

# The Concept of Purification (Tahara) in Qur'an and its Scientific Basis: A Microbiological Analysis of Wudu, Ghusl, and Tayamum

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Received on: 02-01-2026

Accepted on: 04-02-2026

## Abstract

Islam integrates spiritual purification with practices that naturally support physical health, placing a strong emphasis on cleanliness (Tahara). This article compares Qur'anic teachings and prophetic traditions with modern scientific knowledge in order to examine the microbiological wisdom ingrained in the Islamic rituals of Wudu, Ghusl, and Tayammum. The Hadith literature emphasizes the importance of purification to faith and daily hygiene, while Tahara theology establishes it as both a divine mandate and a requirement for worship. The hands, mouth, nose, face, and feet, the body parts highlighted in Wudu, are important reservoirs and routes of transmission for pathogenic microorganisms like *E. coli*, *Staphylococcus aureus*, and respiratory pathogens, according to contemporary microbiology. The microbial load is greatly reduced, biofilm formation is disrupted, and mucosal defenses are strengthened by frequent ablution with running water. By mechanically reducing microbial colonization and promoting the health of the skin barrier, Ghusl provides a thorough hygienic reset that is particularly advantageous following sexual activity, menstruation, and postpartum periods. Although symbolic, tayammum uses clean soil's inherent antimicrobial and adsorptive qualities as a safe substitute when water is scarce. When combined, these customs show a striking balance between preventive health practices and spiritual cleansing. This multidisciplinary analysis demonstrates that Islamic purification practices represent a sophisticated, ageless framework for upholding personal hygiene, preventing infection, and advancing public health rather than being merely ritualistic.

**Keywords:** Tahara, Wudu, Ghusl, Tayammum, Microbial Load, Islamic Hygiene

## 1.Introduction:

Islamic teachings place a strong emphasis on cleanliness and purification, both as spiritual duties and as behaviors that promote physical health. Before every prayer, believers must perform certain cleansing rituals, most notably Wudu (ablution), in accordance with the

concept of Tahara (ritual purity) as stated in Quran:

***"O believers! When you rise up for prayer, wash your faces and your hands up to the elbows, wipe your heads, and wash your feet to the ankles."***[1]

In the Islamic tradition, the Quran serves as both a source of spiritual guidance and an endless source of ideas about the natural world, including aspects related to human health and wellbeing[2]. Human beings are always exposed to different microorganisms that can cause diseases. Factors that raise the risk of illness include eating contaminated food, being unaware of personal and environmental hygiene, poor waste management, and unsanitary practices. These conditions can help spread infections, weaken overall health, and make people more susceptible to diseases[3]. Studies show that handwashing with soap and water reduces the quantity of harmful microorganisms that could cause illnesses[4]. Tahara in Islam means not only spiritual purity but also bodily cleanliness. This means keeping the body, clothes, and surroundings free of dirt and other impurities. This holistic approach to purification is further emphasized in other Quranic verses and Prophetic traditions. For example, the Quran says,

***"Indeed, Allah loves those who are constantly repentant and loves those who purify themselves"*** [5].

The Prophet Muhammad (peace be upon him) specifically linked cleanliness to faith, stating, ***"Cleanliness is half of faith"*** (*Sahih Muslim*).[6]

This creates Tahara as a vital pillar, connecting spiritual intent (niyyah) with physical action. Ghusl is obligatory following significant impurities, such as marital intimacy or menstruation, to ensure a comprehensive purification of both spiritual and physical states[7]. Conversely, in situations where water is unavailable, Islam offers the concession of Tayammum (dry ablution with pure earth), emphasizing the religion's flexibility and emphasis on practicality without compromising the core principle of purification[8]. From a microbiological point of view, the human body, especially the exposed areas required for wudu (hands, face, mouth, nostrils, arms, legs), constitute a major reservoir and site of transmission for pathogenic and commensal microorganisms. Hands are well-documented vectors of nosocomial and community-acquired infections carrying pathogens such as *E. coli*, *Staphylococcus aureus*, and viruses[9]. The oral and nasal cavities contain a complex microbiome, and an imbalance can lead to systemic health problems[10]. Mechanical flushing of these areas with water several times a day is therefore an essential public health measure. The purpose of this article is the microbiological analysis of the Islamic purification rituals wudu, ghusl, and tayammum. This analysis seeks to unravel the profound wisdom (hikmah) embedded in Islamic injunctions by integrating Qur'anic principles with modern microbiological evidence, and shows that the spiritual pursuit of tahara inherently includes a scientific basis for personal and public health.

## **2. Theology of Tahara:**

The Islamic principle of Tahara (ritual purity) extends beyond simple physical cleaning, it represents a deep spiritual condition essential for worship and an important aspect of faith[11]. Its roots are firmly established in the main sources of Islamic law: the Quran and the genuine Sunnah (traditions) of the Prophet Muhammad (peace be upon him).

## 2.1 Quranic Foundations:

The Quran defines purity as a physical state and a spiritual symbol for righteousness.

- **Direct Command for Ablution:**

The primary, unambiguous command for Wudu is found in Surah Al-Ma'idah (5:6):

تَأْتِيهَا الَّذِينَ ءَامَنُوا إِذَا قُمْتُمْ إِلَى الصَّلَاةِ فَاغْسِلُوا وُجُوهَكُمْ وَأَيْدِيَكُمْ إِلَى الْمَرَافِقِ وَامْسَحُوا بِرُءُوسِكُمْ وَأَرْجُلَكُمْ إِلَى الْكَعْبَيْنِ  
"O you who have believed, when you rise to [perform] prayer, wash your faces and your forearms to the elbows and wipe over your heads and wash your feet to the ankles." [12]

- **Purity as a Divine Love:**

The Quran links the act of purification to Allah's love and acceptance. In Surah Al-Baqarah (2:222),

إِنَّ اللَّهَ يُحِبُّ التَّوَّابِينَ وَيُحِبُّ الْمُتَطَهِّرِينَ

"Indeed, Allah loves those who are constantly repentant and loves those who purify themselves." [13]

By the term "al-mutatahhireen," (purified ones), spiritual repentance (tawbah) and physical cleanliness are considered as one, showing their close relationship.

- **Purification as Preparation for Divine Remembrance:**

In Surah Al-Muddaththir (74:4), a command directed at the Prophet emphasizes:

وَتِيَابِكَ فَطَهِّرْ

"And purify your garments." [14]

- **The Concession of Tayammum:**

The Quran, while emphasizing water, provides a practical concession, demonstrating the balance between obligation and ease. The same verse in Al-Ma'idah (5:6) continues:

وَأَنْ كُنْتُمْ مَرْضَىٰ أَوْ عَلَىٰ سَفَرٍ أَوْ جَاءَ أَحَدٌ مِّنْكُمْ مِنَ الْغَائِطِ أَوْ لَمَسْتُمُ النِّسَاءَ فَلَمْ تَجِدُوا مَاءً فَتَيَمَّمُوا صَعِيدًا طَيِّبًا ..  
...فَامْسَحُوا بِوُجُوهِكُمْ وَأَيْدِيكُمْ مِنْهُ...

"...And if you are ill or on a journey or one of you comes from the place of relieving himself or you have contacted women and do not find water, then seek clean earth and wipe over your faces and hands with it..." [15]

It highlights Tayammum as a legitimate, divinely approved option, still sustaining the principle of cleanliness, even under hardship.

## 2.2 Hadith:

The Sunnah of the Prophet Muhammad (PBUH) offers the essential information, spiritual background, and strong affirmation of the commands found in the Quran.

- **Cleanliness as Half of Faith:**

The Prophet (PBUH) elevated the status of physical purity to an essential component of faith itself:

الطُّهُورُ شَطْرُ الْإِيمَانِ

"Cleanliness is half of faith." (Sahih Muslim) [16]

- **The Key to Prayer:**

Wudu's ceremonial purpose is made clear:

مِفْتَاحُ الصَّلَاةِ الطُّهُورُ

"The key to prayer is purification." [17]

This hadith highlights that prayer, the central act of Muslim worship, is inaccessible without the being clean and purified.

• **Purification as a Means of Expiation:**

Hadiths that describe Wudu as washing away small sins emphasize the spiritual cleansing aspect:

إِذَا تَوَضَّأَ الْعَبْدُ فَغَسَلَ وَجْهَهُ خَرَجَتْ مِنْ وَجْهِهِ كُلُّ خَطِيئَةٍ نَظَرَ إِلَيْهَا بِعَيْنَيْهِ...

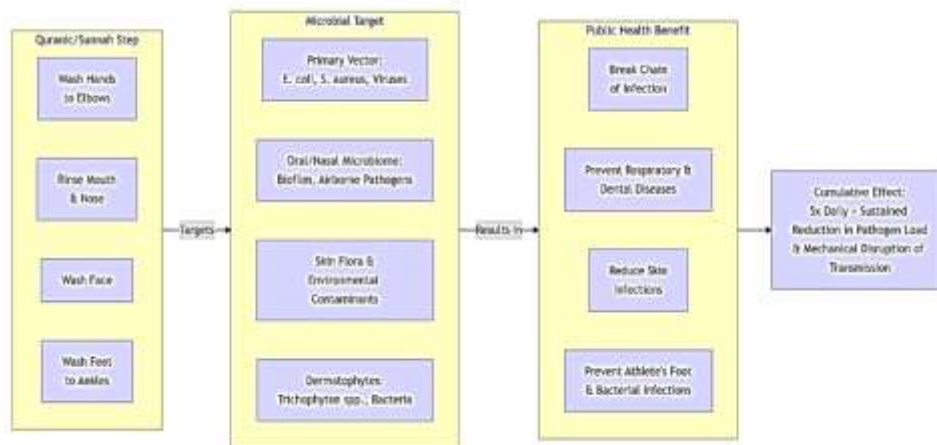
"When a servant (of Allah) performs ablution and washes his face, every sin he committed with his eyes leaves with the water... until he emerges purified from his sins." [18]

• **Emphasis on Specific Hygiene Practices:**

The Prophetic tradition extends Tahara to daily hygiene, mandating practices with clear microbiological benefits, such as:

"Were it not for fear of imposing hardship on my Ummah, I would have ordered them to use the Siwak (tooth-stick) for every prayer."

This integrated framework which combines heavenly command, prophetic example, spiritual symbolism, and physical action makes Tahara a unique and comprehensive system. To clearly illustrate the alignment between the divine command, contemporary microbiology, and preventive health, the correlation is presented in Figure 1.



,1Figure 1: Relation between the divine command, contemporary microbiology, and preventive health

**3. Microbiology: Linking Purification with Germs**

Human skin and bodily openings harbour a large population of microorganisms [19]. While many are harmless or even beneficial, some can cause infection and disease, especially when transferred to vulnerable areas [20]. Islamic purification practices place a strong emphasis on bodily portions that are microbiologically significant, such as high-touch areas and pathogen entry points. As stated in Quran:

شُرِّ مِنْ الْفِطْرَةِ: قَصُّ الشَّارِبِ، وَإِعْفَاءُ اللَّحْيَةِ، وَالسُّوَالِكِ، وَاسْتِنْشَاقُ الْمَاءِ، وَقَصُّ الْأَظْفَارِ، وَغَسْلُ الْبَرَاجِمِ، وَنَتْفُ الْإِيطِ، وَحَلْقُ الْعَانَةِ، وَانْتِقَاصُ الْمَاءِ

"Ten acts are from the Fitrah (natural way): trimming the mustache, letting the beard grow, using the Siwak (tooth-stick), rinsing the nose with water, cutting the nails, washing the knuckles, plucking armpit hair, shaving pubic hair, and cleansing with water after relieving

*oneself.*" (Sahih Muslim 261)

A contemporary scientific perspective demonstrates that the Quranic verses and prophetic traditions serve as a precise, divinely-guided type of microbiological management, notwithstanding their emphasis on the spiritual state and recommended behaviors. It is not arbitrary to be instructed to wash the hands, mouth, nose, face, and feet prior to prayer [21]. These are the body's main microbial reserves and entry points[22]. The hands are the primary means of spreading infections such as *Escherichia coli*[9]. The oral and nasal cavities harbor complex microbiomes where imbalance can lead to disease. Wudu rituals performed with running water several times a day therefore function like repetitive mechanical interventions. This physically removes transient pathogens, disrupts biofilm formation, and restores microbial balance in these critical areas[23]. This remarkable coincidence suggests that the Qur'anic injunction for purification (tahara) embodies a profound and timeless wisdom that seamlessly integrates spiritual devotion with basic principles of microbial hygiene and preventive medicine. The microbiological mechanisms underlying Wudu, Ghusl, and Tayammum are visually summarized in Figure 2, highlighting how each form of purification contributes to reducing microbial load and preventing infection.



**Figure 1:** The relationship between Islamic purification practices and microbial reduction

#### **4. Scientific Analysis of Wudu:**

A Wudu ritual is a structured act of worship consisting of distinct steps. From a microbiological point of view, each step represents a targeted hygienic intervention. The cumulative effect of performing these steps multiple times a day creates a powerful regimen that reduces the microbial load and interrupts the pathogen's transmission route.

##### **4.1 Washing the Hands and Arms: Breaking the Chain of Infection**

The first step of washing your hands up to your elbows is the most important from a public health perspective. Hands are the main vectors for fecal-oral transmission of pathogens[9]. Mechanically washing with water reduces the bacterial count on hands by 90-99%[23]. Extending the cleaning area to the elbow eliminates the possibility of contaminating the sleeve or forearm and re-contaminating the cleaned hands[24]. This step itself, repeated before every prayer, frequently breaks the chain of transmission.

##### **4.2 Rinsing the Mouth: Oral Microbiome Management**

The oral cavity is a major reservoir for over 700 species of bacteria[10]. Washing with water during wudu has two important functions

- 1) Removes food particles and plaque, which are the main substrate for cariogenic (cavity-causing) bacteria such as *Streptococcus mutans*[25].
- 2) Helps neutralize the acidic environment created by bacterial fermentation, thereby protecting tooth enamel[26]. Research shows that regular rinsing can significantly reduce the number of colony forming units (CFU) of salivary bacteria.

##### **4.3 Cleansing the Nostrils: Respiratory Tract Defense**

The nasal passages are a primary entry point for airborne pathogens[27]. Inhaling water through your nostrils and expelling it has the following effects:

- 1) It hydrates the nasal mucosa, thereby improving the natural ciliary clearance function of the nasal mucosa[28].
- 2) Physically removes inhaled allergens, dust, and attached microorganisms, reducing the amount of inoculum that can cause sinusitis and lower respiratory tract infections[29]

##### **4.4 Washing the Face and Feet**

Washing your face removes environmental pollutants, sweat, and oils that can trap bacteria and cause folliculitis, often caused by *Staphylococcus aureus*[30]. The feet, especially between the toes, are a typical site for dermatophyte and bacterial infections such as *Trichophyton* (the causative agent of athlete's foot)[31]. The regular cleaning and careful drying required in wudu maintain the integrity of the skin and create an environment less conducive to fungal growth.

##### **4.5 Microbiological Impact of Frequency and Technique**

A defined frequency (at least 5 times per day) repeatedly resets the microbial colonization of these critical sites to pathogenic levels[22]. Additionally, the use of running water is superior to stagnant water because it physically removes free bacteria and prevents reinfection[32]. The cumulative effect is a sustained reduction in bioburden at the most

important sites of infection entry and transmission within the body, indicating that wudu is an infection prevention protocol based on pre-modern science. Narrated 'Uthman bin 'Affan:

**"The Prophet (ﷺ) said, 'He who performs ablution well, his sins will leave his body, even from under his nails.'" (Sahih Muslim 245).**

### 5. Scientific Analysis of Ghusl:

Ghusl is prescribed in Islam primarily for conditions of severe ritual impurity (janabah), such as after marital intimacy, menstruation, and postpartum bleeding[7]. While its spiritual purpose is to restore a state of purity for worship, from a microbiological and public health perspective, ghusl completely hygienically resets the entire body and has great effects on skin health and infection prevention.

#### 5.1 The Prescribed Method and Its Hygienic Logic

The Prophetic method of Ghusl, as narrated by Aisha (RA), involves a specific sequence as shown in Figure 3:

- Washing the hands first.
- Then washing the genital area thoroughly.
- Performing a complete Wudu.
- Finally, pouring water over the entire body three times, ensuring it reaches the roots of the hair and skin folds[33].

This method is not merely symbolic but follows a logical **decontamination sequence**: starting with the most locally contaminated area (genitals), then cleansing the major portals (face, mouth, nose, hands via Wudu), and concluding with a full-body rinse. This prevents the spread of local flora to other body parts during the bath.



**Figure 3:** The Prophetic method of Ghusl, as narrated by Aisha (RA)

## 5.2 Microbial Ecology of Skin and Mucous Membranes

The skin is the largest organ in the body and is home to a diverse range of resident microbiota, including *Staphylococcus epidermidis* and various fungi[19]. The groin and perineal areas are moist and engorged, therefore, harbor a diverse microbial community[34]. Serious infection and potential overgrowth of microorganisms occurs after intimate relationships or during sexual intercourse and menstruation. Ghusl, which requires washing the whole body with water, mechanically reduces the overall microbial load, thereby restoring the ecological balance of the skin.

## 5.3 Specific Health Benefits Linked to Ghusl Practices

- **Postcoital hygiene:** Marital intimacy facilitates the exchange of genital and skin flora. Washing your entire body removes semen, vaginal fluids, and sweat, which are all conducive environments for bacterial growth. This reduces the risk of urinary tract infections (UTIs), which are often caused by *E.coli*, and promotes genitourinary health[35].
- **Menstrual and postpartum hygiene.** During menstruation and postpartum hemorrhage the vaginal pH changes and the blood acts as a food source for pathogens. Ghusl thoroughly cleanses the perineum, preventing bacterial growth, odor, and infections such as bacterial vaginosis[36]. By focusing on cleaning the hair roots, it also prevents potential contamination from blood and sweat.
- **Removal of sebum and sweat:** Ghusl requires cleaning the entire skin surface, effectively removing sebum (oil), sweat, dead skin cells and accumulated environmental pollutants. This prevents folliculitis, an unpleasant body odor caused by the bacterial breakdown of sweat and allows the skin to function optimally as a barrier[37]. Essentially, ghusl can be viewed as a periodic "reboot" of your skin microbiome. It reduces the overall biological load, eliminates potential pathogenic niches, and maintains skin integrity. This is a physical cleansing that perfectly complements the spiritual rebirth you are trying to achieve. As stated in Quran:

وَيَسْأَلُونَكَ عَنِ الْمَحِيضِ قُلْ هُوَ أَذَى فَأَعْتَزِلُوا النِّسَاءَ فِي الْمَحِيضِ وَلَا تَقْرُبُوهُنَّ حَتَّى يَطْهَرْنَ فَإِذَا تَطَهَّرْنَ فَأْتُوهُنَّ مِنْ حَيْثُ أَمَرَكُمُ اللَّهُ...

*"They ask you about menstruation. Say, 'It is harm, so keep away from wives during menstruation. And do not approach them until they are pure. And when they have purified themselves, then come to them from where Allah has ordained for you...'"*[38]

## 6. Scientific Analysis of Tayammum:

Tayammum is an Islamic concession to use clean soil for ritual purification when water is unavailable, its use is harmful, or is scarce. It is divinely sanctioned in the Quran:

... فَلَمْ تَجِدُوا مَاءً فَتَيَمَّمُوا صَعِيدًا طَيِّبًا...

*"...but you find no water, then seek clean earth and wipe over your faces and hands with it..."*  
(Quran 5:6)

Although tayammum is a symbolic act and spiritually equivalent to wudu, the prescribed material, pure earth (known as tayyib), has essential physicochemical properties that ensure partial and tangible hygiene

### 6.1 The Antimicrobial and Adsorptive Properties of Soil

- **Mechanical Abrasion & Adsorption:** Dry soil particles act as natural adsorbents. When rubbed against the skin, its abrasive action physically binds and removes oil, sweat, and some bacteria from the surface, much like a dry cloth[39].
- **Antimicrobial Action:** Certain clays (such as those rich in kaolinite) have historically been used to clean and heal wounds because of their ability to adsorb bacterial toxins and even inhibit microbial growth[40].

### 6.2 Targeted Application: Face and Hands

The command to wipe the face and hands mirrors Wudu's focus on the body's most exposed and interactive parts. While not as effective as water, the act of applying earth:

- Disrupts the lipid and sweat layer on the skin where microbes reside.
- Partially reduces the microbial load on these critical transmission sites (hands) and sensory portals (face).
- Provides a psychological and tactile signal of transition to a state of cleanliness, preparing the mind for prayer.

### 6.3 A Concession Rooted in Practical Wisdom

The permission for Tayammum underscores Islam's practicality. In arid environments or during illness, seeking water could cause hardship or exacerbate a condition (e.g. hypothermia, wound infection)[41]. The use of dry, clean soil provides a safe and publicly available alternative suitable for the mental state of tahara while avoiding physical harm. This is the most important principle in Islamic jurisprudence.

Narrated Ammar ibn Yasir:

***"We were with the Prophet (ﷺ) on a journey and we had no water. He said, 'Find for me some clean earth.' Then he struck the earth with his hands and blew off the dust, then wiped his face and hands with it."*** (Sunan an-Nasa'i 321, authenticated)

Narrated Abu Dharr:

***The Prophet (ﷺ) said, "Clean earth is a purifier for the Muslim even if he does not find water for ten years."*** (Sunan al-Tirmidhi 124, classified as Hasan)

## 7. Conclusion:

This analysis shows that Islamic purification rituals (Wudu, Ghusl and Tayammum) represent a profound integration of spiritual discipline and microbiological wisdom. Far from being merely symbolic acts, each practice is strategically adapted to the microbial ecology of the body. Wudu functions as a frequent and targeted hygiene protocol that reduces pathogen loads at major transmission sites. Ghusl provides complete restoration of the skin microbiome after major biological events. Tayammum, the dry purification concession, also takes advantage of the mechanical absorptive and cleansing properties of clean earth when water is not available. The Quranic injunction "Allah does not want to cause you trouble, but He wants to purify you" (5:6) therefore finds a strong echo in modern science. The prescribed steps, frequencies, and materials of Islamic Tahara not only facilitate spiritual readiness for worship, but also provide a scientifically sound framework for personal and public health. This remarkable alignment between 1,400-year-old divine guidance and modern infection

control principles speaks to the timeless, holistic wisdom (Hikmah) enshrined in Islamic tradition, in which the pursuit of spiritual purity inherently guarantees the preservation of physical well-being.

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