

Exploring the Concepts of Halal and Haram in Islam and Their Scientific Perspective: A Systematic Literature Review

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Abstract: Islam is a divine religion with its own concepts, principles, and theories. Major Islamic faiths include believing in the one and only Allah Almighty, the holy books, the prophets, the angels, etc. Besides these basic beliefs, Islam has comprehensive rules that deal with modern-day problems. Thus, the number of followers of Islam is increasing rapidly, and have currently become the world's second-largest religion with more than 1.8 billion followers. Halal and haram are criteria determined by Allah and His last prophet, Muhammad S.A.W., while interpreted by Islamic scholars every time. Halal substances are those that are permissible and allowed for and are free from all the attributes that lead to prohibition. While haram things are those that are not lawful and not allowed as it is the order of Allah that requires you to stop doing them. Islam, being the final and universal religion, has rules and guidelines for things to be described as halal or haram. In the modern scientific period, every individual is looking for research-based arguments and product development. Thus, there is a need to explore how scientific methods are used to explain the halal and haram nature of substances. Currently, various analytical, molecular, and instrumental approaches are being used for the halal certification of items. Hence, this article aimed to provide recent and updated literature about the concepts of halal and haram and how the scientific methods are helpful in their explanation.

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1. Introduction

Religion has an essential role for people of different social, political, financial, national, and international backgrounds. This role has become more prominent in the modern period of industrialization and development. Currently, more than 4000 religions, faiths, and denominations exist around the globe with varying number of followers (Hussain, 2024). The top five dominant religions are Christianity, Islam, Buddhism, Hinduism, and Judaism. Islam is the world’s oldest and the only religion in its original state, though the shapes, things, worship methods, etc. are changed with time, regions, and followers. Islam which is the only religion in its original status, is fast-growing, rational, and natural. Truthfulness, completeness, solution to every problem, naturalness, versatility, free from race and region, love, etc. are the marked properties that make Islam the rapidly growing and second-largest religion with 1.8 billion followers. The major reason for its attractiveness is that it is the gift of Allah, the Creator, the Mighty, and the Lord of the Universe (Hussain, 2024). The major world religion and the distinguishing properties of Islam is illustrated in Figure 1.

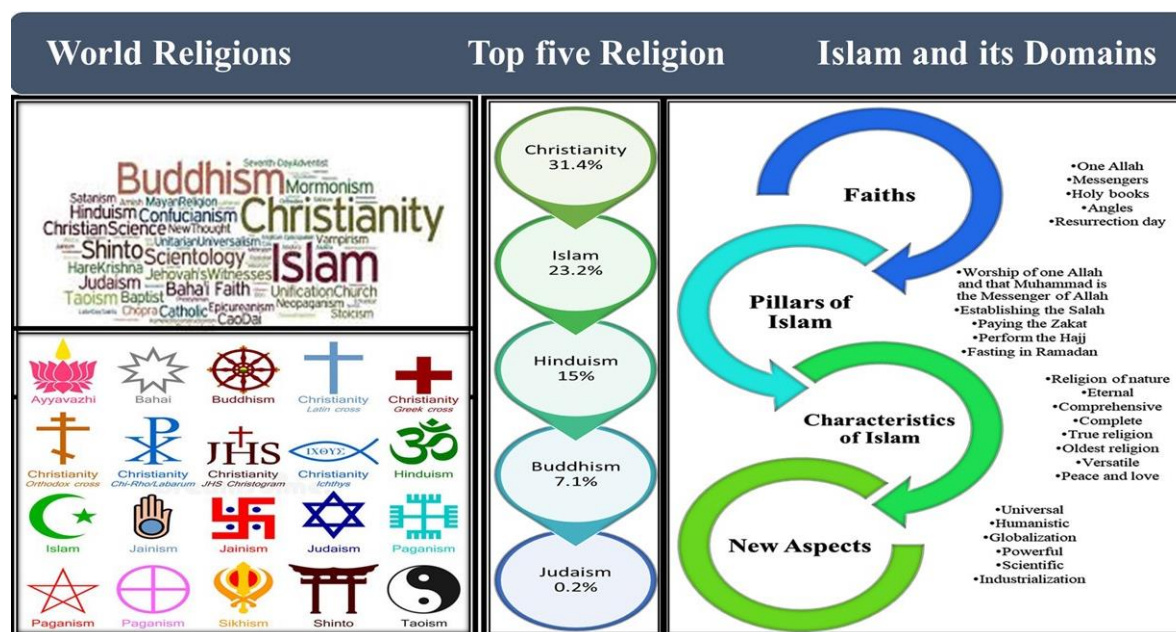


Figure 1. The overview of world’s religions, the top five religions, and the different domains of religion Islam.

It’s the blessing of Allah Almighty that He created us Muslims; in fact, it’s the great success and extreme love of Allah Almighty. As Muslims, it’s our core responsibility to follow Islam in every stage of our lives. The alignment of our lives should be according to the Sharia, i.e., the al-Quran (the Muslim noble book) and the Hadith (the words, actions, or silent approval of the last prophet Muhammad S.A.W.) (Mardian *et al.*, 2021). Aiding more to the beauty of this, the Islamic scholars interpret these sources in easy and understandable ways in different languages, and hence the Islamic Fiqh (Islamic jurisprudence) was developed. The al-Quran and Hadith are in their original form and are non-changeable, while the Fiqh has the versatility to change according to the situation and circumstances (Mardian *et al.*, 2021). Ijtihad is another source of Islamic Sharia in which the scholars (Ulama) address a question in a detailed way in the light of the al-Quran and Hadith, thus leading to the concepts of Fatwa and Ijma. Combining all four basic sources, i.e., the al-Quran, Hadith, Ijma, and Qiyas, provides the solution to every modern-day problem, including the halal and haram concepts

in the current technological period, and satisfies the Muslims to follow the Islamic rule firmly (Hussain, 2024; Mardian *et al.*, 2021).

Islam is the first-ever religion in the world that relies on the acceptance of one and only Allah Almighty, though transformation in its different domains like the ways of worships happened accordingly, but the aim i.e. the Tawheed remains constant. Currently, the Islam religion is widely known, since the last prophet of Allah Almighty, Muhammad S.A.W., came and spread Islam in the whole world through His teachings, and thus, the code of Islam is complete, and till the day of judgment, no new prophet will come (Ali, 2023; Hussain, 2024). It is the responsibility of Muslim scholars to preach Islam and find solutions to every problem that an individual face in the modern technological period. Islam has its own code of conduct for everything, i.e., from personal life to family issues, from societal problems to international rights, and from personal boundaries to others' rights.

In the same context, halal and haram, which are the two terms widely used in Muslims, are clearly defined with their pros and cons. Halal are the permissible things, while haram are those that are not allowed to be done or used. Food is considered the basic need for humans, and as Muslims, we must take care of our food, whether it is halal or haram. The rise in halal food, which is a billion-dollar industry, currently serves as one of the leading industries around the globe. It is anticipated that the global halal market will reach US\$ 2,043.2 billion in 2027, compared to US\$ 715.0 billion in 2018 (Butt *et al.*, 2021). The halal and haram concept is not limited to food items only; it covers other things like cosmetics, pharmaceuticals, tourism, personal care products, financial and non-financial services, human and animal welfare, social equity, a sustainable environment, and the overall lifestyle of an individual (Butt *et al.*, 2021; Farouk, 2023). The comprehensive nature and daily requirements of such stuff make it crucial that a person knows about the basics of halal and haram and thus protect themselves from their harmful effects.

As mentioned, Islam is the complete code of life that covers all aspects of someone's life, including the use of currently available cutting-age technologies. The different aspects of science, particularly the biological and natural sciences, are extensively applied in different applications of our lives. For instance, the use of microorganisms and their potential applications in biotechnology, genetic engineering, probiotics, feed additives and supplements, etc. requires a clear Islamic status for their consumers (Hussain & Ali, 2024a; Hussain, Rahman, *et al.*, 2024a). Likewise, the scientific benefits of Islamic rites like prayer, fasting, hajj, etc. are also well known as modern research has investigated the extensive physical, moral, and societal benefits of these Islamic pillars and rites (Hussain, 2023). Likewise, the basic understanding of life molecules like proteins, carbohydrates, lipids, and nucleic acids are crucial for everyone and are extensively used in our daily lives, again requiring the Shari'ah compliance (Hussain, Jamal, *et al.*, 2024b). Understanding these concepts helps the Islamic scholars and religious researchers to explore the basics of these biological molecules and thus clearly elaborate their Islamic status (Hussain *et al.*, 2024f).

Hence, this article aims to provide a recent and literature-oriented overview of halal and haram, their concepts, and the selection criteria in the marvelous light of Islam. This article also focuses on the halal and haram substances from a scientific point of view, showing how the glory words of the al-Quran and Hadiths are now proven by scientific methods. Thus,

narrating the Islamic concept of halal and haram and their interpretation through scientific methods are summarized in this review article.

2. Methodology

2.1. Searching Words

This literature study was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was performed as recently described (Abdul Mokti *et al.*, 2024). Different search terms like halal, halal in Islam, halal and haram, concepts of halal and haram, science and Islam, scientific benefits of halal, etc. were searched in different websites, i.e. Google scholar, Science Direct, etc. and the articles were downloaded. The methods used in this study is illustrated in Figure 2.

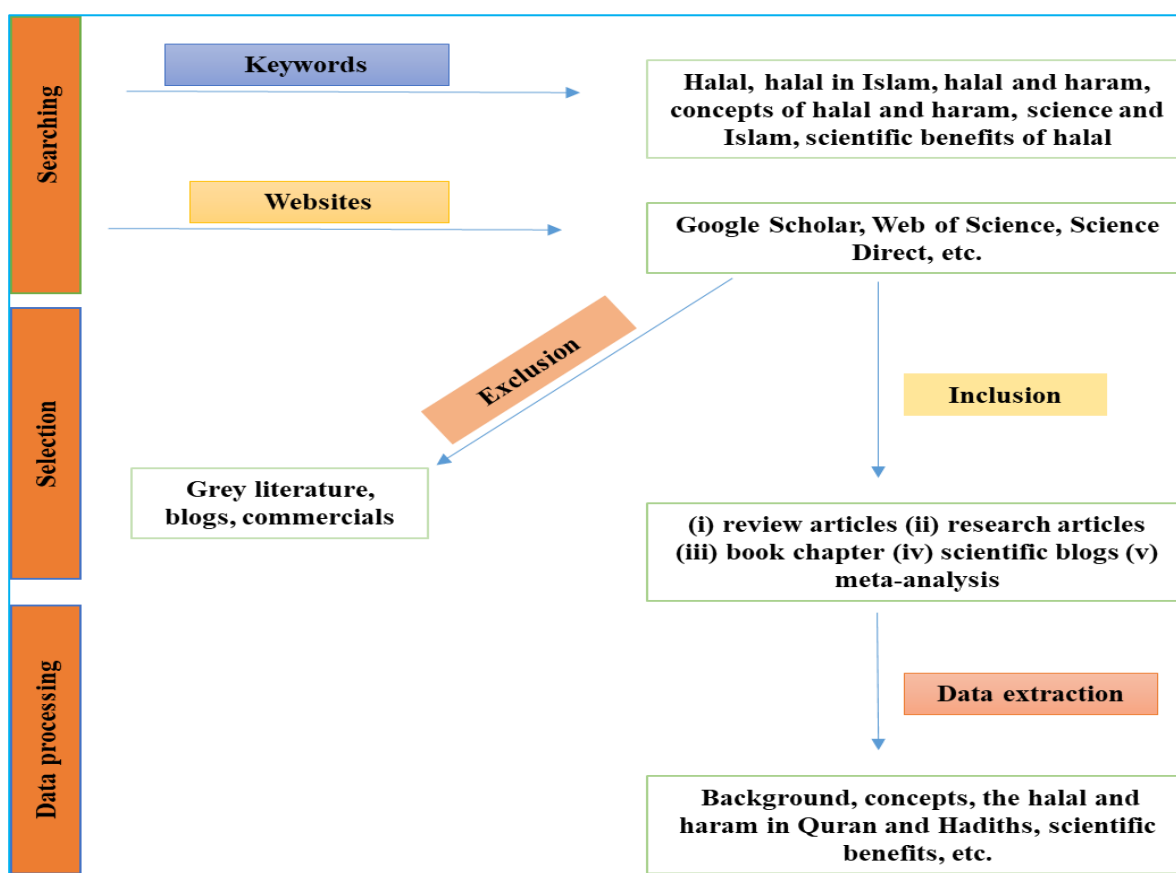


Figure 2. The searching strategy used in this study.

2.2. Criteria for Literature Selection

The inclusion criteria include (i) review articles (ii) original articles (iii) chapters (iv) reviewed scientific blogs (v), and meta-analysis, while commercials and general blog articles are excluded.

2.3. Data Mining

The collected literature was screened for relatedness to the theme of the article. Data were retrieved focusing on the halal and haram nature of substances, the halal and haram in al-Quran and Hadiths, *etc.* Likewise, the scientific perspective of halal and haram was also under-considered during data retrieval.

2.4. Analysis

The selected data were critically reviewed for materials related to the haram and halal concepts, the scientific methods of their validations, and their impacts on individuals, *etc.*

2.5. Outcomes

A large number of articles were downloaded and screened for the selected topic. All the cited materials have an association with the topic in terms of concept, background, effects, methods, and advantages of being used. During the study, it was found that Islam has set clear boundaries for halal and haram and made a complete set of prescribed rules that describe the halal and haram nature, while the scientific methods have a promising result in the validation of halal and haram items.

3. Literature Review

3.1. The Concept of Halal and Haram in al-Quran

Islam is the true and eternal religion of Allah Almighty, and no one is allowed to cross the prescribed Islamic boundaries. The holy al-Quran is the last among the four divine books and is revealed through the last prophet, Muhammad S.A.W., completing the source of faiths and beliefs. Holy al-Quran is the only religious book that is still in its original form and is free from a single mistake or change, thus providing the ultimate source of Muslim faiths, beliefs, and rites. Allah says in the al-Quran:

And this is My path, which is straightforward. So, follow it, and do not follow the (other) ways, lest they should make you deviate from His way. This is what He has enjoined upon you, so that you may be God-fearing (al-Quran 6:153).

Islam is the name of total submission to Allah. Those who follow Allah Almighty's commands are called believers (the Muslims), and those who do not follow the straight path are called disbelievers or non-Muslims). Besides the basic faiths, the concepts of halal and haram is also important and are followed by the true followers. In addition to halal, another term, *Tayyab (Tayyabn)*, is sometime used interchangeably, which refers to something that is halal and completely free from any form of impurity, both external and internal. Halal is that which has been declared permissible by the al-Quran and Sunnah for legitimate and acceptable reasons. It is the opposite of Haram in both vocabulary and Shari'ah, indicating what is visible and permissible. Halal does not contradict religious texts in any way. According to Muslims, Halal is defined by the texts of the al-Quran and Sunnah or by a certain or non-specific status agreed upon by all Muslims. One consensus among Muslims is that everything not explicitly prohibited is considered Halal. Contrary to halal, the literal meaning of Haram is prohibited, unlawful, forbidden *etc.* thus reflect the opposite status of

Halal. (Ahmad *et al.*, 2011; Ahmad & Barvi, 2022). The term *Tayyab* adds more to the halal properties, and it means pure, hygiene, safety, balanced, healthy, quality, nutritious, and clean (Abdul Mokti *et al.*, 2024). The eating of halal things will not only strengthen our soul but can also be traced physically or intentionally in the human body (Aziz *et al.*, 2023; Butt *et al.*, 2021; Fadzlillah *et al.*, 2022; Farouk, 2023; Nafis, 2019; Riaz & Ghayyas, 2023; Said & Hanapi, 2018; Syarifuddin *et al.*, 2019; Yakin *et al.*, 2021; Zin *et al.*, 2021). The concepts and properties of halal and haram are illustrated in Figure 3.

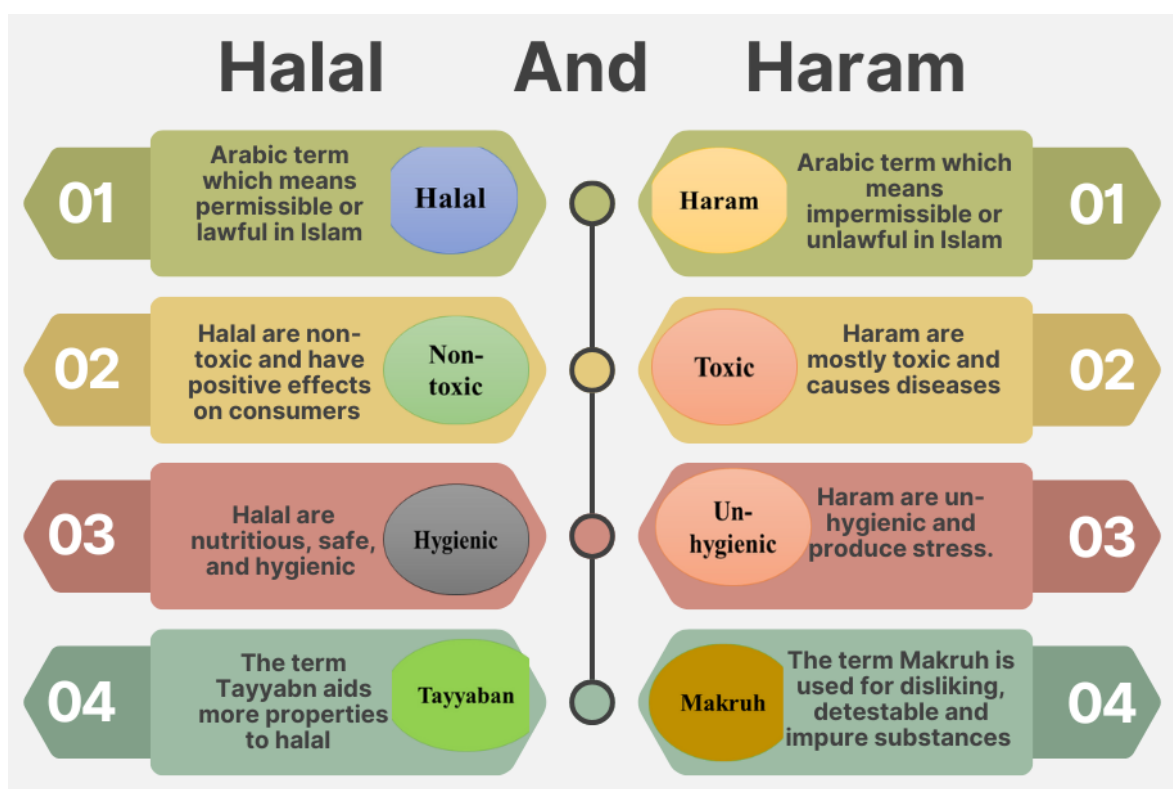


Figure 3. The illustration showing the basics of halal and haram and their properties. Haram can be used during Durrah (emergency) with prescribed conditions.

Generally, every food is halal if there is no prohibition described in the Islamic sources. Halal substances are free from any haram ingredients, derived from halal sources, and processed via halal mechanisms. The process, production, storage, used machines, final packaging, *etc.*—everything must be clean, non-toxic, and halal according to the Islamic rules. Using halal and *Tayyab* things in all regards not only gives mental peace and religious responsibility but can also aid our body with scientifically proven benefits (Farouk, 2023). For instance, organic foods that are free from any chemical contamination represents the *Tayyab* category, while animals that are fed with dirty things represent halal. Human nature also wants halal and *Tayyab* things due to their visible structure and properties (Ahmad & Barvi, 2022; Aziz *et al.*, 2023; Fadzlillah *et al.*, 2022; Nafis, 2019; Yacub, 2009).

In the al-Quran, Allah Almighty mentions halal and haram many times. Allah Almighty allowed the Muslims to eat what they liked except those that are prescribed as Haram.

Following the different verses narrated from the al-Quran, Figure 4 shows the halal and haram concepts of different substances.

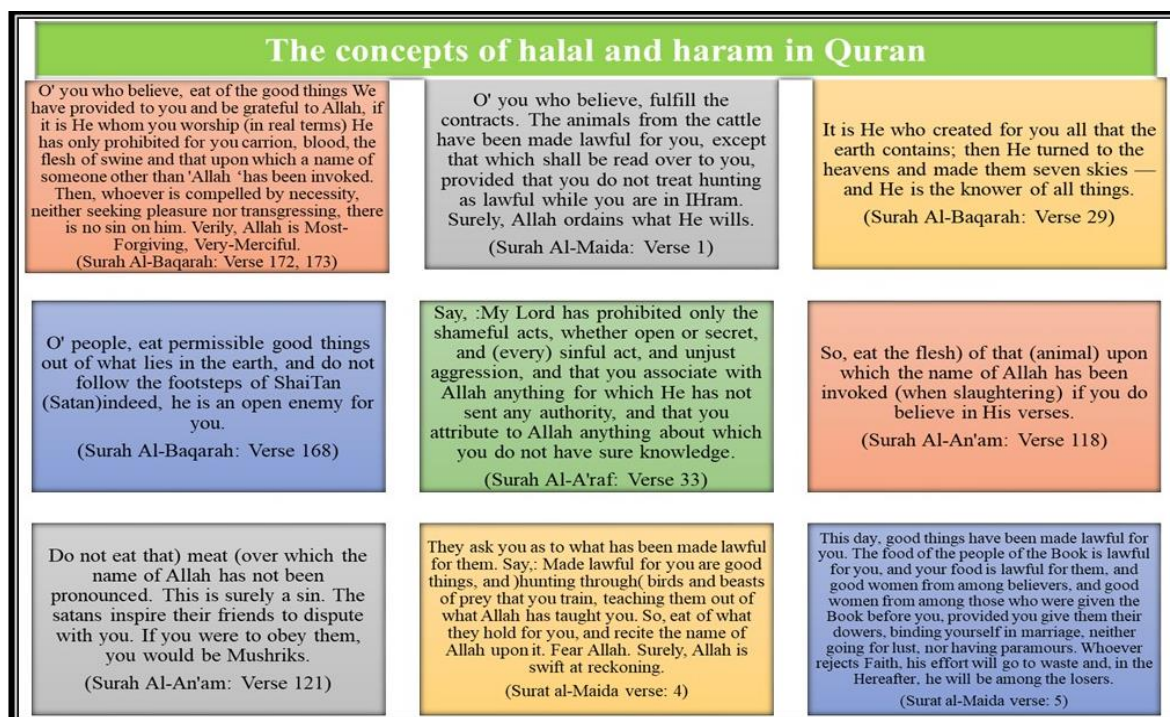


Figure 4. The different aspects and concepts of halal and haram mentioned in the Al-Quran.

The al-Quranic verses mentioned in the figure are just a few examples in which Allah Almighty guides the Muslims to eat, drink, and obey what Allah Almighty describes for them as halal while refraining themselves from unlawful and haram things, irrespective of food stuffs or other substances. It is worthwhile to mention that eating halal and following the straight path do not only give an internal satisfaction to our souls but can also protect us from the toxic effects of haram stuff. Modern scientific research has validated and confirmed the physical, social, and personal benefits of eating and following the halal stuff and the straight path, respectively. The *Tayyab* category solely reflects the physical benefits of halal substances in terms of body needs and requirements. These scientific approaches are getting attention due to the satisfaction of consumers that also include the non-Muslims. The reason of this attractiveness is the visible benefits, safe nature, and healthy profile of the halal food. Like food, other Islamic rites also have a great influence on the mind of non-Muslims and thus they are reverting to Islam. For instance, the medical and health benefits of Islamic fasting on the human body are currently well investigated and known among scientific communities (Hussain, 2023).

3.2. The Concept of Halal and Haram in Hadiths

Hadiths are the words, action, or silent message of the last prophet, Muhammad S.A.W. Hadiths are the second-basic source of beliefs, faiths, and guidance in Islam. In principle, hadiths are the practical explanation and demonstration of the holy al-Quran. Like the holy al-Quran, the described criteria of halal and haram in hadiths are also considered the final statements of permissible or prohibition. Understanding Hadiths in itself is a marvelous field

and requires different critical skills, particularly when Islamic scholars want to interpret the solution to a modern problem. The beauty of Hadith, and in fact Islam, is that they give explanations to every modern-day problem, though they were explained 1400 years ago. In the concept of halal and haram, there are a bunch of hadiths that show the lawful and unlawful status of different substances. The following are a few examples of Hadiths that describe the halal and haram concepts.

1. *I heard from Nu'man bin Bashir, may Allah be pleased with him, that he used to say: I heard from the Holy Prophet, may God bless him and grant him peace, that he, may God bless him and grant him peace, used to say, "The halal is clear and the haram is clear, and between the two, there are some doubtful matters that many people do not know (whether they are permissible or forbidden). So whoever avoids the doubtful matters has saved his religion and honor, and whoever falls into the doubtful matters, it is like the example of a shepherd who grazes his animals around the (royal reserve) pasture. He is about to step into that pasture (and be branded a royal criminal). Listen, every king has a pasture, and the pastures of Allah are the forbidden things on His land. (So beware of them) and listen, there is a piece of flesh in the body, when it is correct, the whole body will be correct, and when it is corrupted, the whole body will be corrupted. Listen, that piece is a man's heart." (Sahih al-Bukhari, in the Statement of Faith, chapter: In the description of the virtue of a person who avoids sin in order to maintain his religion. Hadith No: 52, Sahih Muslim-4094, Jami al-Tirmidhi-1205).*

2. *On the authority of Abu Huraira, who said: The Messenger of Allah, peace and blessings be upon him, said: "O people! Allah is pure and accepts only what is pure. He has commanded the believers as He commanded the messengers. Allah, the Exalted, said, 'O messengers, eat from the good things and do righteous deeds. Indeed, I am Knowing of what you do.' (al-Quran 23:51). And He said, 'O you who have believed, eat from the good things which We have provided for you.' (al-Quran 2:172). Then he mentioned a man who, during a long journey, is disheveled and dusty. He raises his hands to the sky, saying, 'O my Lord! O my Lord!' However, his food is Haram, his drink is Haram, his clothing is Haram, and he has been nourished with what Haram is. How then can his supplication be answered? (Sahih Muslim, Hadith No. 2346: Accepting charity from pure earnings and nurturing it. Jami al-Tirmidhi, Hadith no 2989).*

3. *It was narrated from Sayyiduna Shaddad bin Aws R.A. that I remember two things from the Messenger of Allah, may God bless him and grant him peace. The Prophet (peace and blessings of Allah be upon him) said: "Allah has placed goodness in everything. When you kill, kill well, and when you slaughter, slaughter well, and whoever you want to slaughter, use a knife." Sharpen it and give rest to your animal" (And it is recommended not to sharpen a knife in front of an animal, nor to slaughter an animal in front of another animal, nor to drag it to be slaughtered) (Sahih Muslim, Chapter: Slaughter or killing should be done well and the knife should be sharpened. Hadith No: 5055, Jami al-Tirmidhi 1409).*

4. *On the authority of Rafi' bin Khadij, may Allah be pleased with him, that the Messenger of Allah, may God bless him and grant him peace, said: "Anything from which blood (of an animal) flows and the name of Allah is mentioned over it, then eat it, except that which has been slaughtered by the teeth and nails (Sunan al-Nasa'i, Kitab al-Zahaya, Chapter: Slaughtering with nails is prohibited, Hadith: 4408] Jami al-Tirmidhi 1491).*

5. *On the authority of Abu Tha'laba al-Khushani: "The Messenger of Allah, peace and blessings be upon him, forbade the eating of every predatory animal with fangs (Sunan Abi Dawud, Rulings and issues related to food, Chapter: Prohibition of eating beasts (animals that eat tears), Hadith number: 3802, Sahih al-Bukhari.5781).*

6. *Narrated by Sa'id ibn Jubayr, he said: "I was with Ibn 'Umar when a group of young men or people passed by who had set up a chicken and were shooting at it. When they saw Ibn 'Umar, they dispersed from it. Ibn 'Umar said, 'Who did this? Verily, the Prophet (peace be upon him) cursed those who did this.'" This was also narrated by Sulaiman from Shu'ba (Sahih al-Bukhari, chapter: In the statement of slaughter and hunting, hadith number: 5515).*

The above-mentioned hadiths are the few examples from the bunch of such explanatory hadiths in which the Prophet Muhammad S.A.W. describes the criteria of halal and haram in different things, including food stuffs. It is worthy to mention here that eating halal does not only make us pious and near to Allah but also gives physical and physiological benefits to the human body. The last prophet, Muhammad S.A.W., said that a person's prayer is rejected if they consume haram food. Different food items and drinks and their status are described in Table 1.

Table 1. The common halal and haram foods, drinks, and related substances.

Haram	Halal
Lard	All domestic birds
Pork, Bacon	All cattle (sheep, goat, camel, etc.)
Rennet	All types of bucks
Non-Halal animal fat	Rabbits
Animal's meat upon which the name of Allah is not blessed during slaughtering	Fish
Meat of dead animals (carrion)	Locusts
Carnivorous animals with fangs, e.g. lions, dogs, wolves, tigers, etc.	Parts of halal animals that are not lawful
Birds of prey e.g. falcons, eagles, owls, vultures, etc.	Flowing blood
Reptiles, snakes, crocodiles	Male reproductive organ
Pests e.g. rats and scorpions	Testicles
Mules and Asses	Female reproductive organ
Alcoholic drinks, beer, wine	Pancreas
Intoxicants	Bladder
Blood and blood products	
Any food or drink that contains haram ingredients	

3.3. Islam and Science: The Association

Among the other properties of Islam, universality and humanity are considered a wide-spectrum perspective that covers a range of potentials in different applications. The scientific properties, pros and cons, the scientific origin, etc. of Islam are well defined and documented (Al-Hayani, 2005; Bigliardi, 2014; Mansour, 2011). Islam has the versatility to answer modern-day questions, particularly in food applications. It is the unique property of Islam that the prescribed criteria for halal and haram are currently proved by modern science in multiple ways, indicating the humanistic and natural properties of Islam. The truth about the universe is collected via different scientific pathways, which are derived from religious beliefs. Advancement in science provides easy and effective ways to get more information about the universe, the surroundings, and humans themselves. The complex system of the universe to the intricate and coordinated system of plants and animals *etc.* is currently explored in scientific discoveries, but Islam gives an idea about these things earlier. Thus, understanding the scientific approach for religious faiths vanished the thrust of the learners and hence gives a satisfaction. Particularly, the non-Muslims, whose beliefs are more based on the scientific understanding are currently accepting Islam as they learn the divine origin of Islam (Yap & Al-Mutairi, 2023).

The nature of human beings is to have curiosity about different surroundings. What happened, what is ongoing, and what to predict in the future are the normal thoughts that every individual faces, and people are trying to answer these thoughts. Likewise, following the scientific approach and getting information about the surroundings can give a person satisfaction and enhance their curiosity. When they obtain more details and knowledge, any rational person would think about the proper coordination, management, and the power which hold all these systems, and hence getting closer to its nature. Thus, thinking, imagining, and being curious about the universe can bring these people near to the creator (Allah Almighty), who creates, holds, and operates perfectly different universes (Said & Hanapi, 2018; Yap & Al-Mutairi, 2023).

Currently, the concept of globalization is flowing extensively in the modern world and affects all organizations, communities, and individuals. Globalization is a multidimensional phenomenon that encompasses all spectrums of someone's life (Hussain & Ali, 2024b). Globalization helps to speed up the movements and exchanges of human beings, goods, technologies, *etc.* all around the globe. Being broad and fast-growing, the globalization can also affect the religious beliefs. Islam has its own values, principles, and concepts of universality and humanity, which are not affected by any concepts and idea. Both globalization and Islam have certain properties in common, including universality, humanity, and basic individual rights (Achmad & Hamzani, 2016; Hussain & Ali, 2024b; Abbasi & Tirmizi, 2020). This aspect of Islam also gives an insight on how an individual can explore different aspects in this modern and industrialized world.

The Islamic paradigm of science describes those processes that explain the universe by following the described protocols of Islam and do not cross the reality of Tauhid of Allah Almighty. The Islamic perspective of science can help to seek the truth and solve the existing problems. Thus, the researchers and scientists can reach to the truth of the universe and finally to the power of Allah Almighty (Said & Hanapi, 2018).

4. The Scientific Perspectives of Halal and Haram

In the context of Islam and the science paradigm, it is understood that science can be used to describe natural phenomena, universal processes, and the answers to different problems while drawing light from Islamic principles. Likewise, the scientific understanding of halal and haram is also well-described. Scientific explanations and protocols help to validate the Islamic status of halal and haram, though for halal and haram, it is not a condition that they must be validated by scientific processes. But, still, the scientific validation gives more confidence to the consumers (as in the current scenario, everyone prefers things that are proven by scientific methods) and particularly aids in the *Tayyab* status of the stuff. Likewise, the scientifically proven stuff also enhances the halal industries around the globe, thus strengthening the socio-economic status of Muslim countries and attract the non-muslims to follow the teaching of Islam (Fadzlillah *et al.*, 2012).

Halal science i.e. the scientific validation of halal substances can fulfill the increasing market demands for halal items. As mentioned, the muslims population is increasing rapidly and requires more halal materials around the world. Hence, to complete the users' demands, the scientific methods can help by describing, proving, and processing halal things in more efficient and faster ways. Halal substances are not only used by muslims, but non-muslims are also using these substances extensively due to their health benefits, clean nature, and quality. Using scientific methods in the production of halal substances not only enhances the quantity but also enhances their storage life while using halal stabilizing agent (Said & Hanapi, 2018). The scientific methods provide an easy and fast way to trace the amount and types of ingredients in the food products, thus helps to properly describe the halal and haram status (Fadzlillah *et al.*, 2011). The different scientific methods that are used to describe the halal and haram nature of a food substance are illustrated in Figure 5. These mentioned methods have their own advantages and disadvantages. For instance, the analytical methods used for the detection of adulteration of oils and fats (including lard) are based on the differences in the nature and composition of the minor and major components of the adulterant and those of the unadulterated oils or fats. These methods typically depend on different physical-chemical properties or on their chemical and biological measurements (Fadzlillah *et al.*, 2011).

Advancements in the food technology have made excellent progress in the analysis of halal and haram contents of food items. The halal authentication also requires the consultation of related fields besides Islamic principles and thus satisfies a large number of consumers. Likewise, the use of state-of-the-art technology in these related fields enhances authenticity, confidence, and consumer satisfaction (Fadzlillah *et al.*, 2011). For example, to detect the porcine-based ingredients in different stuffs, the Fourier-transform infrared (FTIR) spectroscopic method is used, which gives the qualitative difference between the pure animal's fats and their blends. It is also used to detect lard adulteration in chocolate and their products (Fadzlillah *et al.*, 2011).

Advancements in genetic tools and DNA-based technology like polymerase chain reaction (PCR) are effectively used to detect the prevalence of different species in meat and fats. It also gives species identification from pork and lard samples and thus becomes a potential and reliable method for halal authentication (Fadzlillah *et al.*, 2011).

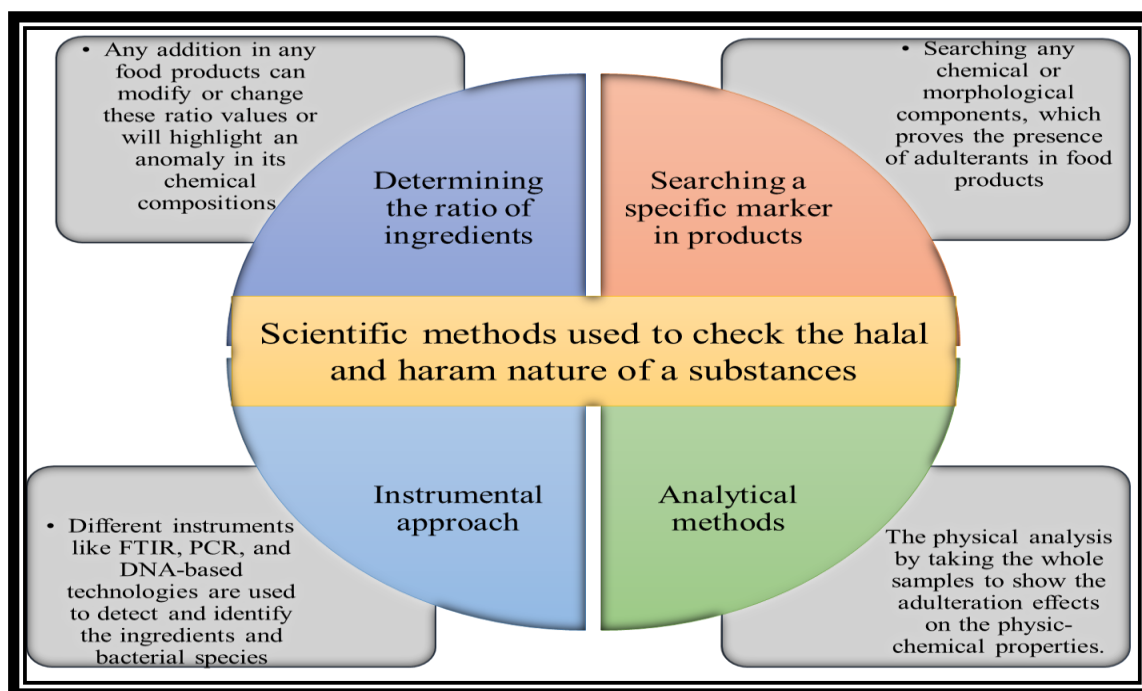


Figure 5. The different scientific approaches used to determine the halal and haram status of a product.

The concept of halal and haram in medicine and pharmaceutical sciences is also a matter of concern. We consume such products often and thus require clarification on their halal and haram status (Busari, 2023). In medicine, the source, process, ingredients, usage, etc. must be halal for any medicine to be taken. Recently, the use of probiotics as medicine and their Islamic perspective is documented (Hussain *et al.*, 2024c).

Drug discovery and development is also modified with different technologies. The use of 3D bioprinting and other related technologies is currently applied in drug development, tissue engineering, and liver regeneration. As this advanced concept also affects humans directly, the Islamic scholars must provide insight and knowledge about these development (Hussain, Rajpoot, *et al.*, 2024e).

The birth of modern genetic tools and developments in the field of biotechnology also raises questions about the use of genetically modified (GM) microbes in different applications. There are certain guidelines that must be followed while describing the halal and haram status of microorganisms. The essential facts that determined the halal perception of microbial products are: the source of microorganisms, the nature of microbes, the growth media compositions, the produced metabolites, the production process, and the additives that help them be used for specific function (Hussain & Ali, 2024c; Kurniati & Hafsan, 2022; Yap & Al-Mutairi, 2023).

The nanotechnology application in the field of humans and other animals also require investigations. Currently, different nanotechnology-based applications are used in cattle to monitor their milk timing and other status (Barwant *et al.*, 2024). These technologies may

also affect other aspects of the cattle, hence there is a need of properly validated and proven usage guidelines either to use this technology or if there is need for modification.

The emerging concept of probiotics and their products also attract experts who want to describe the exact status of these microorganisms. Probiotics are live microorganisms that, when administered in adequate amounts, confer a health benefit to a host. These microbes are selected on the basis of various criteria and have overwhelming health benefit (Hussain *et al.*, 2024d). Their health benefits cover disease prevention and treatment aspects, their biotechnological properties, and their food and other industrial applications. The majority of the probiotic strains are isolated from humans, and according to Islamic guidelines, the use of any human organ is not allowed, thus creating doubt about probiotic usage (Hussain & Ali 2024c; Kurniati & Hafsan, 2022).

5. Discussions

5.1. The Scientific Pros and Cons of Halal and Haram Substances

The concept of halal and haram in Islam does not only complete our religious responsibilities but also gives numerous health, physical, and psychological benefits. The key objective of the prohibition, i.e. the haram, is to ensure that any food or other item is pure and safe for the human health. Eating halal and *Tayyab* foods can give us the real taste of food, as these are clean, nutritious, and have good qualities. Some of the scientifically proven benefits of halal substances are listed (Abdul Rahman, 2017; Fadzlillah *et al.*, 2022, Fischer, 2008; Riaz & Ghayyas, 2023). The prominent benefits are summarized in Figure 6.

- 1- Eating halal things can maintain cleanliness, remove impurities, and protect oneself from dangerous substances that might be present in non-halal foods.
- 2- Muslims do not eat animals that are not slaughtered properly.
- 3- Animals that have diseases and risks for humans are avoided, thus ensuring the clean and healthy consumption of substances.
- 4- Islam forbids the consumption of animals that have been sacrificed for others than Allah Almighty and thus produces a lesson of unity, purity, and safe food.
- 5- The wisdom behind the prohibition of carrion or dead animals is the presence of toxic chemicals that are accumulated during the decomposition process and are harmful for consumption.
- 6- Halal item consumption gives relief and peace. For instance, the halal meat has no stress hormone.
- 7- Pigs are considered a mark of impurity, greed, and immorality; thus its consumption may produce these bad habits. In Islam it is haram, so the Muslims are safe from such effects.
- 8- The blood that is drained from animals are not allowed for consumption as it contains several bacteria that are harmful for human.

9- Swine is not allowed for consumption. Scientifically, it is proven that it serves as a vector for pathogenic worms that can enter the human body and cause diseases.

10- Fatty acids and the composition of pork fat have been mentioned as not allowed as these have incompatibility with the human fat and biochemical systems.

11- Halal meat tastes better than regular meat because it has less blood during its preparation.

12- Halal food can enhance metabolism.

Although these explanations sound good and it has been scientifically proven that haram substances have toxic effects on human body, but the ultimate source of not eating haram is that it is prohibited by Allah Almighty. Hence, if a substance is scientifically considered safe but it is haram in Islam, it will still be haram.

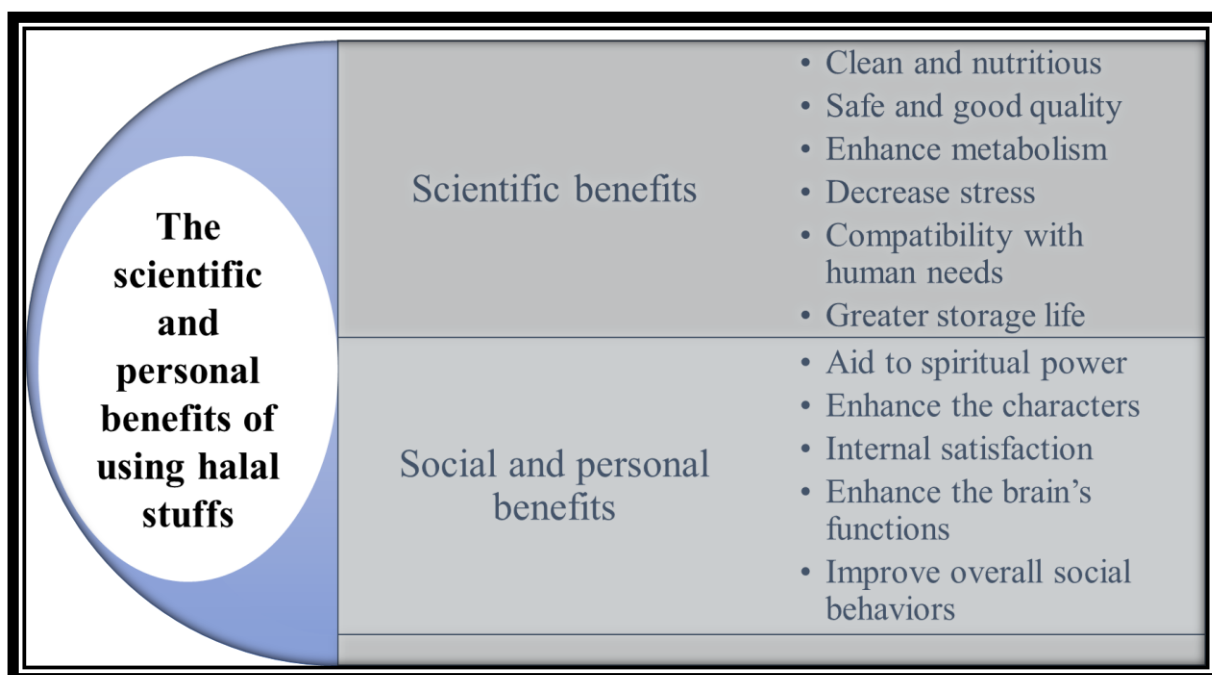


Figure 6. The scientific and psychological benefits of using halal stuffs.

6. Future Perspective

Islam is the religion of the universe, which will remain the same till the day of resurrection. On the other hand, science is still in the developmental stage and new discoveries, concepts, and theories are often developed. Now, it is the responsibility of the Muslim scholar (Ulama) to find solutions for existing and new scientific problems. The solution must be according to the al-Quran and Hadith and give satisfaction to the consumers. The following are a few areas that may be clearly defined as halal or haram in the Islamic context:

- The development of nanoscience and nanotechnology and their application in different areas must be clearly defined. For instance, nano-formulations are now used in different medicines that are consumed by humans. Hence, their complete sharia profile must be defined.

- The development of drugs with advanced technologies also requires Islamic investigation. Drugs are used by humans for disease treatment, and it has been identified that the source of some drugs is not halal, thus requiring investigation to clearly define their halal or haram nature.
- The advancement in genetic techniques, like the CRISPR-Cas system (Clustered Regularly Interspaced Short Palindromic Repeats), is currently extensively used in different molecular and biotechnological processes, hence requiring the exact status of halal or haram. Likewise, manipulation via genetic engineering and their extent should be considering from the Islamic point of view.
- The emerging field of biotic science (probiotics, prebiotics, synbiotics, postbiotics, etc.) is used in different food and other applications. As these are consumed by humans, they also require a clear status of halal or haram with scientifically proven methods (Hussain & Ali, 2024a).
- The creation of artificial substances like artificial meat is also the glory of modern scientific development. This product is directly used by humans and thus requires an Islamic explanation (Mohd Kashim *et al.*, 2023).
- In medical science, which advancing rapidly with new concepts being developed, would also require an investigation. For instance, organ transplants are common in the modern world; thus, there must be scientifically proven and Islamic investigation for these concepts.

7. Conclusion

Islam is a divine religion that remains in its original status and will remain until the occurrence of Qiyamma. Islam has unique properties that make it different from other religions. Islam protects individual rights as well as provides golden guidelines for international humanitarian policies. Due to its divine origin, truthfulness, and comprehensiveness, it has become the world's second-largest religion, with more than 1.8 billion followers. The number of followers is increasing rapidly, indicating their honest nature and completeness. Ranging from basic beliefs to covering the universal problem, Islam has guidelines at every step that are followed by the Muslims. Like other beliefs, halal and haram are two basic concepts that cover all aspects of a person and operate at individual, societal, national, and international levels. The fast and growing halal food industries require halal substances and raw materials for product development. The halal or haram status of a single item is crucial for the whole industry. Islam provides complete guidelines for a product to be halal or haram and thus gives satisfaction to the followers. The authority of halal and haram must be restricted to Allah Almighty and His last prophet, Muhammad S.A.W., while Islamic scholars can interpret these commands according to modern-day problems. The basic concepts of halal and haram include that the item's status must be declared in the mentioned sources (the al-Quran and Hadith). For a food item to be halal, the production, processing, commercialization, and packaging of a halal product must be halal. There must be no toxic effects associated with them, which is described by the term *Tayyabn*. Generally, all things are declared halal except for those that are described as haram. There are many scientific approaches, like using modern technologies, identifying specific markers, and using analytical methods that help in the identification of the haram ingredients in a substance.

Using modern scientific methods and describing the composition of halal or haram nature of a substance is of great importance. In conclusion, Islam has its own criteria for halal and haram, which are currently validated by scientific methods. Following the Islamic rules of halal and haram gives numerous benefits that range from personal to societal and from the national level to the international humanitarian level.

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