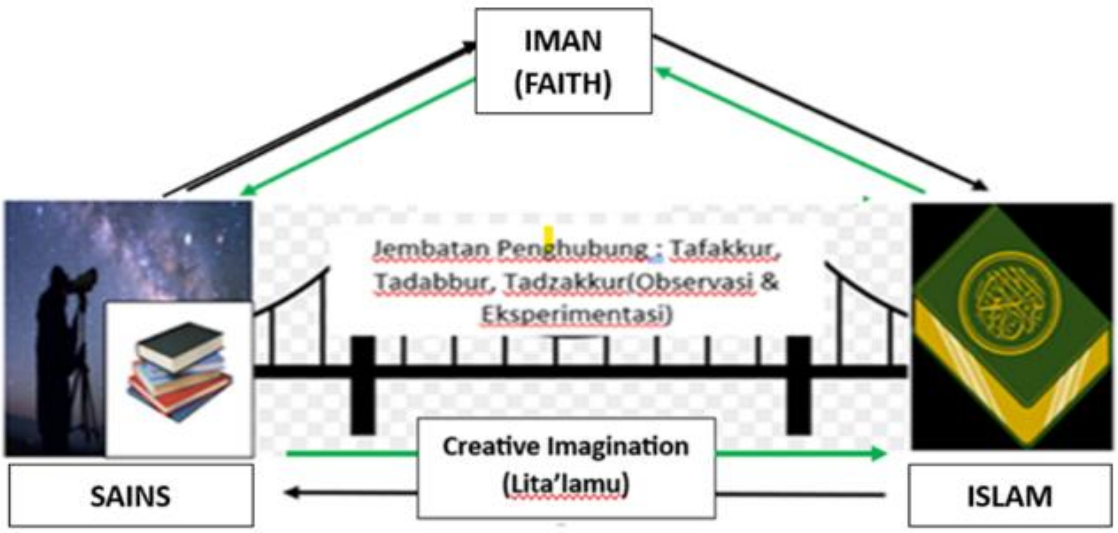

Figure 9. Two-Language Dialogic Pattern (Scientific Language and Islamic Language)

This two-language model always begins with and is based on faith as the foundation and goal of learning, then dialogues various concepts of science and Islam through creative imagination (Lita'lamu). This creative imagination can begin with Islamic narratives or texts (al-hadith & al-Qur'an) as the first language (black line) and then engage in dialogue with scientific concepts as the second language. For example, in the Qur'an, we often find verses that invite us to engage in dialogue with science, such as in Surah Al-Ghasyiyah (QS 88: 17-20), which clearly invites us to pay attention to how camels were created, how the sky was raised, how mountains were erected, and how the Earth was spread out. In this case, Allah Subhanahu Wa Ta'ala does not directly explain these processes in the Qur'an because the Qur'an is not a book specifically about science (Khoirudin, 2017), so this explicitly invites scientists to discuss this in detail using the language of science, and will guide our recognition of the majesty of the Creator. This dialogical model can be implemented in the context of science education. Creative imagination can also begin with scientific concepts (green line) as the first language, then be discussed alongside Islamic narratives or texts, such as in teaching biogeochemical cycles, especially the water cycle, which can be discussed in Surah Qaf.

(QS: 50 verse 9), which states, 'from the sky we send down blessed water.' This also invites us, scientists, to engage in dialogue between scientific concepts and Islamic narratives or texts, enabling the creation of new knowledge that is more comprehensive and complementary.

In science education, the object of study is the universe and its contents, so for a Muslim scientist, creative imagination becomes a gateway to intellectual worship. Similarly, in the context of learning, a teacher must foster this creative imagination through the science learning process, as it will serve as a stimulus and motivation, as learning science is a form of worship that leads students to learn consciously and meaningfully. When learning takes place consciously and meaningfully, it creates a positive learning process and fosters good understanding and attitudes among students (Arends, 2012).

Creative imagination can be stimulated through verses from the Qur'an, especially kauniyah verses (verses about the universe) and hadiths of the Prophet Shalallahu Alaihi Wassalam, as conveyed by Syed Hussein Nashr in relation to Surah An -Nur, when the Qur'an refers to the sun as a 'lamp', it actually reveals an intrinsic reality that needs to be explored, so that it can produce scientific facts (Nasr, 1969). This requires that creative imagination be followed up and connected with the methodological bridge of science, through observation and experimentation (bridge image), so that there will be continuity in producing useful scientific works/products. Moreover, of course, verses that foster creative scientific imagination will still be found if we study the Qur'an and Hadith as members of a science education community affiliated with Islamic sciences, so that, in the future, we can distinguish ourselves and become better.

CONCLUSION

The wings of the housefly (Musca domestica) can serve as both a vector for pathogens and a potential source of

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antimicrobial agents; however, it cannot be determined whether the left or right wing of a single fly contains antibacterial substances (medicines), nor vice versa. This is consistent with the wording of the hadith from Abu Hurairah, which does not specifically mention the left or right wing as the medicine (antidote).

The dialogical paradigm between science and Islam, which is constructed from the intersection of hadith narratives with empirical scientific facts through the growth inhibition by one of the wings of the Musca domestica fly against Salmonella typhi in vitro, inspired by the hadith of the Prophet Shalallahu Alaihi Wassalam, presents a dialogical pattern that bridges the dialogue between science and Islam in the context of learning, which the author calls the "two-language dialogical paradigm".

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