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Downwash in Aircraft Lift Mechanism: An Analytical Study From The Perspective of The Quranic Thematic Tafsir

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Abstract

Scientific Qur'anic exegesis on aircraft lift has often emphasized Bernoulli's principle, while discussions of downwash, airflow momentum transfer, and Newton's third law need further development. This study aims to analyze aircraft lift mechanisms through Qur'anic thematic exegesis and develop a conceptual framework termed the Newtonian–Downwash Causal Chain. Employing qualitative-analytical library research, the study adopts Abdul Hayy al-Farmawi's thematic exegesis method. Data were analyzed through linguistic examination, thematic relationships among verses, authoritative exegetical interpretations, and conceptual correlations with aerodynamic literature. The primary verses examined are Surah Al-Mulk [67]:19 and Surah An-Nahl [16]:79, with Surah Yasin [36]:36 serving as a supplementary verse. The findings indicate that aerodynamic lift can be explained through wing–air interaction, pressure distribution, downward airflow deflection (downwash), and momentum transfer based on Newtonian principles. The proposed relationships between yaqbidhn and downwash, azwāj and action–reaction forces, and tashkhīr and the regularity of the air medium constitute interpretive correlations developed by the researchers rather than direct semantic equivalences or empirical evidence that modern aerodynamic theories are explicitly stated in the Qur'anic verses. The study concludes that the Newtonian–Downwash Causal Chain enriches scientific exegesis by integrating Bernoulli-based and Newtonian explanations as complementary aerodynamic perspectives while maintaining epistemological distinctions between Qur'anic interpretation and contemporary scientific reconstruction.

Kata kunci:
Gaya angkat pesawat; Downwash; Tafsir maudhu'i; Efek Coanda; Hukum III Newton

Abstrak

Kajian tafsir ilmiah mengenai mekanisme gaya angkat pesawat terbang cenderung menekankan prinsip Bernoulli, sementara pembahasan mengenai downwash, perpindahan momentum udara, dan Hukum III Newton dalam perspektif tafsir tematik Al-Qur'an masih memerlukan pengembangan. Penelitian ini bertujuan menganalisis korelasi interpretatif antara ayat-ayat Al-Qur'an tentang fenomena penerbangan dan mekanisme gaya angkat berdasarkan pendekatan aerodinamika modern. Penelitian menggunakan metode kepustakaan (library research) dengan pendekatan kualitatif-analitis melalui metode tafsir tematik (maudhū'ī) Abdul Hayy al-Farmawi. Data dianalisis melalui kajian linguistik, penafsiran mufasir otoritatif, hubungan tematik antarayat, dan sintesis konseptual dengan literatur aerodinamika. Hasil penelitian menghasilkan kerangka Newtonian–Downwash Causal Chain yang menjelaskan keterkaitan antara medium udara, interaksi sayap dengan udara, pembelokan aliran udara ke bawah (downwash), perpindahan momentum, dan gaya angkat. Dalam kerangka tersebut, istilah yaqbidhn (QS. Al-Mulk [67]:19) dikorelasikan secara fenomenologis dengan gerakan sayap dan downwash, musakhkharāt (QS. An-Nahl [16]:79) dikaitkan secara kontekstual dengan keteraturan fenomena penerbangan dalam medium udara, sedangkan azwāj (QS. Yasin [36]:36) dipahami sebagai analogi interpretatif terbatas terhadap pasangan gaya aksi-reaksi. Korelasi tersebut tidak menunjukkan kesetaraan makna secara langsung ataupun membuktikan bahwa teori aerodinamika modern

dinyatakan secara eksplisit dalam Al-Qur'an. Penelitian ini menyimpulkan bahwa pendekatan Newtonian–downwash melengkapi penjelasan gaya angkat berbasis prinsip Bernoulli serta menawarkan kerangka integrasi tafsir tematik dan aerodinamika yang lebih kritis dan proporsional

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Introduction

Flight is a natural phenomenon that invites investigation from both scientific and religious perspectives. The ability of birds to fly and the development of aircraft technology reveal complex interactions among bodies, air, and physical forces that enable an object to remain airborne. From an Islamic perspective, avian flight is one of the signs of Allah's power (Syahputra & Rohman, 2022a), encouraging people to observe, reflect on, and study the order of the universe (Putri et al., 2025). Surah Al-Mulk [67]:19 and Surah An-Nahl [16]:79 draw attention to birds' ability to fly and remain aloft (Hasibuan, 2025). These verses provide a basis for theological reflection on flight that can be brought into dialogue with scientific knowledge, particularly aerodynamics.

In physics, an aircraft's ability to sustain flight depends on interactions between its wing surfaces and the airflow that generate aerodynamic forces (Telaumbanua & Zebua, 2024). One of the principal forces acting on an aircraft is lift, the component of aerodynamic force perpendicular to the direction of the relative airflow (Diantoro et al., 2022). In steady, level flight, lift generally balances the aircraft's weight. Explanations of lift generation have developed through several theoretical approaches, including Bernoulli's principle, Newton's laws, circulation theory, and analyses of pressure distribution and airflow momentum. These approaches offer interrelated perspectives on the aerodynamic mechanisms of flight.

Bernoulli's principle is widely used to explain the relationship between airflow velocity and pressure over wing surfaces (Harefa & Giawa, 2025). In a simplified account, differences in pressure distribution between the upper and lower wing surfaces contribute to lift generation (Wibowo, 2017). Nevertheless, applying Bernoulli's principle in isolation, particularly through the assumption that air particles separated at the leading edge must meet again simultaneously at the trailing edge, does not accurately explain the overall process of lift generation(Masri et al., 2025). explains aerodynamic mechanisms in terms of the relationships among pressure distribution, flow characteristics, and the laws governing fluid motion. A more comprehensive explanation of lift must therefore account for changes in airflow momentum.

One important phenomenon associated with lift generation is downwash, the downward deflection of airflow associated with a lifting wing. This phenomenon can be analyzed using the principle of momentum conservation and Newton's Third Law. When a wing acts on the airflow and changes its momentum in a downward direction, a reaction force acts on the wing. This relationship explains lift in terms of interactions between the wing and the surrounding air mass. However, lift generation must also be understood through the distribution of pressure and shear stress over the wing surface; momentum-based and pressure-based approaches should therefore not be treated as conflicting theories. Sukarwoto et al. shows that understanding lift requires attention to the relationships among flow characteristics, viscosity, circulation, and changes in fluid momentum (Sukarwoto et al., 2024).

In aerodynamic discussions, the Coanda effect is often associated with the tendency of a fluid flow to follow a nearby surface. However, it cannot be treated as the sole reason that airflow follows a wing's contour or as a universal explanation of lift generation. Airflow around a wing is influenced by several factors, including airfoil geometry, angle of attack, pressure distribution, viscosity, and boundary-layer conditions. Accordingly, this study examines downwash within a broader aerodynamic framework that considers the relationships among airflow deflection, momentum transfer, and the aerodynamic forces acting on the wing.

Flight is also discussed within the tradition of Qur'anic exegesis. Classical and modern exegetes have examined verses describing birds in flight as signs of Allah's power. In his interpretation of verses concerning avian flight, Ibn Kathir emphasizes Allah's power to create and sustain His creatures. Similarly, Hamka's Tafsir Al-Azhar directs readers' attention to the order of Allah's creation as a basis for reflection on faith. These interpretations have a strong theological orientation and were not specifically intended to formulate the physical mechanisms of flight. Contemporary scientific knowledge can therefore provide an additional perspective on the natural phenomena mentioned in the Qur'an without converting the theological meanings of the verses into technical statements about aerodynamic laws.

The growing body of research integrating the Qur'an and science has produced several studies linking flight to physical principles (Jumini, 2018), in Gaya Aerodinamik dalam Penerbangan Perspektif Q.S. An-Nahl: 79 [Aerodynamic Forces in Flight from the Perspective of Surah An-Nahl: 79], examines flight through Qur'anic verses using aerodynamic concepts. The study contributes to connecting discussions of aerodynamic forces with interpretations of the verse concerning avian flight. Subsequently, Rahma and Udzma (2024), in Mengeksplorasi Konsep Pesawat Terbang Berdasarkan Hukum Fisika dan Perspektif Al-Qur'an [Exploring the Concept of Aircraft through the Laws of Physics and the Qur'anic Perspective], discuss the relationship between the physical principles of flight and the Qur'anic perspective, including the use of Bernoulli's principle to explain lift. Both studies demonstrate the value of interdisciplinary approaches that bring physics into dialogue with Islamic studies.

Habibullah and Puspitasari, in their article The Bird Aerodinamics in the Qur'an (The Qur'anic Verses Study of Birds Aviation Mechanics), specifically examine the mechanisms of avian flight from the perspective of Qur'anic verses. Their contribution lies in connecting the biological and physical phenomena of flight with Qur'anic studies(Habibullah & Puspitasari, 2021). Meanwhile, Syahputra and Rohman (2022b), in Karakteristik Burung dalam Perspektif

Al-Qur'an dan Sains [The Characteristics of Birds from the Perspectives of the Qur'an and Science], examine avian characteristics through an approach that integrates scientific knowledge with the study of Qur'anic verses transfer (Syahputra & Rohman, 2022b). These studies show that thematic and interdisciplinary approaches have been used to discuss flight from a Qur'anic perspective. Nevertheless, a focus on the characteristics and mechanisms of avian flight should be distinguished from an analysis of aircraft-wing aerodynamics, particularly airflow deflection and momentum

A study more closely related to the present research is Aditama's Aircraft Lift in the Perspective of the Qur'an. It connects aircraft lift with aerodynamic concepts, including the Coanda effect and Newton's Third Law, from a Qur'anic perspective. This study indicates that explanations of lift extending beyond Bernoulli's principle have already begun to emerge in the literature on the integration of the Qur'an and science. Accordingly, the novelty of the present study does not lie in a claim to be the first to connect Newton's laws or airflow deflection with the Qur'an. Rather, it lies in clarifying the role of downwash as the focus of analysis, critically examining the relationship between lift and momentum transfer, and situating these concepts within a thematic exegetical methodology that distinguishes scientific explanations from the textual meanings of the verses.

Previous studies suggest that research on flight from a Qur'anic perspective has developed along several lines: explaining the physical principles of flight, examining avian characteristics, and integrating aerodynamic concepts with verse interpretation. Nevertheless, there remains scope for an analysis that specifically focuses on downwash while explaining its conceptual relationship with pressure distribution, changes in airflow momentum, and Newton's Third Law. The methodological boundaries between Qur'anic interpretation and contemporary scientific theory also require clarification. This is necessary to prevent scientific exegesis from assuming that every modern scientific concept is stated literally in the Qur'anic text.

The research gap therefore concerns the need for a more focused and critical discussion of downwash in the dialogue between modern aerodynamics and thematic Qur'anic exegesis. This study does not seek to demonstrate that the Qur'an formulated modern aerodynamic theory at the time of its revelation. Instead, it treats verses concerning avian flight as texts conveying theological messages and encouraging attention to natural phenomena. Aerodynamic theory serves as a scientific analytical tool for examining flight, rather than as the sole basis for determining the meanings of the verses. This distinction provides an essential foundation for establishing a balanced relationship between Islamic studies and scientific knowledge.

Within this context, the study adopts thematic exegesis (tafsīr mawdūʿī), drawing on Al-Farmawi's methodological framework. This approach is used to collect and examine Qur'anic verses relevant to flight and to interpret their meanings in light of linguistic context, exegetical explanations, and relationships among verses. Surah Al-Mulk [67]:19 and Surah An-Nahl [16]:79 are the primary focus because both directly describe birds flying in the air. Terms appearing in these verses, such as yaqbidhn and musakhkharāt, are analyzed according to their linguistic meanings and relevant interpretations, rather than being treated from the outset as technical equivalents of downwash or momentum transfer in modern physics.

The novelty of this study lies in developing an interdisciplinary analytical framework that places downwash at the center of discussions of aircraft lift and critically connects it with thematic Qur'anic exegesis. Unlike studies primarily concerned with Bernoulli's principle or the characteristics of avian flight, this study focuses on airflow deflection, momentum transfer, and action–reaction forces in lift generation. At the same time, it preserves the epistemological boundaries between scientific explanation and theological interpretation, ensuring that their integration does not produce claims that the Qur'an explicitly formulates modern aerodynamic laws.

Accordingly, this study aims to analyze the role of downwash in aircraft lift generation and examine its conceptual relevance from the perspective of thematic Qur'anic exegesis. Specifically, it explains the relationships among airflow deflection, momentum change, and lift using aerodynamic principles, then brings these explanations into dialogue with interpretations of Qur'anic verses concerning flight. The discussion is limited to lift mechanisms arising from interactions between aircraft wings and airflow. Drag, thrust, and aircraft stability are not examined in depth except where necessary to clarify lift generation. Through this approach, the study seeks to contribute to a more comprehensive, critical, and scientifically responsible integration of science and the Qur'an.

Method

This study employed qualitative analytical library research using thematic exegesis (tafsīr mawḍūʿī), drawing on Abdul Hayy al-Farmawi's methodological framework in Al-Bidāyah fī al-Tafsīr al-Mawḍūʿī: Dirāsah Manhajiyyah Mawḍūʿiyyah (Al-Farmawi, 1977). This approach was used to collect, examine, and analyze Qur'anic verses concerning flight and to bring their interpretations into dialogue with modern aerodynamic concepts, particularly the role of downwash in aircraft lift generation. The Qur'an was the primary source for textual analysis, while the principal exegetical sources were Fakhruddin al-Razi's Mafātīḥ al-Ghayb, Thanthawi Jauhari's Al-Jawāhir fī Tafsīr al-Qurʾān al-Karīm, and M. Quraish Shihab's Tafsir Al-Mishbah: Pesan, Kesan dan Keserasian al-Qur'an. Supporting sources included Ibn Manzur's Lisān al-ʿArab, scientific literature on aerodynamics, and relevant research articles. The analysis comprised seven stages adapted from Al-Farmawi's thematic exegetical approach and developed to meet the requirements of interdisciplinary research: verse compilation, linguistic analysis, examination of contextual relationships among verses, review of authoritative exegesis, scientific–aerodynamic correlation, theoretical synthesis, and generalization and contextualization of the findings. At the scientific correlation stage, relationships between Qur'anic terminology and aerodynamic concepts were treated as conceptual interpretations to be evaluated for semantic compatibility, exegetical context, and the validity of the scientific theories, rather than as literal equivalences between revelation and modern physical concepts.

First, textual data compilation. The researchers identified and collected Qur'anic verses related to flight, particularly Surah Al-Mulk [67]:19 and Surah An-Nahl [16]:79. Supporting verses were selected according to their thematic relevance and exegetical context, rather than merely on the basis of terminological similarities with concepts in modern physics.

Second, linguistic analysis. The researchers examined the roots, lexical meanings, and usage of key terms in the verses using Lisan al-Arab and exegetical explanations. This stage

established the semantic scope of terms such as musakhkharāt and yaqbidhn according to Arabic linguistic principles while avoiding the imposition of modern scientific terminology on the original meanings of the text.

Third, analysis of contextual relationships among verses. The researchers examined verse contexts, thematic relationships (munāsabah), and information about the chronology of revelation where relevant and supported by reliable sources. This stage sought a comprehensive understanding of the verses' messages, particularly the relationships among avian flight, the order of nature, and Allah's power.

Fourth, analysis of authoritative exegesis. The researchers compared explanations in Mafatih al-Ghaib, Al-Jawahir, and Tafsir al-Misbah to identify similarities, differences, and defensible interpretive limits. This analysis provided the basis for determining whether a proposed relationship with an aerodynamic concept was textual, conceptual, or merely a reflective analogy.

Fifth, scientific–aerodynamic correlation. The researchers compared the linguistic and exegetical findings with aerodynamic theory using five criteria: (1) lexical compatibility, whereby a proposed relationship did not contradict the basic meaning of a Qur'anic term; (2) contextual compatibility, whereby the phenomenon under comparison was relevant to the verse; (3) exegetical support, whereby the relationship took account of authoritative interpretations; (4) scientific validity, whereby aerodynamic concepts were grounded in reliable scientific theory and literature; and (5) epistemological boundaries, whereby a correlation was not treated as evidence that a verse literally formulated a modern physical law. These criteria were used to examine the relationships between musakhkharāt and the air medium, yaqbidhn and downwash, and azwāj and action–reaction as possible conceptual connections rather than semantic equivalences. A correlation was accepted as a reflective analogy when it was phenomenologically relevant and consistent with both the meaning of the verse and scientific knowledge. Conversely, a correlation was rejected if it depended solely on terminological resemblance or required a change in meaning unsupported by linguistic and exegetical analysis.

Sixth, theoretical synthesis. The researchers integrated the exegetical findings and aerodynamic analysis through interdisciplinary reasoning that distinguished textual findings, scientific explanations, and conceptual interpretations. The synthesis focused on downwash, changes in airflow momentum, and lift in relation to Newton's Third Law, while accounting for pressure distribution and other aerodynamic principles. This stage produced a framework connecting Qur'anic reflection on flight with contemporary scientific explanations.

Seventh, contextualization and conclusion drawing. The researchers critically formulated the findings by treating Qur'anic verses as sources of theological reflection and aerodynamic theory as an empirical explanation of flight mechanisms. The conclusions were limited to conceptual relationships supported by the analysis, rather than claims that downwash theory or Newton's Third Law is explicitly described in the Qur'anic text.

Result and Discussion

Result

Conceptual Framework for Aerodynamics and Qur'anic Terminology

Understanding aircraft lift requires an examination of the relationships among wing geometry, airflow characteristics, momentum change, and aerodynamic forces. In aerodynamics, lift results from interactions between wing surfaces and airflow and can be explained through pressure distribution, circulation, and changes in airflow momentum (Yunianta & Wijaya, 2025). One phenomenon associated with lift generation is downwash, the downward deflection of airflow caused by a lifting wing. This phenomenon can be analyzed using momentum conservation and Newton's Third Law (Babinsky, 2003; Anderson, 2017; McLean, 2018).

Within this discussion, the role of the Coanda effect requires careful qualification. The effect describes the tendency of certain fluid flows to follow a nearby surface under particular flow conditions. Although relevant to fluid-flow behavior, it cannot be regarded as the sole cause of lift. Airflow around a wing is influenced by airfoil geometry, angle of attack, pressure distribution, viscosity, and boundary-layer conditions. The relationship between airflow deflection and lift generation must therefore be examined through aerodynamic principles as a whole.

From a Qur'anic perspective, avian flight is mentioned in Surah Al-Mulk [67]:19 and Surah An-Nahl [16]:79 as a sign of Allah's power. Scientific exegesis allows dialogue between natural phenomena described in revelation and developments in scientific knowledge. Scholarship in this field highlights the importance of examining verses concerning natural phenomena (āyāt kawniyyah) in light of scientific knowledge. However, the relationship between scripture and science must be developed critically so that contemporary scientific theories are not treated as literal meanings directly stated in the Qur'anic text (Rosa, 2021).

On this basis, the study distinguishes three levels of analysis. The first is lexical meaning: the meaning of a Qur'anic term in Arabic and its context of use. The second is exegetical meaning: the understanding advanced by exegetes through their interpretive approaches and sources. The third is scientific reconstruction: the researchers' analysis bringing exegetical findings into dialogue with modern aerodynamic theory. This distinction is used to assess the relationships between musakhkharāt, ṣāffāt, yaqbidhn, and azwāj and the phenomenon of flight without assuming that these terms constitute technical vocabulary in modern physics.

Linguistic and Terminological Analysis of Verses Concerning Flight

a. **Ṣāffāt and Yaqbidhn in Surah Al-Mulk [67]:19**

Lexical meaning. The term ṣāffāt (صَافَّاتٍ) refers to birds spreading their wings, whereas yaqbidhn (يَقْبِضْنَ) derives from the root qabaḍa, meaning to grasp, draw in, gather, or bring together. In Lisān al-ʿArab, Ibn Manzur explains that al-qabḍ is the opposite of al-basṭ, meaning to spread out(Manẓūr & ibn Mukarram, 2003). In the

context of avian flight, the two terms describe outstretched wings and the movement of drawing them in.

Exegetical interpretation. The use of these terms in Surah Al-Mulk [67]:19 demonstrates the Qur'an's attention to birds flying through the movement of their wings. In Mafātīḥ al-Ghayb, Fakhruddin al-Razi explains wing movement by comparing flight through air with swimming through water(Ibn al-Ḥusayn al-Rāzī, 1981). This analogy reflects his attention to the relationship between bodily movement and the medium in which it occurs. However, it does not explicitly formulate the theory of downwash as understood in modern aerodynamics.

The researchers' scientific reconstruction. In aerodynamics, the movement of birds' wings can affect the pressure distribution and momentum of the surrounding air. Flapping generates aerodynamic interactions that can contribute to both lift and thrust. Downward airflow deflection is one aspect that can be analyzed using momentum conservation. The terms ṣāffāt and yaqbidhn may therefore provide a starting point for a conceptual discussion of wing–air interactions. Nevertheless, yaqbidhn cannot be translated directly as downwash: its linguistic meaning refers to wing movement, whereas downwash is an airflow phenomenon. Their relationship is phenomenological rather than terminological equivalence.

b. **Musakhkharāt in Surah An-Nahl [16]:79**

Lexical meaning. The term musakhkharāt (مُسَخَّرَاتٍ) derives from sakhkhara, meaning to subject something or bring it under a particular order. Ibn Manzur explains taskhīr as the condition of being subjected or placed under an ordering influence (Manzur & Mukarram, 2003). Linguistically, the term does not mean air, air mass, or fluid medium.

Exegetical interpretation. In Surah An-Nahl [16]:79, musakhkharāt describes birds in the air as subject to Allah's decree. Interpretations of this verse emphasize that birds' ability to fly is an expression of Allah's power and care for His creation. The expression jaww al-samāʾ identifies the aerial space in which flight occurs, whereas musakhkharāt describes the birds' condition under Allah's decree. The two expressions therefore perform distinct semantic functions.

The researchers' scientific reconstruction. In aerodynamics, air is a fluid medium with mass, density, pressure, and viscosity. These properties enable wing–air interactions that generate aerodynamic forces. This understanding can be brought into dialogue with the phenomenon of avian flight in Surah An-Nahl [16]:79. However, the relationship belongs to the scientific explanation of flight, rather than an interpretation in which musakhkharāt literally means the air medium. The proposed correlation is therefore contextual: it connects the

phenomenon mentioned in the verse with the physical conditions that make it possible.

c. **Is Azwāj in Surah Yasin [36]:36**

Makna leksikal. Istilah azwāj (أَزْوَاجٍ) merupakan bentuk jamak dari zawj yang secara umum bermakna pasangan atau jenis-jenis yang berpasangan. Ibn Manzur menjelaskan bahwa istilah tersebut dapat digunakan untuk menyebut dua hal yang berkaitan, baik yang memiliki kesamaan maupun perbedaan. Dalam QS. Yasin [36]:36, istilah ini digunakan untuk menggambarkan penciptaan pasangan-pasangan sebagai bagian dari tanda kekuasaan Allah.

Lexical meaning. The term azwāj (أَزْوَاجٍ) is the plural of zawj, generally meaning pairs or paired kinds. Ibn Manzur explains that the term may refer to two related entities, whether similar or different (Manzur & Mukarram, 2003). In Surah Yasin [36]:36, it describes the creation of pairs as a sign of Allah's power.

Interpretations by exegetes: Fakhruddin al-Razi discusses the verse within the context of exalting God as the Creator (Al-Rāzī, 1981). Meanwhile, Quraish Shihab explains the scope of the term "pairs" (or "couples") in the context of the diversity of creation (Quraish Shihab, 2007). Thus, the primary focus of the interpretation of this verse is the creation and order of the natural world, rather than the formulation of mathematical relationships between two forces in mechanics.

Exegetical interpretation. Fakhruddin al-Razi discusses the verse in the context of glorifying Allah as the Creator (Al-Rāzī, 1981). Quraish Shihab, meanwhile, explains the semantic scope of pairing in relation to the diversity of creation (Quraish Shihab, 2007). The primary exegetical focus is therefore creation and the order of nature, rather than the formulation of a mathematical relationship between two forces in mechanics

The researchers' scientific reconstruction. Newton's Third Law states that when one body exerts a force on another, the second body exerts an equal and opposite force on the first. In aerodynamics, wing–air interactions can be analyzed according to this principle: the wing exerts a force on the air, and the air exerts a reaction force on the wing. However, the general similarity of two related entities is insufficient to establish azwāj as a textual basis for Newton's Third Law. The connection between azwāj and action–reaction can therefore be treated only as a limited reflective analogy, not as linguistic or exegetical evidence for the physical law.

Contextual Relationships among Verses

Thematic exegesis considers semantic relationships among verses relevant to flight. Surah An-Nahl [16]:79 and Surah Al-Mulk [67]:19 are closely related thematically because both directly address birds flying in the air. Surah An-Nahl

[16]:79 emphasizes birds remaining in the air under Allah's decree, whereas Surah Al-Mulk [67]:19 draws attention to birds spreading and drawing in their wings.

The relationship between these verses allows a thematic examination of flight from two perspectives: birds' presence in the air and wing activity during flight. In scientific analysis, both phenomena involve interactions between wings and the air medium. However, the relationship between the verses does not in itself establish an aerodynamic causal sequence of the kind described in modern physics

Surah Yasin [36]:36, by contrast, addresses the creation of pairs in a broader context. It may serve as a basis for reflection on the order of creation, but it does not have the same direct thematic relationship with flight mechanisms as the two preceding verses. Accordingly, this study treats Surah Al-Mulk [67]:19 and Surah An-Nahl [16]:79 as the primary basis for thematic exegesis, while using Surah Yasin [36]:36 as a supporting verse with limited theological relevance.

Authoritative Exegesis and Its Relevance to Aerodynamics

a. **The Analogy between Flight and Swimming in Al-Razi's Exegesis**

In Mafātīḥ al-Ghayb, Fakhruddin al-Razi (1981) uses an analogy between birds flying through air and swimming through water to explain wing movement. The comparison identifies a phenomenological similarity between the movements of bodies or organisms within fluid media. It is significant because it demonstrates an exegete's attempt to understand natural phenomena through the observations and reasoning available in his time.

In modern physics, air and water are both fluids, although their physical properties differ. Wing–air interactions can be analyzed through fluid dynamics, including pressure distribution and momentum transfer. However, al-Razi's analogy cannot be treated as an early formulation of downwash theory. Its contribution is more appropriately understood as a conceptual explanation of the relationship between wing movement and the medium in which flight occurs.

b. **The Materiality of Air and Aviation Technology in Al-Jawahir**

In Al-Jawāhir fī Tafsīr al-Qurʾān al-Karīm, Thanthawi Jauhari discusses natural phenomena with attention to developments in science and technology. In the passage cited in the research manuscript, he describes air as having material properties and as providing a medium in which objects can move or remain suspended. His discussion of aviation technology, including engines and wing surfaces, reflects an effort to relate natural phenomena to the scientific knowledge of his time.

From an aerodynamic perspective, air is a fluid with mass and physical properties that permit momentum transfer. When a wing interacts with airflow, momentum changes and pressure distribution contribute to lift generation.

Thanthawi Jauhari's discussion can therefore provide a conceptual point of contact between scientific observation and Qur'anic exegesis.

Nevertheless, statements about air's ability to support objects cannot be equated directly with the Coanda effect or downwash theory. Thanthawi Jauhari's interpretation provides an intellectual context for considering the air medium and aviation technology, whereas explanations of lift mechanisms still require an independent foundation in aerodynamic theory.

c. **The Concept of Pairs in Al-Razi's Exegesis and Al-Misbah**

The discussions of Surah Yasin [36]:36 in Mafātīḥ al-Ghayb and Tafsir al-Misbah concern the creation of pairs as a sign of Allah's power. In this context, pairing has a broad theological and linguistic scope. In physics, an action–reaction force pair has a specific technical meaning: two forces of equal magnitude acting in opposite directions on two different bodies. The concept of pairs in Surah Yasin [36]:36 therefore cannot automatically be equated with force pairs under Newton's Third Law.This study treats the relationship between these concepts as a reflective analogy concerning the order of nature. The analogy is not used to prove that the Qur'an literally explains Newton's Third Law, but as part of a dialogue between theological reflection and contemporary scientific knowledge.

Scientific and Aerodynamic Correlations in Downwash and Lift Mechanisms

The linguistic and exegetical findings indicate that relationships between Qur'anic verses and aerodynamic concepts can be explored through conceptual correlation. In this study, such correlations are evaluated according to lexical compatibility, verse context, exegetical support, scientific validity, and epistemological boundaries.

First, wing interaction with the air medium. Surah An-Nahl [16]:79 describes birds flying in the air, while Surah Al-Mulk [67]:19 refers to their wings being spread and drawn in. Both verses can serve as starting points for reflection on flight. Aerodynamically, flight involves interactions between wings and airflow that are influenced by wing geometry, angle of attack, and flow conditions. At this stage, the relationship between scripture and scientific theory is phenomenological, as they address flight from different perspectives.

Second, airflow deflection and downwash formation. In aerodynamics, a lifting wing affects the airflow and changes its momentum. For finite-span wings, downwash is associated with the flow field around and behind the wing. In avian flight, flapping produces more complex flow patterns because wing geometry and motion change dynamically. The term yaqbidhn can provide a starting point for discussing wing movement, but it cannot serve as a textual definition of downwash. The explanation of downwash is thus the researchers' scientific reconstruction based on aerodynamic literature, rather than the direct meaning of a Qur'anic term.

Third, momentum transfer and Newton's Third Law. In lift generation, the wing and the air exert forces on one another. This interaction can be analyzed through Newton's Third Law and momentum conservation. When airflow undergoes a downward change in momentum, a force acts on the wing as part of the aerodynamic interaction. Scientific studies of the relationship between airflow deflection and lift generation support this explanation (Babinsky, 2003; McLean, 2018). The concept of azwāj in Surah Yasin [36]:36 is not used to establish the validity of this law, since neither its linguistic meaning nor its exegetical context specifically addresses physical force pairs.

These three stages explain lift through the relationships among the wing, airflow, momentum change, and aerodynamic forces. This causal sequence derives from modern physical theory, while the Qur'anic verses provide a context for reflection on flight and the order of nature. Accordingly, the study does not conclude that the sequence musakhkharāt–yaqbidhn–azwāj constitutes an aerodynamic formulation explicitly present in the Qur'an.

Synthesis of Findings and Research Contribution

The findings indicate that thematic exegesis of Surah Al-Mulk [67]:19 and Surah An-Nahl [16]:79 can be developed through dialogue with modern aerodynamics. Lexical analysis shows that ṣāffāt and yaqbidhn concern the positions and movements of birds' wings, whereas musakhkharāt denotes submission to Allah's decree. Exegetical interpretations situate flight within the framework of divine power and the order of creation, while modern science explains its mechanisms through wing–air interactions.

The study contributes an analytical framework that distinguishes three domains of knowledge: the linguistic meanings of Qur'anic terms, exegetical interpretations, and scientific reconstruction based on aerodynamic theory. This distinction allows downwash to be discussed as part of lift generation without imposing it as the literal meaning of yaqbidhn. Similarly, the air medium and Newton's Third Law can be brought into dialogue with the phenomena mentioned in the verses without equating them with the meanings of musakhkharāt and azwāj.

The study therefore suggests that integrating thematic exegesis and aerodynamics is better approached through dialogue and analysis than through claims of direct equivalence between revelation and physical theory. This approach supports the development of scientific exegesis that respects the interpretive context of the Qur'an while preserving the accuracy of scientific concepts concerning aircraft lift.

Discussion

Sintesis Teoretis: Rekonstruksi Paradigma Gaya Angkat dalam Tafsir Ilmiah

Theoretical Synthesis of Aircraft Lift in Scientific Exegesis

Drawing on thematic relationships among Qur'anic verses, exegetical interpretations, and aerodynamic literature, this study develops a theoretical synthesis of aircraft lift through

the Newtonian–Downwash Causal Chain. This framework seeks to broaden explanations of lift within scientific exegesis, which have included the use of Bernoulli's principle to explain the relationship between airflow velocity and pressure differences over wing surfaces. Bernoulli's principle and the Newtonian approach are not treated as competing mechanisms. Rather, they provide complementary explanations of wing–air interactions. Pressure distribution explains the aerodynamic forces acting on wing surfaces, while momentum analysis relates those forces to changes in airflow momentum (Sugati, 2026a).

Within Indonesian scientific exegesis, the work developed by the Ministry of Religious Affairs of the Republic of Indonesia in collaboration with the Indonesian Institute of Sciences (LIPI) contributes to discussions of avian flight in Surah Al-Mulk [67]:19. It relates the aerodynamic shape of birds' wings to pressure differences between their upper and lower surfaces. This discussion demonstrates an effort to bring phenomena mentioned in the Qur'an into dialogue with the physics of flight (Lajnah Pentashihan Mushaf Al-Qur'an, 2012). Nevertheless, lift generation can be analyzed more broadly by considering airflow deflection, momentum change, and force interactions between the wing and the air medium.

1. **Airfoil Geometry and the Role of the Coanda Effect**

   Descriptions of a curved upper wing surface and a relatively flat lower surface illustrate one airfoil shape capable of generating lift (Rachman et al., 2025). In aerodynamics, wing geometry influences the surrounding airflow and pressure distribution (Prasetyo, 2024). However, curvature is not an absolute requirement for lift, since symmetrical wings and flat plates can also generate lift under particular flow conditions and at suitable angles of attack.

   The Coanda effect can explain the tendency of certain fluid flows to follow a nearby surface, but it cannot be treated as the sole cause of lift or as a mechanism that invariably governs flow around a wing (Sugati, 2026b). Lift generation involves pressure distribution, boundary-layer characteristics, circulation, and changes in airflow momentum. The Ministry of Religious Affairs–LIPI explanation of aerodynamic wing shape can therefore be extended through a discussion of interactions between wing geometry and airflow, without concluding that the exegetical account directly explains the Coanda effect or downwash

2. **Downwash Dynamics and Their Relationship with Bernoulli's Principle**

   Bernoulli's principle explains the relationship between fluid pressure and velocity under the conditions in which it applies (Rojabi, 2025). In lift generation, pressure distribution over the wing surface is an important determinant of aerodynamic force (Dzulfikar et al., 2024). However, an explanation that merely assumes air above the wing must travel faster because it follows a longer path is inadequate. Lift must also be analyzed in terms of changes in airflow momentum.

   Downwash involves a downward deflection of airflow associated with a lifting wing. Within a momentum-conservation framework, this change in airflow momentum is related to the force acting on the wing. An analysis of downwash and Newton's Third Law therefore supplements rather than replaces Bernoulli's principle, offering an additional perspective on the same aerodynamic phenomenon. Explanations based on

pressure distribution and momentum change are complementary components of aerodynamic analysis (Ahmad Hariri, 2026).

In avian flight, flapping produces more complex aerodynamic interactions than those associated with relatively fixed aircraft wings. Under many flapping-flight conditions, the downstroke makes an important contribution to lift and thrust. However, the contribution of each phase depends on the species, flight speed, and wingbeat pattern (Kurniawati & Nahar, 2020). The term yaqbidhn in Surah Al-Mulk [67]:19 therefore cannot be equated directly with either downstroke or downwash. The relationship is treated as a phenomenological correlation between the wing movement mentioned in the verse and the mechanisms of wing–air interaction explained by modern aerodynamics

3. Reconstructing the Newtonian–Downwash Causal Chain

On this basis, the study develops the Newtonian–Downwash Causal Chain as a conceptual framework linking wing interaction with the air medium, flow deflection, momentum change, and lift generation. It is not intended as a new aerodynamic theory, but as an analytical synthesis that clarifies lift mechanisms within studies integrating the Qur'an and science.

Rekonstruksi tersebut dibangun melalui tiga pokok argumentasi berikut.

a. Air as a Material Medium

Dalam aerodinamika, udara merupakan fluida yang memiliki massa, kerapatan, tekanan, dan viskositas. Sifat-sifat tersebut memungkinkan terjadinya interaksi antara sayap dan udara serta perpindahan momentum(Cahyadi et al., 2024). Dengan demikian, hubungan antara *musakhkharāt* dan medium udara dalam penelitian ini bersifat kontekstual: ayat mengarahkan perhatian pada fenomena penerbangan, sedangkan ilmu aerodinamika menjelaskan kondisi fisik yang memungkinkan fenomena tersebut berlangsung.

This reconstruction rests on the following three arguments.

b. Air as a Material Medium

Lexically, musakhkharāt in Surah An-Nahl [16]:79 denotes a state of being subjected or governed by Allah's decree. In the verse, it refers to birds flying in the air. The explanation of air as a material medium, however, derives from scientific inquiry and exegetical discussions of flight, rather than from the literal meaning of musakhkharāt.

In aerodynamics, air is a fluid with mass, density, pressure, and viscosity. These properties enable wing–air interactions and momentum transfer (Cahyadi et al., 2024). The relationship between musakhkharāt and the air medium is therefore contextual: the verse draws attention to flight, while aerodynamics explains the physical conditions that make it possible

c. **Yaqbidhn as a Description of Wing Movement**

Linguistically, yaqbidhn in Surah Al-Mulk [67]:19 refers to drawing in or folding the wings. Through his analogy between flight and swimming, Fakhruddin al-Razi explains the relationship between bodily movement and the medium in which it occurs (al-Razi, 1981).

From an aerodynamic perspective, the movement of birds' wings influences airflow, pressure distribution, and momentum change. A comparable interaction occurs in aircraft when wings moving relative to the air generate lift (Muhammad, 2024). However, avian flight involving flapping is not entirely identical to flight with relatively fixed aircraft wings (Purnomo, 2025). Accordingly, yaqbidhn is understood as a textual description of birds' wing activity, while downwash is a scientific concept used by the researchers to analyze one aerodynamic consequence of wing–air interaction.

d. **Pairing as an Interpretive Correlation with Newton's Third Law**

Surah Yasin [36]:36 describes the creation of pairs (azwāj) as a sign of Allah's power. Lexically and within its exegetical context, azwāj encompasses pairing and the diversity of creation. It does not refer directly to force pairs in Newtonian mechanics.

In physics, Newton's Third Law states that two interacting bodies exert forces of equal magnitude and opposite direction on one another. In wing–air interactions, the force exerted by the wing on the air is paired with the force exerted by the air on the wing. This principle can explain lift mechanisms alongside analyses of pressure distribution and momentum conservation (Kiswanto, 2022).

This study treats the relationship between azwāj and action–reaction force pairs as a limited interpretive analogy. Surah Yasin [36]:36 is not used as a textual foundation for, or proof of, Newton's Third Law, but as a basis for theological reflection on the order of creation. The scientific validity of action–reaction mechanisms therefore remains grounded in physical laws, while the Qur'anic verse offers an epistemologically distinct reflective perspective.

Taken together, the Newtonian Downwash Causal Chain explains lift in terms of wing–air interaction, changes in airflow momentum, and the resulting aerodynamic forces. Under certain flight conditions, lift can balance an aircraft's weight, enabling it to maintain altitude. This does not mean that an aircraft negates or overrides gravity; rather, it operates according to the physical laws governing motion and fluid interactions

Generalization and Contextualization of Flight from a Qur'anic Perspective

1. Generalization of the Findings

The theoretical synthesis indicates that the flight phenomena mentioned in Surah An-Nahl [16]:79 and Surah Al-Mulk [67]:19 can be brought into dialogue with modern aerodynamic explanations of lift. Lexical and exegetical analyses show that musakhkharāt concerns creatures' submission to Allah's decree, while ṣāffāt and yaqbidhn describe the positions and movements of birds' wings. Scientific analysis, meanwhile, explains lift through wing–air interaction, pressure distribution, flow deflection, and momentum change.

The finding is therefore not that the Qur'an literally formulates downwash mechanisms or Newton's Third Law, but that the flight phenomena mentioned in these verses can be investigated through interdisciplinary inquiry involving thematic exegesis and aerodynamics. The study's principal contribution is the Newtonian–Downwash

Causal Chain, a conceptual synthesis that clarifies the relationship between physical explanations and theological reflection

2. **Contextualizing the Development of Scientific Exegesis**

These findings contribute to the teaching and study of scientific exegesis, particularly discussions of flight. Explanations of lift that emphasize only air-pressure differences can be enriched by analyses of momentum change and airflow deflection. This extension does not constitute a rejection of Bernoulli's principle. In modern aerodynamics, analyses of pressure distribution and momentum conservation are used together to understand lift generation.

For scientific exegesis, this approach demonstrates the importance of distinguishing verse interpretation from the researchers' scientific reconstruction. Musakhkharāt and yaqbidhn retain their linguistic meanings and exegetical contexts, while downwash and Newton's Third Law serve as scientific tools for analyzing flight. Research integrating the Qur'an and science can thus develop without making contemporary physical theory the sole determinant of scriptural meaning.

3. **Epistemological Implications**

Epistemologically, the study affirms that the Qur'an and aerodynamics have distinct domains of inquiry and modes of explanation. The Qur'an directs people to consider natural phenomena as signs of Allah's power, while aerodynamics explains the physical mechanisms of flight through theory, observation, and scientific analysis.

Their relationship can be developed through a dialogical approach that respects the boundaries of each domain of knowledge. Within Islamic theology, the regularity of natural laws can be contemplated as part of sunnatullāh. Meanwhile, the successful development of aircraft technology demonstrates the human capacity to understand and apply the physical principles operating in nature. The Newtonian–Downwash Causal Chain thus provides a synthetic framework that enriches scientific exegesis through a more comprehensive aerodynamic analysis while avoiding direct equivalence between Qur'anic terminology and modern physical laws.

Conclusion

The principal finding of this study is a reconstructed conceptual account of aircraft lift within scientific exegesis, emphasizing the relationships among the air medium, wing–air interaction, downward airflow deflection (downwash), momentum transfer, and Newtonian action–reaction forces. This framework complements Bernoulli-based explanations by integrating pressure distribution and momentum conservation as interconnected aspects of aerodynamic lift. Within the proposed interpretive framework, yaqbidhn in Surah Al-Mulk [67]:19, which lexically refers to the folding or drawing in of birds' wings, is conceptually correlated with wing movement and its potential aerodynamic consequences, including downward momentum transfer. The Coanda effect may contribute to airflow attachment under certain conditions, but it is not regarded as the sole or universal mechanism responsible for lift.

The scholarly contribution lies in developing the Newtonian–Downwash Causal Chain as an interdisciplinary conceptual synthesis connecting thematic Qur'anic exegesis with contemporary aerodynamic explanations. The relationships between yaqbidhn and

downwash, between azwāj in Surah Yasin [36]:36 and Newtonian action–reaction forces, and between tashkhīr in Surah An-Nahl [16]:79 and the regularity of the air medium are interpretive correlations proposed in this study. They are neither direct semantic equivalences nor empirical evidence that specific modern aerodynamic theories are explicitly contained in the Qur'anic verses. These correlations draw on linguistic analysis, authoritative exegesis, and comparison with aerodynamic literature, while preserving distinctions among the original meanings of Qur'anic terms, their exegetical interpretations, and the researchers' contemporary scientific reconstruction. The framework thus extends previous Bernoulli-focused discussions in scientific exegesis without treating Bernoulli's principle and Newtonian momentum analysis as mutually exclusive explanations.

This study is limited to qualitative library-based analysis of wing aerodynamics and selected Qur'anic terms. It provides neither experimental verification of aerodynamic mechanisms nor empirical validation of the proposed interpretive correlations. Future research could examine additional Qur'anic terminology related to wind (rīḥ/riyāḥ), investigate aerodynamic stability and turbulence, and employ computational fluid dynamics simulations to analyze airflow behavior and downwash further. Such investigations should preserve a clear distinction between scientific evidence concerning aerodynamic phenomena and interpretive arguments concerning Qur'anic texts.

Ethical Statement

This study did not require ethical approval, as it relied exclusively on library research involving published Qur'anic exegesis, linguistic references, and scientific literature. The research did not involve human participants, animals, or the collection of personal data.

Artificial Intelligence (AI) Use Statement

The authors declare that artificial intelligence (AI) tools were used solely to assist with language editing, grammatical correction, and improving the clarity and readability of the manuscript. AI was not used to generate research findings, conduct linguistic or exegetical analysis, develop aerodynamic interpretations, or formulate the Newtonian–Downwash Causal Chain. All interpretations, scholarly arguments, references, and conclusions were critically reviewed and verified by the authors, who take full responsibility for the manuscript.

Author Contributions

Wahyu Aditama contributed to the conceptualization, research methodology, literature investigation, linguistic and thematic analysis of Qur'anic verses, aerodynamic conceptual synthesis, and preparation of the original manuscript. Anisatul Fikriyah Aprilianti contributed to the literature review, analysis of exegetical sources, validation of interpretive arguments, critical evaluation of the interdisciplinary framework, and manuscript review and editing. Both authors reviewed and approved the final version of the manuscript.

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