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Bacteria as a microbiological harm in halal food: An integrated preventive concept from maqasid syariah

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Abstract

The presence of microorganisms, particularly bacteria, can cause damage to halal food. Bacterial microorganisms are primarily accountable for the majority of foodborne illnesses that result in discomfort and harm, particularly within the gastrointestinal tract. The objective of this study is to review and refine the concept of microbiological harm in halal food as a preventive concept from a *maqasid syariah* perspective. This study employs a qualitative approach of content analysis to enhance and advance the conceptual development of *maqasid syariah* concerning the preventive notion of microbiological harm in halal food. The finding of this study shows that the concept of *maqasid syariah* can be applied to the prevention of bacterial growth as a microbiological harm in halal food through basic *maslahah* (*daruriyyah*). In summary, it is recommended that *maqasid syariah* assumes a distinct function in advancing a preventative concept for microbiological harm, which encompasses the safeguarding and conservation of halal food consumption. Further research is recommended to explore the potential of extending the concept of microbiological harm prevention to encompass a wider range of microorganisms, including viruses, parasites, and mycotoxins produced by moulds.

Keywords: bacteria, microbiological harm, halal food, preventive concept, maqasid syariah

1.0 Introduction

The presence of microorganisms, particularly bacteria, can cause damage to halal food. Bacteria are primarily unicellular, autonomous organisms that belong to the prokaryotic domain and exist in substantial populations. The equilibrium state of bacterial populations is achieved when the quantity of beneficial bacteria surpasses that of harmful bacteria (Hosseini et al., 2021). The human body harbors beneficial bacteria that provide various health benefits, particularly in digestion and immunity (Alanazi et al., 2024). It is commonly believed that a healthy balance of gut microbiota consists of approximately 85 percent beneficial bacteria and 15 percent harmful bacteria to ensure proper digestive function (Fathurrohim, 2022).

The objective of this study is to review and refine the concept of microbiological harm in halal food as a preventive concept from a *maqasid syariah* perspective. The quality of food, a fundamental human resource, can be regulated by applying the principles of *maqasid syariah*, which are designed to maintain human health and well-being (Maksum, 2024). *Maqasid syariah* is an essential framework that guides various aspects of life, including the assurance of halal food safety and hygiene (Fageh, 2022). The discussion on the application of *maqasid syariah* principles to bacterial prevention as a means of mitigating microbiological harm extends to the broader concept of human care in everyday life (Chaniago et al., 2024).

Harmful bacteria, viruses, mycotoxins, and parasites are the primary microbiological agents that can cause food spoilage. Bacterial microorganisms are primarily accountable for the majority of foodborne illnesses

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that result in discomfort and harm, particularly within the gastrointestinal tract. A thorough understanding of microorganisms and the process of fermentation is crucial in aiding individuals to create fermented foods that preserve a substantial portion of their initial nutritional value (Talon & Zagorec, 2017). Foods that have undergone fermentation through bacterial activity include dairy products such as cheese and yoghurt. The utilisation of hazardous technology and novel substances in food production may lead to microbiological spoilage and the onset of foodborne diseases (Hasmin et al., 2022).

Bacteria can cause harm to humans by triggering infections, contaminating food, and spreading in healthcare environments. Pathogenic bacteria utilize various strategies to evade the immune system, leading to infections that range from mild to severe (Soni et al., 2024). Additionally, foodborne pathogens such as Salmonella and Escherichia coli contribute to morbidity and mortality, especially among vulnerable populations (Sunarti, 2024). Furthermore, bacteria can contaminate medical equipment, increasing the risk of hospital-acquired infections (Araújo & Oliveira, 2020). The rising challenge of antimicrobial resistance further exacerbates bacterial pathogenicity, making treatment more difficult. These concerns highlight the importance of infection control, food safety, and research into new antibacterial strategies.

2.0 Literature Review

The literature review discusses the following topics: (a) the concept of halal food; (b) *maqasid syariah* in halal food consumption; (c) microbiological harms in food; (d) the role of bacteria; and (e) recent cases regarding microbiological harm.

2.1 The Concept of Halal Food

The Islamic concepts of *halal* (lawful), and *tayyib* (good quality), are referred to in both the Quran and the Hadith. These ideas are the basis for the standards of quality that apply to food. The fundamental guidelines of *halal* and *tayyib* demonstrate intolerance in significant areas like cleanliness, safety, and quality of the food (Elgharbawy & Azmi, 2022). Both of these concepts (*halal* and *tayyib*) can be referred to in the explanation of some Quranic verse (chapter 2, verse 172):

يَٰٓأَيُّهَا ٱلَّذِينَ ءَامَنُواْ كُلُواْ مِن طَيِّبَٰتِ مَا رَزَقۡنَٰكُمۡ وَٱشۡكُرُواْ لِلَّهِ إِن كُنتُمۡ إِيَّاهُ تَعۡبُدُونَ

Translation: “O you who have believed, eat from the good things which We have provided for you and be grateful to Allah if it is [indeed] Him that you worship.” (Qur’an, 2004)

The following are examples of hadiths that clarify the concept of consideration between halal and haram, which covers concerns about food safety (hadith no. 52 in Sahih al-Bukhari) (Md Ariffin et al., 2018):

عَنْ عَامِرٍ، قَالَ سَمِعْتُ النُّعْمَانَ بْنَ بَشِيرٍ، يَقُولُ سَمِعْتُ رَسُولَ اللَّهِ ﷺ يَقُولُ ”الْحَلاَلُ بَيِّنٌ وَالْحَرَامُ بَيِّنٌ، وَبَيْنَهُمَا مُشَبَّهَاتٌ لاَ يَعْلَمُهَا كَثِيرٌ مِنَ النَّاسِ...

Translation: “Al-Numan bin Bashir narrated that the Messenger of Allah (PBUH) said: The lawful is clear and the unlawful is clear, and between those are matters that are doubtful (not clear); many of the people do not know whether it is lawful or unlawful.” (Al-Bukhari, 2022)

"Halal" is an Arabic word that signifies "permitted" or "lawful by syariah." It also refers to items that are permitted for consumption inside the Muslim community, such as foods and services (Bux et al., 2022). In the context of food and its products, it refers to the logistics of the business, the composition of the ingredients, the descriptions used in the industry, and any possible mixing with other goods. Additionally, it denotes that it has not been polluted with anything that the syariah regards as impure (Riaz & Chaudry, 2019). For instance, the term "halal meat" (which can be consumed) refers to meat that comes from animals that have been slaughtered following syariah law (Abdullah et al., 2019).

According to the syariah, food or its products are not considered halal (which is *haram* or forbidden) if they have any of the following characteristics (Riaz & Chaudry, 2019): (a) pork and its by-products; (b) animals that were not slaughtered or died before they were slaughtered; (c) animals that were killed in the name of something other than Allah; and (d) alcoholic beverages that are considered to be intoxicating. Illegal food and its products also include the following elements (Riaz & Chaudry, 2019): (a) carnivorous animals; (b) terrestrial

animals without external ears; (c) blood and its products; and (d) food that has been tainted with any illegal product.

Countries that have distinct official sectarian holdings have particular considerations based on numerous elements that are relevant to the circumstances and realities of the country. These considerations can vary from country to country (Azam & Abdullah, 2021). Conversely, the principles and customs of Islamic dietary guidelines are universally applicable, regardless of geographical location. The uniformity observed in the practise of fiqh across the Muslim world can be attributed to its reliance on primary sources such as the Quran and hadith, which serve as the main points of reference (Busari & Sitiris, 2021). The authorities in charge of domestic affairs place significant emphasis on the status and quality of halal food products. They assert that reliable analysis techniques are necessary to verify that these products satisfy the necessary criteria. The initiative aims to engage not only the Muslim minority residing in secular nations as consumers but also to advance the concept of equitable trade and commerce devoid of bias (Ariffin et al., 2021).

2.2 Maqasid Syariah in Halal Food Consumption

The implementation of syariah, the Islamic legal system, in Muslim societies is intended to promote righteousness and benefit humanity. The objective of *maqasid syariah* is to safeguard the welfare and meet the essential needs of individuals in both the present life and the hereafter (Hashim et al., 2022). *Maqasid syariah* refers to the underlying purpose and objective that Allah (referred to as God in the context of Muslims) has established for each law. The purpose and objective of this endeavour are to attain both individual and communal happiness, uphold the law, and promote global advancement towards a state of excellence, virtue, progress, and civilization (Al-Zuhaili, 1997). The principle in question aims to safeguard not only the welfare and concerns of individuals during their lifetime and active engagement with society but also to safeguard those interests posthumously (Al-Syatibi, 1996). This demonstrates that the advent of Islam was a beneficial occurrence not solely for humanity, but for the entirety of the world, as stated in the Quran (chapter 21, verse 107):

وَمَآ أَرۡسَلۡنَٰكَ إِلَّا رَحۡمَةٗ لِّلۡعَٰلَمِينَ

Translation: “And We have not sent you, [O Muhammad], except as a mercy to the worlds.” (Qur’an, 2004)

As per the experts in the field of Islamic jurisprudence, the four fundamental elements that propel the concerns of individuals and communities, and are safeguarded by Shariah, are as follows (Al-Teinaz & Al-Mazeedi, 2020): (a*) jalb al-masalih*, which translates to “achieving significance in one's life” (Ulum, 2019); (b) *dar al-mafasid*, which means “rejecting the harm that will emerge in society” (Tayyabi & Shah, 2021); (c) *sadd al-dharar*, which means “restraining harmful interests” (Ruzulan et al., 2023); and (d) *taghayyur al-zaman*, which means “emphasising the passing of time” (Harun et al., 2020). About the *jalb al-masalih*, the primary objective of Islamic law is to protect the public interest. If one does not engage in this activity regularly, they will have disruptions in their efforts to maintain mental and physical health. In the Quran (chapter 2, verse 195), it is stated that this idea is a worthy human activity and that it needs to be refined all the time to prevent any damage from occurring:

وَأَنفِقُواْ فِي سَبِيلِ ٱللَّهِ وَلَا تُلۡقُواْ بِأَيۡدِيكُمۡ إِلَى ٱلتَّهۡلُكَةِۛ وَأَحۡسِنُوٓاْۛ إِنَّ ٱللَّهَ يُحِبُّ ٱلۡمُحۡسِنِينَ

Translation: “And spend in the way of Allah and do not throw [yourselves] with your [own] hands into destruction [by refraining]. And do good; indeed, Allah loves the doers of good.” (Qur’an, 2004)

The principle under consideration can typically be categorised into three distinct groups of matters of public interest (*maslahah*) (Musadik et al., 2020): (a) *maslahah daruriyyah* (basic interest); (b) *maslahah hajiyyah* (necessity interest); and (c) *maslahah tahsiniyyah* (complementary interest).

The safeguarding and maintenance of five key aspects are integral to the preservation of an individual’s fundamental interests: religion (Islam), the soul (illness and harm), the intellect (cognitive and psychological processes), the honour (dignity and descendants), and property (rights and belongings). The preservation and sustenance of five fundamental elements, known as *maqasid syariah*, are deemed essential for the well-being of

every individual. These elements collectively constitute an optimal human maintenance system. The term "*mafsadah*" denotes a state of perplexity or disturbance in any of the five fundamental elements, which can lead to destruction. The term "necessity interest" pertains to any essential facility, amenity, or locality that is indispensable for the sustenance of daily living. Following the initial level of interest, this is the most significant factor that individuals assign the greatest importance to. Disregarding this notion could potentially lead to dissatisfaction in an individual's life. However, it is necessary to take measures to avoid challenges in daily life. Simultaneously, an additional concern is upholding an individual's sense of self-worth and adhering to the cultural standards of their society. In the majority of instances, possession of it is deemed necessary to guarantee a certain degree of comfort in one's daily life.

The consumption of halal food can be classified as a fundamental concern that encompasses the protection and maintenance of one's well-being (health and safety), intellect (psychology and behavior), honour (dignity and descendants), and property (rights and belonging). This concept generally refers to the preservation of life and body, human physiological and psychological health, hereditary offspring and dignity, as well as property and rights.

The consumption of halal food can be interpreted as a preventative measure against potential harm to one's life, as it is rooted in the principle of *hifz al-nafs* (preserving the life), *hifz al-aql* (preserving the mind), *hifz al-nasab* (preserving the descendants), and *hifz al-mal* (preserving the property). The elements abide by the principles and precepts of syariah, as is appropriate. However, it is imperative to regulate the preservation and management of halal food consumption based on the criteria set forth by governing bodies and in consideration of present circumstances (Khalil, 2003).

2.3 Microbiological Harms in Halal Food

The phrase "microbiological harm in halal food" pertains to microbiological factors present in halal food, encompassing various microorganisms, that exert an adverse effect on the quality of food and the health of its consumers. In the majority of instances, adverse microbiological effects result in the primary indications and manifestations of an illness. Microorganisms are responsible for significant harm, particularly in the context of foodborne illnesses, where pathogens infiltrate the human body and result in sickness. The subsequent are a few of the challenges associated with ensuring food safety, specifically (Md Ariffin et al., 2018): (a) the concept of food management.; (b) the method of preparing and/or utilising food items; and (c) food security for consumers. The concept of food management is founded on established standards that are designed to safeguard the well-being and security of food for consumers, specifically about the hygiene of the food. Food safety is a crucial aspect that is given due consideration during the preparation and/or consumption of food products. Food products are considered safe when they are prepared in compliance with food safety regulations and procedures. All stakeholders, including consumers, producers, processors, suppliers, and vendors, are required to comply with the safety standards and protocols mentioned previously. The provision of safe food to customers involves the consideration of both the visible and concealed attributes that relate to the food's quality, as well as its internal characteristics. This is regarded as the standard practise in ensuring food safety. Consequently, this will facilitate customers to make autonomous choices based on the specifications and relevance of the suggested application (food compatibility).

2.4 The Role of Bacteria

Bacteria are microscopic single-celled organisms that can only be observed through a microscope owing to their diminutive size (Gracelin, 2021). In the overwhelming majority of cases, bacteria do not induce illness or pathological conditions. The human digestive tract can harbour over 300 distinct bacterial species (Knackstedt et al., 2020). On the contrary, the incorporation of certain microorganisms may prove advantageous in the manufacturing of food products. This ingredient is commonly utilised in the production of yoghurt, cheese, and bread. While not all bacteria possess the ability to transmit diseases to humans, certain strains are accountable for food spoilage.

Acquiring knowledge about the differentiation between bacteria responsible for food spoilage and those accountable for causing diseases is crucial for proficiently controlling and averting foodborne illness. Identifying pathogenic bacteria can often pose a challenge as their visual, olfactory, or gustatory characteristics may not be indicative of their presence. The manifestation of pathogenic bacteria in foodstuff serves as a clear indication of

spoilage, and such bacteria can instigate foodborne illness through any of three discrete mechanisms (Hernández-Cortez et al., 2017): (a) infection; (b) toxicity (poisoning); or (c) toxic poisoning infections.

2.4.1 Infection

Some strains of bacteria can cause harm to the intestinal tract through an indirect mechanism. The primary cause of this condition is the ingestion of food contaminated with pathogenic bacteria (Ribet & Cossart, 2015). Vegetative cells refer to living cells that possess the ability to undergo self-reproduction. Acidic environments are generally not conducive to bacterial growth. However, certain bacterial strains have demonstrated the ability to thrive and proliferate within the small intestine despite the acidity present. The degree of bacterial resistance and potency, along with the level of immunity of the infected host, are crucial determinants of reproductive capacity. Once the bacterial colony reaches a critical mass that can cause damage to the gastrointestinal tract, the individual may experience symptoms such as abdominal pain and discomfort.

Salmonella exemplifies a bacterial species within this particular classification (Switt et al., 2015). Salmonella is known to colonise the gastrointestinal tract of various animal species, including those that serve as a source of sustenance for human consumption. *Salmonella* is capable of obtaining nourishment from uncooked milk and eggs (Castañeda-Salazar et al., 2021). *Salmonella* can be eliminated by exposure to high temperatures; however, inadequate cooking temperatures may lead to its persistence. Cross-contamination is a common mode of transmission for *Salmonella* (Sreedharan et al., 2017). The preceding occurrence is observed with regularity when utilising a singular cutting board to slice both meat or poultry and subsequently uncooked vegetables, such as salads. *Salmonella* can undergo replication at an approximate rate of every 20 minutes. As the colonies of *Salmonella* grow, certain ones exhibit the ability to endure the hostile conditions of the stomach and propagate within the confines of the small intestine. Delayed onset of gastrointestinal injury and manifestation of symptoms associated with foodborne illness are observed.

2.4.2 Toxicity

Certain strains of bacteria have the ability to produce harmful substances, such as toxins or other compounds derived from food sources, that can be detrimental to human health. In this scenario, the disease aetiology attributes the primary causative agent to the toxin rather than the bacterium (Vitale et al., 2015). Despite the inactivation of pathogenic microorganisms, such as *Staphylococcus aureus*, they may still have sufficient time to produce toxins (Tong et al., 2015). *Staphylococci* have been detected in various environmental and biological sources, including the atmosphere, particulate matter, wastewater, potable water, dairy products, animal and human hosts, as well as food and food-processing apparatus. It is prevalent among more than 50 percent of healthy individuals, residing in the nasal cavity, pharynx, pilosebaceous units, and integumentary system.
The presence of toxins in food originating from *Staphylococcus aureus* is commonly attributed to its optimal proliferation. While it is true that heating can eliminate bacteria, it should be noted that the toxins produced by bacteria before cooking exhibit a significant degree of resistance to extreme temperatures (Jusot et al., 2017). The sensory properties of food, such as its smell, colour, texture, and taste, are not reliable indicators for the presence of toxins.

2.4.3 Toxic Poisoning Infections

Certain bacterial strains are capable of colonising the gastrointestinal tract, where they undergo adaptations to survive the acidic conditions of the stomach. Subsequently, these microorganisms produce toxins within the digestive system (Ermenlieva et al., 2018). Toxic poisoning is a medical condition caused by exposure to harmful substances that can lead to adverse health effects. The condition of infection is a combination of the aforementioned instances of infection and toxicity. This is distinguished by the production of toxins that induce disease within the intestinal tract (Ribet & Cossart, 2015). *Clostridium perfringens* is a type of bacteria that is known to be a causative agent of foodborne illnesses (Hailegebreal, 2017). Similar to other bacterial species, these microorganisms are omnipresent in various environmental niches, such as soil, water, dust, and even the gastrointestinal tracts of animals. In general, a significant quantity of microorganisms is necessary to induce illness. Nonetheless, the mere production of dormant spores by *Clostridium perfringens* is sufficient to induce pathogenicity (Talukdar et al., 2016).

Under unfavourable environmental conditions, such as high temperatures or limited availability of water and nutrients, vegetative cells undergo sporulation to produce spores. Due to these circumstances, the spores exhibit high resistance to heat, water, and food, making their elimination challenging. Upon the return of favourable environmental conditions, spores initiate growth. The common origin of this foodborne illness is meat that contains viable, thermally processed spores, which remain unaffected even after being subjected to high temperatures. As the temperature decreases, the spores will undergo a transition to the plant form and exhibit rapid and prolific multiplication. Upon ingestion of food, Clostridium perfringens produces pathogenic toxins within the gastrointestinal tract (Li et al., 2016).

Certain bacteria can induce illness by utilising a combination of the aforementioned mechanisms. The onset of illness caused by bacteria or toxins is contingent upon several factors, including the duration between food consumption and the emergence of symptoms (Mohammad et al., 2018). Most living organisms, including humans, harbour diverse bacterial species, some of which can cause illnesses transmitted through food. It is not feasible to completely eradicate hazardous microorganisms from food. The control of bacterial growth and progress can be attained by the administration of elements that facilitate bacterial reproduction (Saxena et al., 2015).

The growth and progression of bacteria are influenced by both intrinsic characteristics and environmental factors (Rolfe & Daryaei, 2020). The intrinsic variables of a substance include acidity, nutrient content, antimicrobial preservatives, biological structure, and water activity. External variables encompass factors such as temperature, relative humidity, oxygen presence, and microbial activity. The growth and progression of bacteria are influenced by various factors, including (Matthews et al., 2017): (a) water; (b) food and nutrients; (c) optimal temperature; (d) time; (e) oxygen; and (f) optimal pH.

2.5 Recent Cases Regarding Microbiological Harm

Several recent cases have emerged concerning microbiological harm within the local Malaysian community. On the 6th of October 2019, a foodborne outbreak transpired during a large assembly in the Petaling district of Selangor (Rajakrishnan et al., 2022). The cases were delineated as individuals who participated in the mass gathering event. The individuals ingested the prepackaged sustenance and subsequently exhibited symptoms such as vomiting, abdominal discomfort, diarrhoea, and other related indications (e.g., fever, nausea, and vertigo). The collected specimens from the presumed food sources, food handlers, and surrounding surroundings yielded affirmative results for *Bacillus cereus*, *Staphylococcus aureus*, or coliforms.

Before that, According to reports, *Salmonella spp.* is the primary cause of foodborne illness outbreaks among schoolchildren in Terengganu (Abdullah & Ismail, 2021). The study findings indicate that poultry (61.9%) was the predominant food vehicle, while *Salmonella spp.* (52.4%) was the most frequently identified microbial etiological agent. Insufficient cooking and reheating practises were found to be the most probable factors associated with school-related foodborne illnesses, as opposed to food cross-contamination. The occurrence of food poisoning among schoolchildren in Terengganu has been linked to both non-modifiable and modifiable factors. Non-modifiable factors include the location of the school district, while modifiable factors include food vehicles and critical control points.

3.0 Methodology

This study employs a qualitative approach of content analysis to enhance and advance the conceptual development of *maqasid syariah* concerning the preventive notion of microbiological harm in halal food. The comprehension of the notion of bacterial growth is utilised in formulating a preventative concept that conforms to the principles of *maqasid syariah*. Scholar Google, a search engine, is utilised as an instrument for data collection to retrieve scientific literature from databases such as Scopus, ScienceDirect, and Web of Science. The search technique employs specific keywords that pertain to the subject matter, including "*maqasid syariah*," "bacterial growth," "microbiological harm," and "halal food." The preventive concept development employs a conceptual approach that integrates the analysis of "*maqasid syariah*" with the conventional comprehension of "bacterial growth/microbiological harm/halal food".

4.0 Results and Discussion

The finding of this study shows that the concept of *maqasid syariah* can be applied to the prevention of bacterial growth as a microbiological harm in halal food through basic *maslahah* (*daruriyyah*). The concept of *maqasid syariah*, which involves the care and preservation of humans, consists of four (4) main aspects, namely: (a) preserving lives (*hifz al-nafs*); (b) preserving the mind (*hifz al-aql*); (c) preserving descendants (*hifz al-nasab*); and (d) preserving property (*hifz al-mal*).

4.1 **Preserving Lives (*Hifz al-Nafs*)**

To Muslims, spiritual well-being is of paramount importance. Islam considers the preservation of human life to be one of the *maqasid syariahs* in its application to human beings. Maintenance of basic bodily functions includes securing adequate nutrition. Humans have an innate requirement to consume food. Thus, according to Islamic law, everyone has a religious obligation to consume halal food. This is in line with the appeal made to all people in the Quran to eat only halal, clean, and safe food (chapter 2, verse 168). The effects of bacteria on food can be both harmful and helpful. When bacteria cause food poisoning, they are dangerous. Symptoms like the flu, vomiting, diarrhoea, and fever are all telltale signs of foodborne disease. Cheese and cultured milk, for example, benefit from bacteria's role in the fermentation process.

Preserving lives in *maqasid syariah* to inhibit bacterial proliferation in halal food is a multifaceted and intricate matter. The use of antibiotics in halal animal husbandry, although advantageous, can result in the emergence of antibiotic-resistant bacteria, which contradicts the principle of *maqasid syariah*. The *tayyib* part of halal food manufacturing, encompassing the integrity and safety of the food, plays a vital role in inhibiting bacterial proliferation. Cultured meat, which has been suggested as a possible substitute for conventional beef, has been offered as a food product that adheres to *maqasid syariah* (Reza Adnan et al., 2021). When incorporating microbial bioprocesses in halal food production, it is crucial to thoroughly assess the halal status (Kurniadi & Frediansyah, 2017). Assessing different components in growth media for the production of halal probiotics is a crucial feature of this matter (Pratiwi et al., 2020). The incorporation of *maqasid syariah* with contemporary biotechnology, particularly in the realm of food items, is of utmost importance. Water activity plays a crucial function in maintaining microbiological stability in food and is an important factor in inhibiting bacterial development (Tapia et al., 2020).

4.2 Preserving the Mind (*Hifz al-Aql*)

In Islam, the preservation of mental health is an important part of living a good life. There's a critical necessity to maintain good mental health because it affects how people act. According to a recent study from the University of Illinois (Mudd et al., 2017), the health and behaviour of persons with certain neurological illnesses, such as autism, may be affected by bacteria in the gut. Cortisol has been shown to play a role in the communication between the stomach and the brain's microorganisms. Cortisol, also known as the "stress hormone," is a bioindicator of stress levels in humans and other mammals.

This shows that Islam has a claim about inhibiting the growth of bacteria, which is a microbiological threat. If the growth of these bacteria is inhibited early on, it won't have any effect on the nervous system of the human brain. Their results (Mudd et al., 2017) also show that the number and size of bacterial colonies are bigger in Alzheimer's patients' brains than in healthy brains. Also, certain combinations of gut bacteria make chemicals that can change how people get along with each other in social situations. Recent research (Madan et al., 2020) found a link between the gut microbiota and the severity of symptoms in psychiatric inpatients as well as a link to remission of depression after treatment.

Furthermore, to prevent neurological problems caused by microbiological harm, it is possible to explore the gut microbiota-brain axis, by the preservation of the mind in *maqasid syariah*. The axis in question is of utmost importance in the progression of neurological disorders, as gut dysbiosis and disrupted permeability of the intestinal/blood-brain barrier are significant contributing factors (Ullah et al., 2023). The Islamic viewpoint on health, encompassing mental health as well, underscores the significance of sustaining a sound state of mind. Disturbances in the gut microbiota throughout early life can affect the development of the nervous system and

potentially result in negative mental health consequences (Borre et al., 2014). Probiotics and a well-balanced diet can contribute to the management of neurological illnesses and mental states (Thangaleela et al., 2022).

The relationship between the gut microbiome, which refers to the accumulation of microorganisms in the digestive system, and microbial dysbiosis, an imbalance in these microorganisms, has been associated with mental health and neurocognitive problems. This connection implies the possibility of developing novel approaches for managing these conditions (Halverson & Alagiakrishnan, 2020). The gut microbiota can regulate behavioural and physiological anomalies linked to neurodevelopmental diseases, which could have significant implications for probiotic therapy (Hsiao et al., 2013). The relationship between the microbiota-gut-brain axis and neuropsychiatric diseases, such as anxiety and depression, has been identified, indicating the possibility of gastrointestinal-focused therapy alternatives (Rieder et al., 2017).

4.3 Preserving Descendants (*Hifz al-Nasab*)

The third claim of *maqasid syariah* is that inhibiting bacteria from reproducing is the best way to keep descendants alive. Moon et al. (2015) did a study that showed that some traits that were thought to be passed down through the parent's genes are caused by bacterial DNA that is passed from the mother to the baby soon after birth. This is the first study to demonstrate that bacterial DNA may be passed down from parents to offspring. Microorganisms can be passed from mother to child through touch or when the baby is born through the mother's reproductive system. Inflammatory bowel illness in neonates, such as Crohn's disease, is an example of a disease that can be transferred through this inheritance. It is related to low intestine levels of disease-defense antibodies, or IgA, which helps fight germs. It is hypothesised that these symptoms are inherited from the mother's parent gene (Moon et al., 2015).

Due to that, the microbiological condition of food preparation surfaces in Makkah restaurants is a cause for worry, as they exhibit significant contamination by pathogenic microorganisms such *E. coli* and *Staphylococcus aureus* (Bukhari et al., 2021). This holds particular significance within the realm of halal food, as it plays a critical role in upholding the five fundamental aspects of *maqasid syariah*, which includes the preservation of descendants (Wahyudi & Ali, 2021). Ready-to-eat food may include hazardous bacteria, such as *E. coli* and *Salmonella*, which can cause foodborne illness (Abdul Rafa, 2015). In nations such as Pakistan, inadequate food management is a prominent concern that leads to gastrointestinal issues (Ishaq et al., 2021). Ensuring a safe food supply requires understanding the mechanisms, implications, and prevention of microbiological contamination, as harmful microorganisms pose significant risks to food safety (Alum et al., 2016).

In Arab countries, microbiological food safety management is crucial, particularly in addressing foodborne pathogens through risk management strategies such as hygiene enforcement and regulatory measures (Kamleh et al., 2012). From a halal perspective, microbial bioprocessing is integral to food production, but adherence to legal and religious requirements is essential, particularly in the selection and use of microorganisms. Compliance with these standards ensures the integrity of halal food while mitigating microbiological hazards (Kurniadi & Frediansyah, 2017). Integrating scientific and religious considerations strengthens food safety frameworks, safeguarding public health and maintaining halal food standards.

4.4 Preserving Property (*Hifz al-Mal*)

Preventing the spread of these bacteria is a requirement of *maqasid syariah*, which also stipulates that one must maintain one's property. The food business suffers losses as a result of ruined halal food products brought about by bacterial growth. When it becomes clear that a product poses a threat to customers' health and safety, the industry is required to issue a recall. This is especially true in the case of foodborne illness. Similar to how a low-fat dairy product was previously pulled from shelves due to bacterial contamination. In this case, the manufacturer loses credibility with government regulators and suffers the consequences when customers sue over medical bills related to their illnesses.

In avoiding a product recall due to foodborne illness, various research has investigated strategies to mitigate microbiological harms in halal food products. Bukhari et al. (2021) discovered significant levels of contamination on food processing surfaces within restaurant establishments, emphasising the necessity for ongoing evaluation. Pangaribuan et al. (2022) established that the adoption of Good Manufacturing Practice (GMP) and the utilisation

of natural preservatives can effectively diminish bacterial contamination in meat products. Babunova et al. (2022) highlighted the significance of maintaining worker cleanliness and the possibilities of using natural preservatives, including honey and *miswak* root extract, to avoid microbiological deterioration. Adiyastiti et al. (2019) examined the significance of microbial bioprocesses in the production of halal food items, while Kurniadi and Frediansyah (2017) emphasising the necessity of addressing crucial factors in the utilisation of microorganisms. Alharbi et al. (2019) concluded that ready-to-eat fast foods had significant levels of bacterial contamination, highlighting the importance of implementing sanitary practices during food preparation.

5.0 Conclusion

In summary, it is recommended that *maqasid syariah* assumes a distinct function in advancing a preventative concept for microbiological harm, which encompasses the safeguarding and conservation of halal food. This aligns with the fundamental requirements of human beings, primarily centred around nourishment. Microbiological factors should be considered due to their involvement in the development of foodborne illnesses, particularly concerning food spoilage. Further research is recommended to explore the potential of extending the concept of microbiological harm prevention to encompass a wider range of microorganisms, including viruses, parasites, and mycotoxins produced by moulds. For a more comprehensive understanding of this issue, inspections should be conducted at food-producing establishments.

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References

Abdul Rafa, A. A. (2015). *Microbiological indicator of medium filth (najs mutawassitah) in ready to eat food: Towards standardization of toyyibah food*. [Unpublished doctoral thesis]. International Islamic University Malaysia.

Abdullah, F. A. A., Borilova, G., & Steinhauserova, I. (2019). Halal criteria versus conventional slaughter technology. *Animals, 9*(8), 530. https://doi.org/10.3390/ani9080530

Abdullah, N. B. A., & Ismail, A. F. (2021). Food poisoning outbreaks among schoolchildren in Terengganu and their associated factors. *Sains Malaysiana, 50*(4), 1027-1036. http://doi.org/10.17576/jsm-2021-5004-13

Adiyastiti, B. E. T., Lingga, R., Arifin, S., & Hendraningsih, L. (2019). Potential microbial contamination on kebab meat in the area of University of Muhammadiyah Malang. *Jurnal Ilmu dan Teknologi Hasil Ternak, 14*(2), 107-116. https://doi.org/10.21776/ub.jitek.2019.014.02.5

Alanazi, M. M., Alhajji, Y. B., Almutairi, M. J., Alharbi, S. B., Aljawad, T. H., & Aljawad, A. H. (2024). A dietary approach to reducing halitosis: The impact of certain foods on oral bacteria. *Journal of Healthcare Sciences, 4*(12), 800-806. https://doi.org/10.52533/johs.2024.41220

Al-Bukhari, A. A. M. (2022). *Sahih al-Bukhari*. Dar al-Kotob al-Ilmiyah.

Alharbi, S. A., Abdel-Ghaffar, M. H., & Kadher, N. R. (2019). Isolation and identification of pathogenic bacteria from ready-to-eat fast foods in Al-Quwayiyah, Kingdom of Saudi Arabia. *African Journal of Food, Agriculture, Nutrition and Development, 19*(3), 14739-14751. https://doi.org/10.4314/AJFAND.V19I3.17840

Al-Syatibi, A. I. (1996). *Al-muwafaqat fi usul al-syariah*. Beirut: Dar al-Ma'rifah.

Al-Teinaz, Y. R., & Al-Mazeedi, H. M. M. (2020). Halal certification and international halal standards. In Y. R. Al-Teinaz, S. Spear, I. H. A. Abd El-Rahim (Eds.), *The halal food handbook* (pp. 227-251). Wiley. https://doi.org/10.1002/9781118823026.ch15

Alum, Akanele, E., Urom, Chukwu, S. M., Ben, & Ahudie, C.M. (2016). Microbiological contamination of food: The mechanisms, impacts and prevention. *International Journal of Scientific & Technology Research, 5*, 65-78.

Al-Zuhaili, W. (1997). *Nazariyah al-dhorurah al-syari'yyah muqaranah ma'a al-qanun al-wadhi'*. Damsyik: Dar Al-Fikr.

Araújo, D. L., & Oliveira, J. L. (2020). Identification and analysis of bacterial presence in diagnostic imaging equipment. *Research, Society and Development, 9*, e777974711. https://doi.org/10.33448/RSD-V9I7.4711

Ariffin, M. M., Riza, N. S. M., Hamid, M. F. A., Awae, F., & Nasir, B. M. (2021). Halal food crime in Malaysia: An analysis on illegal meat cartel issues. *Journal of Contemporary Issues in Business and Government, 27*(2), 1407-1412. https://doi.org/10.47750/cibg.2021.27.02.152

Azam, M. S. E., & Abdullah, M. A. (2021). Halal standards globally: A comparative study of unities and diversities among the most popular halal standards globally. *Halalpshere, 1*(1), 11-31. https://doi.org/10.31436/hs.v1i1.20

Babunova, V. S., Osipova, I. S., & Popov, P. A. (2022). Study of preserving properties of honey in composition of marinades for meat. Problems of Veterinary Sanitation, Hygiene and Ecology. https://doi.org/10.36871/vet.san.hyg.ecol.202204009

Beuchat, L. R. (1981). Microbial stability as affected by water activity. *Cereal Foods World, 26*(7), 345-349.

Borre, Y. E., O'Keeffe, G. W., Clarke, G., Stanton, C., Dinan, T. G., & Cryan, J. F. (2014). Microbiota and neurodevelopmental windows: implications for brain disorders. *Trends in Molecular Medicine, 20*(9), 509-518. https://doi.org/10.1016/j.molmed.2014.05.002

Bukhari, M. A., Banasser, T. M., El-Bali, M., Bulkhi, R. A., Qamash, R. A., Trenganno, A., Khayyat, M., Kurdi, M. A., Al Majrashi, A., & Bahewareth, F. (2021). Assessment of microbiological quality of food preparation process in some restaurants of Makkah city. *Saudi Journal of Biological Sciences, 28*(10), 5993-5997. https://doi.org/10.1016/j.sjbs.2021.06.050

Busari, S. A., & Sitiris, M. (2021). Standardisation of halal industry towards sustainable development goals (SDG). *Journal of Islam in Asia, 18*(1), 163-198. https://doi.org/10.31436/jia.v18i1.1001

Bux, C., Varese, E., Amicarelli, V., & Lombardi, M. (2022). Halal food sustainability between certification and blockchain: A review. *Sustainability, 14*(4), 2152. https://doi.org/10.3390/su14042152

Castañeda-Salazar, R., del Pilar Pulido-Villamarín, A., Ángel-Rodríguez, G. L., Zafra-Alba, C. A., & Oliver-Espinosa, O. J. (2021). Isolation and identification of *Salmonella spp*. in raw milk from dairy herds in Colombia. *Brazilian Journal of Veterinary Research and Animal Science, 58*, e172805-e172805. https://doi.org/10.11606/issn.1678-4456.bjvras.2021.172805

Chaniago, S. A., Izza, M., Wijaya, B. S., & Rozi, F. F. P. (2024). Implementation of halal supply chain in the cooperative of Islamic boarding school: Maqashid syariah perspective. *Jurnal Hukum Islam, 22*(1), 57-88. https://doi.org/10.28918/jhi_v22i1_3

Elgharbawy, A., & Azmi, N. A. N. (2022). Food as medicine: how eating halal and tayyib contributes to a balanced lifestyle. *Halalpshere, 2*(1), 86-97.

Ermenlieva, N., Tsankova, G., Naydenova, D., Todorova, T. T., Tsankova, D., & Georgieva, E. (2018). Foodborne bacteria: Potential bioterrorism agents. In Y. El-Samragy (Ed.), *Food safety–Some global trends* (pp. 51-65). UK: IntechOpen Limited. https://doi.org/10.5772/intechopen.75965

Fageh, A. (2022). Building a synergy between the halal industry and the green industry in the maqasid syariah review as the basis of Islamic economics. *Journal of Islamic Economic Laws, 5*(1), 139-158. https://doi.org/10.23917/jisel.v5i1.17034

Fathurrohim, M. F. (2022). Narrative review: Study of microbial-based tipping points as halal food products. *International Journal Mathla'ul Anwar of Halal Issues, 2*(1), 1-5. https://doi.org/10.30653/ijma.202221.39

Gracelin, D. H. S. (2021). Bacteria: An overview. In T. B. Galande, R. B Desai, R. A Jachak, & D. Kumar (Eds.), *Frontiers in life science* (Vo. I, pp. 101-112). India: Bhumi Publishing.

Hailegebreal, G. (2017). A review on clostridium perfringens food poisoning. *Global Research Journal of Public Health and Epidemiology, 4*(3), 104-109.

Halverson, T., & Alagiakrishnan, K. (2020). Gut microbes in neurocognitive and mental health disorders. *Annals of Medicine, 52*(8), 423-443. https://doi.org/10.1080/07853890.2020.1808239

Harun, M. S., Abdullah, L. H., Rosele, M. I., & Ali, A. K. (2020). Analisis kaedah *taghayyur al-hukm bi taghayyur al-zaman wa al-makan* (*al-'urf*) dalam hukum Islam dari perspektif maqasid al-shari'ah. *Jurnal Ilmi, 10*(1), 31-46.

Hashim, K. E., Tumiran, M. A., & Mohammad, N. (2022). Elements of food product safety and its relationship with the concept of preserving life in maqasid shariah. *Journal of Contemporary Islamic Studies, 8*(Special Issue). https://doi.org/10.24191/jcis.v8i3.5

Hasmin, N. A., Azizun, N., & Amit, S. M. (2022). Right to food information and food choice from the perspective of fundamental liberties. *ESTEEM Journal of Social Sciences and Humanities, 6*(2), 56-70.

Hernández-Cortez, C., Palma-Martínez, I., Gonzalez-Avila, L. U., Guerrero-Mandujano, A., Solís, R. C., & Castro-Escarpulli, G. (2017). Food poisoning caused by bacteria (food toxins). In N. Malangu (Ed.), *Poisoning: From specific toxic agents to novel rapid and simplified techniques for analysis* (pp. 33-72). UK: IntectOpen Limited. https://doi.org/10.5772/intechopen.69953

Hosseini, E., Rahban, M., Moosavi-Movahedi, A. A. (2021). Halal products and healthy lifestyle. In A. A. Moosavi-Movahedi (Ed.), *Rationality and scientific lifestyle for health* (pp. 115-127). Springer. https://doi.org/10.1007/978-3-030-74326-0_7

Hsiao, E. Y., McBride, S. W., Hsien, S., Sharon, G., Hyde, E. R., McCue, T., Codelli, J. A., Chow, J., Reisman, S. E., Petrosino, J. F., Patterson, P. H., & Mazmanian, S. K. (2013). Microbiota modulate behavioral and physiological abnormalities associated with neurodevelopmental disorders. *Cell, 155*(7), 1451-1463. https://doi.org/10.1016/j.cell.2013.11.024

Ishaq, A. R., Manzoor, M., Hussain, A., Altaf, J., Javed, Z., Afzal, I., Noor, A., & Noor, F. (2021). Prospect of microbial food borne diseases in Pakistan: A review. *Brazilian Journal of Biology, 81*, 940-953. https://doi.org/10.1590/1519-6984.232466

Jusot, J. F., Neill, D. R., Waters, E. M., Bangert, M., Collins, M., Moreno, L. B., Lawan, K. G., Moussa, M. M., Dearing, E., Everett, D. B., & Collard, J. M. (2017). Airborne dust and high temperatures are risk factors for invasive bacterial disease. *Journal of Allergy and Clinical Immunology, 139*(3), 977-986. https://doi.org/10.1016%2Fj.jaci.2016.04.062

Kamleh, R., Jurdi, M., & Annous, B. A. (2012). Management of microbial food safety in Arab countries. *Journal of Food Protection, 75*(11), 2082-2090. https://doi.org/10.4315/0362-028X.JFP-11-405

Khalil, F. (2003). *Al-Maslahah al-'amah min manzur Islamiy wa yalihi tatbiqat al-maslahah al-'amah fi 'asr al-khulafa' al-rasyidin*. Beirut: Muassasah al-Risalah.

Knackstedt, R., Knackstedt, T., & Gatherwright, J. (2020). The role of topical probiotics on wound healing: A review of animal and human studies. *International Wound Journal, 17*(6), 1687-1694. https://doi.org/10.1111/iwj.13451

Kurniadi, M., & Frediansyah, A. (2017). Halal perspective of microbial bioprocess based-food products. *Reaktor, 16*(3), 147-160. https://doi.org/10.14710/REAKTOR.16.3.147-160

Li, J., Paredes-Sabja, D., Sarker, M., & McClane, B. (2016). Clostridium perfringens Sporulation and Sporulation-Associated Toxin Production. *Microbiol Spectrum 4*(3):TBS-0022-2015. https://doi.org/10.1128/microbiolspec.TBS-0022-2015

Madan, A., Thompson, D., Fowler, J. C., Ajami, N. J., Salas, R., Frueh, B. C., Bradshaw, M.R., Weinstein, B. L., Oldham, J. M., & Petrosino, J. F. (2020). The gut microbiota is associated with psychiatric symptom severity and treatment outcome among individuals with serious mental illness. *Journal of Affective Disorders, 264*, 98-106. https://doi.org/10.1016/j.jad.2019.12.020

Maksum, M. (2024). Urgensi sertifikasi produk halal perspektif maqasid al-syariah Al-Ghazali. Al-*Mikraj Jurnal Studi Islam dan Humaniora, 5*(1), 300-3011. https://doi.org/10.37680/almikraj.v5i01.5651

Matthews, K. R., Kniel, K. E., & Montville, T. J. (2017). *Food microbiology: An introduction*. USA: ASM Press.

Md Ariffin, M. F., Ahmad, K., & Man, S. (2018). Parameter keselamatan makanan menurut perspektif hadith. *Online Research Journal in Islamic Studies, 5*(1), 49-64. https://doi.org/10.15364/ris2018-0501-04

Mohammad, A. M., Chowdhury, T., Biswas, B., & Absar, N. (2018). Food poisoning and intoxication: A global leading concern for human health. In A. M. Grumezescu & A. M. Holban (Eds.), *Food safety and preservation* (pp. 307-352). Academic Press. https://doi.org/10.1016/B978-0-12-814956-0.00011-1

Moon C., Baldridge M. T., Wallace M. A., Burnham C. D, Virgin H. W & Stappenbeck T. S. (2015). Vertically transmitted faecal IgA levels determine extra-chromosomal phenotypic variation. *Nature*, 521, 90-93. https://doi.org/10.1038/nature14139

Mudd, A. T., Berding K., Wang, M., Donovan, S. M., & Dilger, R. N. (2017) Serum cortisol mediates the relationship between fecal Ruminococcus and brain N-acetylaspartate in the young pig. *Gut Microbes*, 8(6), 589-600. https://doi.org/10.1080/19490976.2017.1353849

Musadik, S. H. S. A., Yusuf, N., Abd Aziz, N., & Azmi, I. A. G. (2020). Maqasid syariah in Islamic consumption. *International Journal of Business and Economy, 2*(4), 146-152.

Pangaribuan, M., Julianti, E., & Suryanto, D. (2022, June). The effect of implementation of Good Manufacturing Practice (GMP) and the use of andaliman fruit extract as natural preservatives on microbiological quality of beef meatbals in household food industry "Mak Iji" in Medan City. In *IOP Conference Series: Earth and Environmental Science* (Vol. 977, No. 1, p. 012084). IOP Publishing. https://doi.org/10.1088/1755-1315/977/1/012084

Pratiwi, R. D., Zanjabila, S., Fairuza, D., Aminah, A., Praharyawan, S., & Fuad, A.M. (2020). Evaluation of alternative components in growth media of Lactobacillus brevis for halal probiotic preparation. *Annales Bogorienses, 24*(1), 11-17. http://doi.org/10.14203/ann.bogor.2020.v24.n1.11-17

Qur'an (2004). *The Qur'an: English meanings*. Al-Muntada Al-Islami.

Rajakrishnan, S., Ismail, M. Z. H., Jamalulail, S. H., Alias, N., Ismail, H., Taib, S. M., Cheng, L. S., Zakiman, Z., Richai, O., Silverdurai, R. R., & Yusof, M. P. (2022). Investigation of a foodborne outbreak at a mass gathering in Petaling District, Selangor, Malaysia. *Western Pacific Surveillance and Response Journal, 13*(1), 1-5. https://doi.org/10.5365/wpsar.2022.13.1.860

Reza Adnan, M. R. A., Mohd Fadzil, S. D. N., Baharuddin, A. S., & Harun, W. (2021). Cultured meat as halalan toyyiban food: A maqasid review in the preservation of life (hifz an-nafs). *Food Research, 5*(5), 174-178. https://doi.org/10.26656/fr.2017.5(5).161

Riaz, M. N., & Chaudry, M. M. (2019). *Handbook of halal food production*. Boca Raton: CRC Press. https://doi.org/10.1201/9781315119564

Ribet, D., & Cossart, P. (2015). How bacterial pathogens colonize their hosts and invade deeper tissues. *Microbes and Infection, 17*(3), 173-183. https://doi.org/10.1016/j.micinf.2015.01.004

Rieder, R., Wisniewski, P. J., Alderman, B. L., & Campbell, S. C. (2017). Microbes and mental health: A review. *Brain, Behavior, and Immunity, 66*, 9-17. https://doi.org/10.1016/j.bbi.2017.01.016

Rolfe, C., & Daryaei, H. (2020). Intrinsic and extrinsic factors affecting microbial growth in food systems. In A. Demirci, H. Feng, & K. Krishnamurthy. (Eds.), *Food safety engineering. Food engineering series*. Springer, Cham. https://doi.org/10.1007/978-3-030-42660-6_1

Ruzulan, Z., Mana, B., Tumiran, M. A., & Jamaludin, M. A. (2023). Managing the halal food related issues in the halal food certification process based on the concept of *sadd al-dharai'*. *Journal of Nusantara Studies, 8*(1), 429-445. https://doi.org/10.24200/jonus.vol8iss1pp429-445

Saxena, S., Anand, A., & Lal, M. (2015). Use of antibiotics to control bacterial contamination during in vitro micropropagation of sugarcane. *Agrica, 4*(1), 41-44. https://doi.org/10.5958/2394-448X.2015.00011.5

Soni, J., Sinha, S., & Pandey, R. (2024). Understanding bacterial pathogenicity: A closer look at the journey of harmful microbes. *Frontiers in Microbiology, 15*, 1370818. https://doi.org/10.3389/fmicb.2024.1370818

Sreedharan, A., Li, Y., De, J., Gutierrez, A., Silverberg, R., & Schneider, K. R. (2017). Determination of optimum sanitizer levels for prevention of Salmonella cross-contamination of mature round tomatoes in a laboratory model flume system. *Journal of Food Protection, 80*(9), 1436-1442. https://doi.org/10.4315/0362-028X.JFP-17-032

Sunarti, L. S. (2024). Bacterial contamination in food: Sources, risks, and prevention strategies. *International Journal of Pathogen Research, 13*(6), 90-100. https://doi.org/10.9734/ijpr/2024/v13i6324

Switt, A. I., Sulakvelidze, A., Wiedmann, M., Kropinski, A. M., Wishart, D. S., Poppe, C., & Liang, Y. (2015). Salmonella phages and prophages: genomics, taxonomy, and applied aspects. *Methods in Molecular Biology, 1225*, 237-287. https://doi.org/10.1007/978-1-4939-1625-2_15

Talon, R., & Zagorec M. (2017). Special Issue: Beneficial microorganisms for food manufacturing-fermented and biopreserved foods and beverages. *Microorganism, 5*(4), 71. https://doi.org/10.3390/microorganisms5040071

Talukdar, P. K., Udompijitkul, P., Hossain, A., & Sarker, M. R. (2016). Inactivation strategies for Clostridium perfringens spores and vegetative cells. *Applied and Environmental Microbiology, 83*(1), e02731-16. https://doi.org/10.1128/AEM.02731-16

Tapia, M. S., Alzamora, S. M., & Chirife, J. (2020). Effects of water activity (aw) on microbial stability as a hurdle in food preservation. In G. V. Barbosa-Cánovas, A. J. Fontana Jr., S. J. Schmidt, & T. P. Labuza (Eds.), *Water activity in foods: Fundamentals and applications (2nd ed)* (pp. 323-355). Wiley. https://doi.org/10.1002/9781118765982.ch14

Tayyabi, A., & Shah, M. A. (2021). A critical study on the fundamentals of masalih and mafasid's attainments in the light of sharia's objectives. *Al Khadim Research Journal of Islamic Culture and Civilization, 2*(3), 111-126. https://doi.org/10.53575/arjicc.v2.03(21)u9.111-126

Thangaleela, S., Sivamaruthi, B. S., Kesika, P., & Chaiyasut, C. (2022). Role of probiotics and diet in the management of neurological diseases and mood states: A review. *Microorganisms, 10*(11), 2268. https://doi.org/10.3390/microorganisms10112268

Tong, S. Y., Davis, J. S., Eichenberger, E., Holland, T. L., & Fowler, V. G. (2015). Staphylococcus aureus infections: Epidemiology, pathophysiology, clinical manifestations, and management. *Clinical Microbiology Reviews, 28*(3), 603-661. https://doi.org/10.1128/cmr.00134-14

Ullah, H., Arbab, S., Tian, Y., Liu, C. Q., Chen, Y., & Li, K. (2023). The gut microbiota-brain axis in neurological disorder. *Frontiers in Neuroscience, 17*, 1225875. http://doi.org/10.3389/fnins.2023.1225875

Ulum, M. (2019). The concept of maslahah by al-Imam Malik and al-Imam al-Tufi. *Veteran Law Review, 2*(1), 58-76. https://doi.org/10.35586/velrev.v2i1.689

Vitale, M., Scatassa, M. L., Cardamone, C., Oliveri, G., Piraino, C., Alduina, R., & Napoli, C. (2015). Staphylococcal food poisoning case and molecular analysis of toxin genes in *Staphylococcus aureus* strains

isolated from food in Sicily, Italy. *Foodborne Pathogens and Disease, 12*(1), 21-23. https://doi.org/10.1089/fpd.2014.1760

Wahyudi, R., & Ali, M. B. (2021). Halal food based on maqâshid al-syarî'ah perspective. *Journal of Halal Science and Research, 2*(2), 43-50. https://doi.org/10.12928/jhsr.v2i2.3778