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THE HYPOTHESIS OF *WUḌŪ'* (ISLAMIC RITUAL ABLUTION) PRACTICE AS A POSSIBLE REGULATOR IN THE INTERACTIVE COMPLEX OF SKIN, SKIN MICROBIOTA AND THE OUTER WORLD.

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ABSTRAK

Wuḍū' (wudhu) adalah praktik keagamaan yang dilakukan setiap hari oleh umat Islam. Pengetahuan yang berkembang tentang mikrobiota kulit manusia yang terdiri dari mikroorganisme komensal dan patogen membutuhkan pendekatan baru terhadap pengelolaannya. Pentingnya wuḍū' sebagai praktik pembersihan dan pengatur mikrobiota kulit perlu dipelajari dan diterapkan jika hasilnya terbukti bermanfaat. Pendekatan baru yang didasarkan pada estimasi efek wuḍū' pada awalnya membutuhkan kerangka kerja dimensi yang mengarah pada hipotesis yang mungkin. Sebuah tinjauan literatur akan berfungsi sebagai langkah pertama untuk mengidentifikasi dimensi mikrobiota kulit yang mungkin dipengaruhi oleh praktik wuḍū'. Perhitungan area tubuh, frekuensi pencucian dan kualitas air yang digunakan adalah langkah selanjutnya dari evaluasi. Wuḍū' berfungsi seperti sebuah algoritma dan protokol. Ini mencakup 14,5% dari permukaan tubuh dan dipraktikkan satu hingga lima kali sehari. Tangan dicuci enam kali dan secara total dicuci dan digosok dua belas kali dari kontak dengan bagian yang dicuci. Area telapak tangan (volar) dicuci dan digosok lebih banyak daripada area opisthenar (punggung) tangan. Lengan bawah dicuci tiga kali hingga siku dan dianggap sebagai 'area abu-abu' dengan potensi infektif yang meragukan, hanya satu cm di luar tangan yang dicuci yang mungkin dapat menginfeksi ulang tangan yang sudah dicuci. Urutan tindakan ini memperhatikan gravitasi sebagai faktor kontaminasi yang mungkin terjadi. Ringkasan temuan menunjukkan kemungkinan dimensi wuḍū' dapat dimasukkan sebagai variabel dalam penelitian. Praktik Wuḍū' dapat membantu teknik sanitasi yang sebenarnya. Rekomendasi langsung yang berasal dari praktik ini di masa pandemi seperti COVID-19 adalah kemungkinan rekomendasi WHO (Organisasi Kesehatan Dunia) untuk memperluas jangkauan cuci tangan hingga ke siku, seperti yang dilakukan para ahli bedah.

Kata kunci: wuḍū', wudhu ritual Islam, kulit, mikrobiota

ABSTRACT

Wuḍū' (Islamic ritual ablution) is a religious based practice performed daily by Muslims. The expanding knowledge of human skin microbiota composed of commensal and pathogenic microorganisms requires a novel approach toward their management. The importance of *wuḍū'* as a cleaning practice and skin microbiota regulator needs to be studied and applied in case results are found beneficial. A novel approach based on estimating *wuḍū'* effects at first requires a framework of dimensions pointing at possible hypotheses. A literature review will serve as a first step to identify dimensions of skin microbiota possibly affected by *wuḍū'* practice. Calculations of body areas, washing frequency and quality of used water are the following steps of the evaluation. *Wuḍū'* functions like an algorithm and a protocol. It covers 14.5% of body surface and is practiced one to five times daily. Hands are washed six times and in total are washed and rubbed twelve times from contact with other washed parts. Palm (volar) area is washed and rubbed more than opisthenar area (dorsal) part of hand. The forearm is washed thrice to the elbow and is considered a 'grey area' of doubtful infective potential, just one cm beyond the washed hand which can probably reinfect the already washed hand. The sequence of actions respects gravitation as a possible contaminating factor. A summary of findings shows possible dimensions *wuḍū'* can be included as a variable in a study. *Wuḍū'* practice can be of help to actual sanitization techniques. An immediate recommendation derived from the practice in times of pandemics like COVID-19 is the possible WHO (World Health Organization) recommendation of hand washing extension to elbows, as surgeons do.

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Keywords: *wuḍū'*, Islamic ritual ablution, skin, microbiota

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1. INTRODUCTION

What is *wuḍū'*? For Muslims the answer does not require a reply as they practice *wuḍū'* many times daily and for non-Muslims the short answer would be that it is one of the obligatory conditions for the ritual prayer, *salah*. The question is reformulated in context as the approaches towards a cleaning and as well, a worshiping act are many. Then the question is; how can *wuḍū'* be seen as a hygienic act and as such, investigated?

The approach about hand hygiene that WHO (World Health Organization) recommends as a paramount measure to avoid germ transmission and prevent health care-associated infections, is our approach towards *wuḍū'*.

Wuḍū is the ritual purification required from every Muslim who will pray.

Muslims practice the ritual ablution (*wuḍū'*) almost in the same way all around the world. We referred to the well-known *Ḥanafī* school of thought scholar *Burhan al-Din al-Marghinani* in his treatise *Bidayat Al-Mubtadi* translated with comments in Albanian.[1] Although there are some differences, related to importance or repetition of some of the acts, the following is how Muslims practically make *wuḍū'*. The ritual can be summarized as follows: **'*wuḍū'* requires hand washing thrice, followed by washing the mouth, nostrils, and face thrice, then the rewashing of hands till the elbows, followed by wiping one fourth of the head, neck, and ears, cleaning once, and at the end, feet are washed thrice.'** The reference author strongly recommends the rule of washing thrice, which is widely practiced. *Wuḍū'* is required after defecation and breaking wind, vaginal discharge, vomiting, blood and pus flow to areas obligatory of *wuḍū'*, sleep except sleeping siting still, or consciousness loss. The topic is extremely large and our goal is to give an idea about the rituals' acts description and sequential occurrence. A whole chapter describes the types of water permissible for ablution. Another chapter explains using clean earth for ritual cleaning, *taymmum,* in the absolute absence of water. Cleaning through date juice or clean earth are representations of extreme situations and can easily be misunderstood and taken out of context.

Wuḍū' is part of a complex schema, part of the cleaning rituals of everyday life of Muslims. *Wuḍū'* is special because of its absolute necessity for the ritual prayer practiced five times daily. One ablution can suffice for more than one prayer, making it obligatory in a range of one to five times daily, with undisputable cleaning effects. What makes it obligatory is well defined, making possible the description of a theoretical frame as a minimum indispensable purification practice for a whole population upon which other cleaning practices, ritual or not, can be added as needed. With what, when, and how are the three questions, which find

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exhaustive answers in traditional fonts and are not subject to further modification. Their consolidation originates in Qur'an and prophetic tradition, elaborated in their definitive stance from the scholars of the first generations. For Muslims, *wuḍū'* is an absolute standard for prayer and a golden standard for cleanliness, likewise it must be considered in the spectrum of other Islamic purification standards and always under the risk of the observers' bias. There is some historical disagreement about the term 'gold standard' and its validity as all biological tests are subject to continuous betterment and the gold standard remains a moving target.[2] A gold standard would be in concordance with an accepted transcendental standard but not universally accepted, as there are many beliefs among people. For a certain group of people a transcendent standard is accepted and practiced, making it a 'gold standard', a type of standard impossible to be found among the continuously changing scientific standards, which for the same group of believers would make its practicality undisputable and its interpretation always subject of discussion and change.

2. METHOD

Wuḍū' in sacred texts and its importance

Islam offers a well-structured algorithm of dealing with impurity. The oversimplified schema **(Figure 1)** discriminates between material and ritual impurity, placing wudu in the subcategory of minor ritual impurity (*hadath al asghar*).

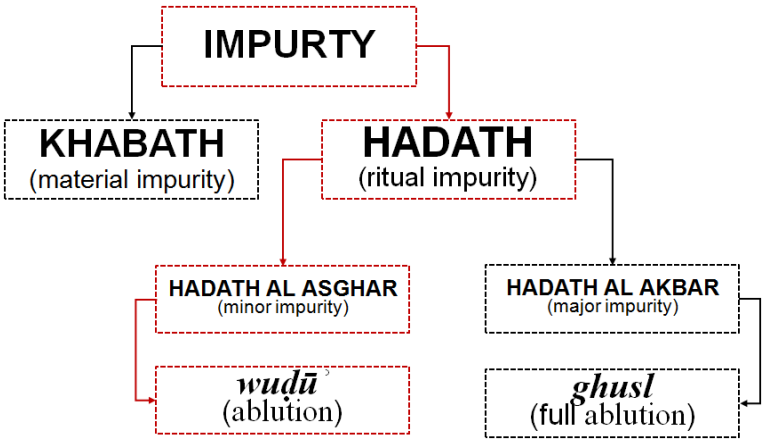

Fig. 1 The impurity classification and dealing, in Islam

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3. RESULTS

Texts from the Qur'an are explained through the Prophet's (pbuh) traditions, which offer a behavioral framework. Texts from Qur'an explain the obligatory actions; **"O you who have believed, when you rise up for prayer, then wash your faces, and your hands up to the elbows, and wipe your heads, (Or: "part of" the head) and (wash) your legs to the ankles. ..." Qur'an; 5:6** and the rest of the practice come from prophetic tradition interpreted by scholars.[3] There are not major contradictions in this view. The explanation of purity and impure states is complex and goes beyond a hygienic act, including other aspects such as spiritual purity or the combination of both. **"O you who have believed, do not approach prayer while you are intoxicated until you know what you are saying or in a state of janabah, except those passing through [a place of prayer], until you have washed [your whole body]. 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 find no water, then seek clean earth and wipe over your faces and your hands [with it]. Indeed, Allah is ever Pardoning and Forgiving." Qur'an; 4:43.**[4] Purification, actually *wuḍū'*, is appraised in the words of the Prophet (pbuh), comparing it to half of faith.[5] The consequences of this act extend the beneficial gains, spiritual or practical, beyond the term of this life. The following transmission eloquently portrays *wuḍū'* as an act with everlasting effects. "'Abdullah bin Mas'ud said: "It was said: 'O Messenger of Allah, how will you recognize those whom you have not seen of your *Ummah*?' He said: 'From the blazes on their foreheads and feet, like horses with black and white traces (which make them distinct from others), which are the traces of ablution.'"[6]

Note that the cleaning practices in Islam are complex, ranging from obligatory to purely voluntary. For example, teeth cleaning is strongly recommended as often as possible. Other practices are specific for: cleaning after defecation, urination, sexual relationships, giving birth, end of menstruation, skin damage including pus or blood, major and minor impurity, trauma and injury, etc. It is worth noting that washing the dead is a purification ritual and a respect for the body and the soul in the journey to his Lord. The ritual is composed of washing, shrouding, praying and burial.[7] The best choice remains clean water, odorless, colorless and tasteless. The other extreme is clean earth. These create a spectrum of possible elements to discuss about, their permissibility and benefits, apart from ritual purification but for sure are good indices for material impurity handling.

Skin microbiota, what is 'normal'?

Germs populating the human skin are subject to many scientific questions. Germ's inhabitation of skin can be seen as an enemy invasion, or commensal germs categorized as passive or beneficial cohabitants. When they create pathological situations, humans tend to acknowledge them and find solutions to eliminate the effects. Otherwise, at least lay people remain indifferent to them. Seeing it in the perspective of comparing a ritual cleaning like *wuḍū* and other recommendations for skin cleaning and against germ protection requires a specific

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approach towards skin microbiota. In this case, microbiota is the subject of the intervention; frequency, chemical or physical action, and or biological manipulation. Skin itself is quite different from human to human. Microbiome is a component of the outer world making contact with the individual's limit to his own world, making it a special population of germs, making it a biofilm, composed of bacteria, fungi, viruses, and archaea. The holistic approach requires taking into consideration all the dimensions of the skin microbiota as an interface between the human and the world. Following is a short summary of recent works in human skin microbiota which can be redesigned as experiments in case the variable *wuḍū* is included. Microorganisms develop in human skin growth depending on skin qualities, such as the production of sweat, sebum, and moisture, thus creating ecological niches.[8] *Wuḍū* is performed in the same fashion and covers well-defined body parts.

Table 1. A summary of findings on human skin microbiota and its importance

Year published	Sampling site	Number of participants	Findings of interest	Importance to a dimension	Ref.
2019	review	NA*	Microbiome study techniques are evolving rapidly from historical Culture growing of microbes to Metagenomics-Amplicon, Metagenomics-WMS, Metatranscriptomics, Metaproteomics, Metabolomics.	Metagenomics is a revolutionary method but is prone to weaknesses, such as results limited to an already known reference database. A possibility to study microorganisms not only as pathogens but also their contribution to skin functions as a barrier, the formation of lipids, and immunity.	9
2019	calf	9	The differences found between study subjects on bacterial communities were lost after swimming. Ocean-borne bacteria predominated over usual microbiota.	The relative standardization of microbiota after contact with ocean water could further entice studies to evaluate water and *wuḍū'* as universal cleaner and technique,	10

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				as relatively non-aggressive toward usual skin microbiota.	
2019	plantar or interdigital foot area	26 tinea pedis patients and 10 healthy controls	Skin microbiota of tinea pedis patients vs. healthy controls resulted in 26 vs. 12 bacterial phyla and 8 vs. 5 fungal phyla.	Normal microbial community in overgrowth results in disease and here hygienic manipulation techniques have to be compared to each other who is best in maintaining the breaking point between physiological and pathological modes.	12
2007	volar forearm	6	Bacterial biota is diverse from individual to individual but some are conserved and well represented in all. Little is known about their composition.	Forearm is subject to *wuḍū'* washing and study subjects are an excellent population for comparison.	13
2015	review	hand	Hands microbiome temporarily varies more than other body parts and rarely is considered a source of beneficial bacteria. Palms of women had a different composition of bacteria than men, a dissimilarity extended to inanimate object	Hands are more special and subject to more *wuḍū'* rubbing and washing. Gender differences have to be studied beyond *wuḍū'* practice as it is a universal, no gender purifying practice making necessary other cleaning practices for special occasions or gender,	14

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			where women hand had more similarities with the object, example mobile phone.	which do exist in Islam.	
2019	cheek	73 healthy women	Significant changes on microbiome structure were found between two age groups. Replication and repair are more characteristic of the young sub-group, while biodegradation is more related to the older group of women.	The practice of *wuḍū'* is universal while age results with differences on microbiome structure and biodegradation/repair posing the question of its efficacy between the best outcomes that *wuḍū'* acts the same in both age-groups or special care is needed.	15
2013	review	NA	Host–microbiome interactions disequilibrium is associated with disease. Some known nosology are proved to be subject of such modification as acne, atopic dermatitis, psoriasis, rosacea, etc.	Not damaging commensal microorganisms beyond their beneficial momentum while fighting pathogenic microbes, and including *wuḍū'* as possible determinant variable, makes a complex study question.	16
2019	lesional skin antecubital fold or the popliteal fold and non-lesional	75 (38 alpine climate , 37 moderate maritime)	Atopic dermatitis correlates with Staphylococcus aureus overgrowth. Alpine climate treatment was associated with S aureus larger reduction than	Climate is a universal variable affecting health and interacting with skin cleaning practices choices.	17

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	skin volar arm		treatment in moderate maritime climate.		
2019	review	NA	Skin microbiomes of animals from domestic to wild ones, were found to be higher in diversity and diverse from humans'. This review brings for the first time evidence of phylosymbiosis between vertebrates and their skin microbiome.	Mapping of vertebrates' subphylum is already complete. In this view the microbiome specific for each species would be of interest and classify the human's with its interactions and specific traits of human skin. Vertebrates use mechanisms of purification, for example sparrows that use water and dust bathing which use same cleaning agents as in *wuḍū'* and *taymmum*.	20
2019	review	971 human skin bacterial taxa	Skin taxa are found to be overrepresented or underrepresented. Also the study shows the possibility of biases because results have to be compared to known taxa and the limitation of exploring functional traits on a sole species.	The evolution of human skin diversity taxa from cataloging to traits and functionality are hopes that studies will take in consideration exploring and comparing traditional ways of cleaning, embodying wining techniques to best practice.	21

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2016	cheek, chest	10	Skin fungus *Malassezia* increased during stay on space and returned to usual levels upon return on earth. Otherwise, fungal diversity decreased in space and increased upon return on earth. *Malassezia* is a lipophilic skin fungus.	Space travel is a novel human activity. Skin is one of the organs to confront the new situation and as many answers have to be found before travel because of the few possibilities to correct mistakes or change their conditions once inside the Space Station or the travelling vehicle.	23
2011	review	NA	A large variation in skin microbes between individuals may be caused by different hygiene standards or number and type of contacted objects.	As the role of bacteria and other microbes is somewhat unknown the approach in their management has to always by changing in the light of new findings.	24

* NA – not available

Before deciding how to behave towards skin microbiota we must know its composition and their functionality in health and disease, also in differing chemical and physical environments. This is an ever evolving trait as our knowledge progresses and new methods of investigation are on place. An estimate counts 1,014 microorganisms inhabiting human skin.[9] Human Microbiome Project has already started from more than a decade bringing new insights. For example modern methods like biopsies for sampling purposes although seem at first more accurate when compared to traditional old methods as superficial swabs, makes both necessary and specific to our study question.[11] Skin conditions act on microbiome modifying it and microbiome traits are representative of special health or disease situations, in some cases serving even as biomarkers for certain conditions.[18 19] Thus, all these dimensions require a holistic approach, which in itself changes. The new trends of human exploration of space add to this approach. A study of 46 astronauts found self-reporting of skin peeling (21.74%) and rash (17.39%) making microbiome a player, raising the question of *wuḍū* in space for Muslim astronauts.[23]

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Wuḍū' algorithm of purification, an Islamic religious practice is also a body cleaning procedure

Wuḍū' creates a precise population, the population of people who practices it. This makes prominent the possibility of comparison with the other part of the world population. The question is; does *wuḍū* as an all population obligatory basic population purification practice, which uses a universal cleaning agent, water, achieves its goal while preserving microbiome in beneficial amounts compared to other recommendations based on aggressive germ killing techniques recommended, as non-conducted to a single infective agent.

The Islamic approach towards *wuḍū* is holistic, thus a summary of studies on skin microbiome would try to explore the possible studied dimensions of skin, skin microbiome and the outer world (**Table 1**). This would form a framework for further studies comparing samples from *wuḍū* population with controls, for other cleaning practices common to both. This type of experimental studies require designations to compare the effect over long time of *wuḍū* compared to other practices. Microorganisms have to be categorized as commensal and pathogenic, measurement before and after the cleaning method and their presence and effects over time would be the studies subject.

For this purpose, a map of body parts covered by *wuḍū* and the intensity of washing and rubbing has to be designed. Following are, schematized (**Figure 2.**), the body parts touched by *wuḍū* (Areas A, B and C) colored by an index intensity of color created by the number of times they are washed and rubbed. Area A (hands) are the most washed and rubbed, followed by Area B (face, nostrils, mouth, forearms and feet), and Area C (head hair and ears).

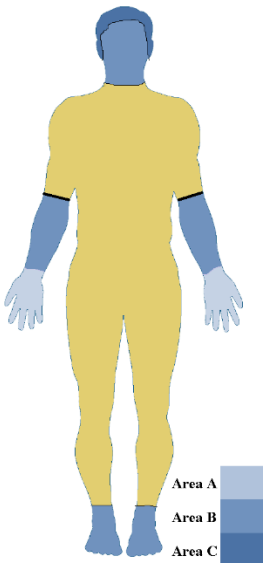

Fig. 2 The schema of body parts touched by *wuḍū,* frequency, washed and rubbed

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Making some calculations on number of washed and rubbed times it results;

Area A (hands)	
palms (volar)	12 times
opisthenar area (dorsal)	6 times
Area B (face, nostrils, mouth, forearms and feet)	3 times
Area C (head hair and ears)	1 time

4. DISCUSSION

The area covered by *wuḍū* using the rule of nines makes 14.5% of total body surface, split as follows; head (front) (3.5%), neck (2%), forearms (3%), hands (2.5%), feet (3.5%). The calculations, especially hand takes in consideration the washing of hand by itself, participating in washing the face and itself again, forearms and feet. Hypothenar palm is more similar to volar forearm than it is to index finger. Proximity doesn't make hypothenar palm similar in microbiota to index finger. Hypothenar palm shares with volar forearm the population of Proteobacteria, which compose the majority of their microbiota followed by Bacteroidetes, while index finger is populated mainly by Propionibacterineae and Cyanobacteria. The same trend of differences not related to proximity but especially to anatomical shape and function result in differences between toe web space and plantar heel, the first populated mostly of Corynebacterineae and Micrococcineat and the second of Staphylococcaceae.[25]

Empirically the *wuḍū* algorithm can be successfully compared with study results on skin cleaning and protection;

- creating a cleaning mechanism proportional to contamination hazard, the consideration of 'gray zone', the forearms
- palm (volar) goes through a process of rubbing more than opisthenar area (dorsal) part of hand
- The sequential actions after initial hand washing happen from the upper to the lower body parts, respecting the gravitational factor as a possible contaminating actor.

Journal articles found as representative of a particular dimension that fulfil the subject of our literature review (**Table 1**), range from year 2011 to 2019. Of the 12 articles chosen, seven belong to the year 2019. It can be supposed that a model of research priorities focuses on studying skin microbiota. One trend is the study of systemic infection and microbiota's benefits on human skin. the second trend can be quantified as the study of exposed skin to external biological agents, and the third topic is the role of microbiota as a biological interface between humans and animals living near them, especially pet animals. The second trend, studying the behavior of the microbiota of the skin exposed parts, coincides well with body parts cleaned during *wuḍū'* practice. One example of disease complexity depending on microbial skin composition is the study of tinea pedis, a fungal infection, found in altered microbial skin

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composition. Results show the disease develops in different microbiota compositions, making it subject to more than one factor.[12] The *wuḍū'* practice emphasizes the washing of heels with special caution which comply with study results.

What are called 'the grey zone' are the forearms. The washing of hands followed by the washing of forearms to the elbow helps the cleaning of the 'grey zone' of doubtful infective potential, just one cm beyond the washed hand, which can probably reinfect the already washed hand. Palm skin is a rarely exposed area of skin in comparison to the dorsal area, which is an exposed area. Both parts are so close and so different. Palm skin has more than 3 times as many bacterial phylotypes as the forearm and elbow.[14] Both findings go hand in hand with *wuḍū'* recommendations. Another aspect of interest is the chemical and physical characteristics of the *wuḍū'* cleaning agent, water. For example, it is found that *Staphylococcus epidermidis* modulates host immunity and also inhibits skin pathogens, and agents it produces inhibit the inflammation of the skin.[24] Such skin protection factors have to be controlled through cleaning or have to be eradicated, which is a judgment that makes the first step in sanitization methods protocols. The study of the area *wuḍū'* relates to specific phyla of microbiota, but actually, no studies have been found on this topic.

With *wuḍū'* we find ourselves in front of a protocol, like 'My Five Moments for Hand Hygiene' recommended by WHO (World Health Organization).[26] *Wuḍū'* is a whole population daily practice, in many body sites while the WHO recommendation is directed toward health care workers in special occasions only for hand hygiene, but otherwise quite similar following the logic of an algorithm. While the WHO's recommendation has proven to be successful and as a tool of education, in the same region where the population performs wuḍū' daily, studies lack.[28] Other studies on ablution can bring contradictory conclusions at first. One study showed reduced acute respiratory tract infection while performing nasal rinsing during ablution, while another contention was that if it is done with unclean water, it could cause fatal brain infections.[27] [28] Both pretentions could be right, but the possibility of making a meta-analysis is none. The washing of forearms till the elbows is reported to be a prophetic tradition, even beyond wuḍū', a practice even after non-ritual hand washing.[29]

5. Conclusions

Wuḍū' is a religious-based practice performed billions of times daily by Muslims for centuries. In contrast to perseverance in its performance, based on Qur'anic orders and widely accepted by this community, health benefits remain understudied. A quick search in PubMed shows almost no results with keywords *wuḍū'* and ablution.

In no way the recommendations derived from *wuḍū'* analysis tend to replace actual sanitization techniques as hand washing with soap and water, or similar ones. *Wuḍū'* for Muslims is practiced in tandem with medical recommendations. *Wuḍū'* is irreplaceable by Muslims partitioning their religion, and any of the suggestions, if applicable, have to be scientifically confronted if they require authority for application from others.

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Some immediate profits can be realized from the study of *wuḍū'* practice as is the case of the hand washing recommendations from WHO (World Health Organization). In times of crisis, such as the COVID-19 pandemic, the protocol for hand washing could extend to elbows. During *wuḍū'* hands are washed and rubbed twice as much than forearms, a lesser but potentially contaminating area, thus creating a cleaning mechanism proportional to contamination hazard, making the WHO's recommendation an act which needs revalidation. In times of crisis, like a pandemic, strengthening usual precautionary techniques is lifesaving. A good comparison to *wuḍū'* is the standard of handwashing of surgeons for hand and forearm washing.

Concluding, the *wuḍū'* practice is not the only mechanism to create a hygienic defense based on a relative risk approach. The example of segregation between right and left hand, the first preferred when eating and similar actions, while the second preferred for self-cleaning after toilet use, is another recommendation. Both these approaches and others can be viewed in tandem to gain insight, and if realizable, create a profitable protocol and subsequent algorithms.

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