

Fermentation in Islamic Jurisprudence: A Scientific and Methodological Analysis of Permissibility

¹Dr. Khadija Aziz, ²Prof. Dr Janas Khan, ³Dr. Samina Begum, ⁴Dr. Hashmat Begum, ⁵Dr. Mir Sadiq Shah

¹Associate Professor, Department of Islamic Studies, Shaheed Benazir Bhutto Women University, (SBBWU), Peshawar, Email: khadijaaziz@sbbwu.edu.pk, ORCID ID: 0009000807430157

²Professor, Department of Islamic Studies, University of Malakand, Malakand., Email: janas9911@uom.edu.pk

³Associate Professor, Department of Islamic Studies, Shaheed Benazir Bhutto Women University, (SBBWU), Peshawar, Email: Saminaphd@sbbwu.edu.pk

⁴Associate Professor, Department of Islamic Studies, Shaheed Benazir Bhutto Women University, (SBBWU), Peshawar, Email: hashmat.begum@sbbwu.edu.pk

⁵Assistant Professor, Department of Zoology, University of Science & Technology, Bannu, Pakistan, Email: mirsadiqshah@gmail.com, ORCID ID: 0000-0003-3546-4262, Corresponding author:

HOW TO CITE:

Khadija Aziz, Janas Khan,
Samina Begum, Hashmat Begum,
Mir Sadiq Shah (2026).
Fermentation In Islamic
Jurisprudence: A Scientific and
Methodological Analysis of
Permissibility.
International Journal of Special
Education, 41(11s), 1113-1122

COPYRIGHT STATEMENT:

Copyright: © 2026 Authors.
Open access publication under the
terms and conditions
of the Creative Commons Attribution
(CC BY)
license (<http://creativecommons.org/licenses/by/4.0/>).

ABSTRACT:

Fermentation is one of the oldest methods humans have used to preserve and transform food. While it falls under a single umbrella of microbial activity, the products of fermentation hold very different statuses in Islamic dietary law (Fiqh). Pickles and vinegar, both of which are fermented, are Halal in Islamic jurisprudence. In contrast, wine and other alcoholic drinks that come from the same fermentation process are strictly prohibited (Haram).

The present study was conducted to determine whether this distinction is backed by solid scientific and biochemical reasoning or if it's purely based on religious authority.

By systematically examining fermentation biochemistry, microbiology, and Islamic legal principles, especially the idea of 'Illah (effective legal cause), this study reveals that the Islamic ban aligns perfectly with the biochemical results of alcoholic fermentation, specifically the creation of ethanol (ethyl alcohol), which is a psychoactive substance. On the other hand, lactic acid fermentation (like in pickles) and acetic acid fermentation (like in vinegar) don't produce any intoxicating agents.

It is concluded from the present study that Islamic food law seems to anticipate modern food science in its guidelines for what's prohibited; it's not the fermentation process itself that's the issue, but rather the pharmacological effects of the final product.

Keywords: Fermentation, Islamic Jurisprudence, Khamr, 'Illah

1. Introduction

Fermentation has been a key player in human food culture for over 10,000 years. From the vinegar of ancient Mesopotamia to the tangy Korean kimchi and the pickled delights of the Middle East, fermented foods have been vital for

nutrition, flavour, and preservation throughout various civilizations. In the Islamic world, the conversation around fermented products is quite fascinating, as they have been both celebrated and restricted, creating a paradox that has intrigued scholars in both food science and Islamic law.

The Holy Quran clearly prohibits the consumption of Khamr (خمر), a term that both classical and modern Islamic scholars interpret to include wine and all intoxicating drinks ¹. However, vinegar, which is made from wine through a secondary fermentation process, is praised in authentic Hadith literature as a cherished condiment. Likewise, pickled vegetables, which undergo lactic acid fermentation, are widely accepted as Halal in Islamic dietary laws. This brings up an interesting question. Is the Islamic distinction between allowed and forbidden fermented products scientifically and methodologically sound? By drawing on established principles of food microbiology, biochemistry, and Islamic legal theory, it is shown that the line between Halal and Haram in fermented foods aligns perfectly with the presence or absence of ethanol as a metabolic byproduct, a compound known for its intoxicating and neurological effects. The Islamic legal concept of 'Illah (the underlying reason for a legal ruling) serves as the methodological link between divine prohibition and the realities of biochemistry.

Scholarly engagement with the Islamic treatment of fermented beverages is not monolithic. Within Islamic jurisprudence itself, significant internal debate exists regarding the precise scope of the prohibition on alcoholic beverages. The Hanafi school, the largest and historically most influential school of Sunni Islamic law, articulates what Sheikh and Islam (2018) characterise as a position of “narrow prohibition,” wherein only grape-derived wine (khamr) is strictly forbidden in all quantities, while non-grape fermented beverages (nabidh) remain permissible until the threshold of intoxication (Iskaar) is reached. This intra-Islamic jurisprudential diversity is not a contradiction of the 'Illah framework but rather its most precise formulation. The Hanafi tradition was uniquely the only major school of Islamic law to dedicate an entire chapter, Kitab alashriba, within its jurisprudential corpus to the systematic classification of alcoholic beverages, distinguishing them by substrate, production method, and intoxicating potential ². This analytical specificity cataloguing over a dozen

distinct beverage types according to their source material and fermentation characteristics anticipates the product-by-product approach that contemporary food science and halal certification bodies now employ. Furthermore, the rapid growth of the global halal food market, driven in part by surging consumer demand for functional fermented beverages such as kombucha, kefir, and probiotic fermented milks, has rendered rigorous halal compliance increasingly complex and commercially critical ³. These products are produced through microbial fermentation, which inherently generates ethanol as a metabolic byproduct, placing them at the intersection of documented health benefits and halal compliance risks. A systematic interdisciplinary analysis that bridges Islamic jurisprudential methodology with the biochemical science of fermentation is therefore both academically timely and practically indispensable for producers, regulators, and Muslim consumers worldwide.

1.1 Scope and Objectives

This research aims to achieve four main goals:

1. To outline and compare the biochemical pathways involved in lactic acid, acetic acid, and alcoholic fermentation.
2. To pinpoint the specific metabolite that underpins the Islamic prohibition on wine and other alcoholic drinks.
3. To utilize the Islamic jurisprudential concept of 'Illah to align theological rulings with biochemical evidence.
4. To assess whether the Islamic differentiation between allowed and forbidden fermented products holds up scientifically.

2. Literature Review

2.1 Fermentation in Food Science

Fermentation is broadly defined as the metabolic process by which microorganisms convert organic substrates primarily, carbohydrates, into simpler compounds through enzymatic activity, typically in the absence of oxygen (anaerobic conditions). Doyle and Beuchat classify food fermentation into three primary categories: lactic acid fermentation, acetic acid fermentation, and

alcoholic (ethanolic) fermentation, each characterized by distinct microbial agents and metabolic end products ⁴.

Lactic acid bacteria (LAB), including species of *Lactobacillus*, *Pediococcus*, and *Leuconostoc*, are responsible for lactic acid fermentation. These are among the most widely studied food-grade microorganisms, and their GRAS (Generally Recognized as Safe) status reflects their long history of safe human consumption ⁵. The acetic acid bacteria, particularly *Acetobacter* and *Gluconobacter* species, drive acetic acid fermentation, the biochemical basis of vinegar production. Alcoholic fermentation is primarily mediated by the yeast *Saccharomyces cerevisiae*, which converts sugars into ethanol and carbon dioxide under anaerobic conditions.

2.2 Islamic Dietary Law and Fermentation

Fermentation is the process in which microorganisms break down organic materials, mostly carbohydrates, into simpler substances through their enzymatic activity, usually without oxygen (anaerobic conditions). According to Doyle and Beuchat (2007), food fermentation can be grouped into three main types: lactic acid fermentation, acetic acid fermentation, and alcoholic (or ethanolic) fermentation ⁴. Each type is marked by its own unique microbial players and the end products they create. Lactic acid bacteria (LAB), which include well-known species like *Lactobacillus*, *Pediococcus*, and *Leuconostoc*, are the stars of lactic acid fermentation. These microorganisms are some of the most researched food-grade options out there, and their GRAS (Generally Recognized as Safe) status shows they've been safely consumed by humans for a long time ⁵. On the other hand, acetic acid fermentation is driven by acetic acid bacteria, especially the *Acetobacter* and *Gluconobacter* species, which are key players in making vinegar. Lastly, alcoholic fermentation is primarily carried out by the yeast *Saccharomyces cerevisiae*, which converts sugars into ethanol and carbon dioxide in the absence of oxygen.

2.2 Islamic Dietary Law and Fermentation

Islamic dietary laws come from two main sources: the Holy Quran and the authenticated Sunnah

(the traditions of the Prophet). The Quran clearly states the prohibition of Khamr in verse 5:90: "O you who have believed, indeed, intoxicants, gambling, sacrificing on stone altars, and divining arrows are but defilement from the work of Satan, so avoid it that you may be successful" ¹. Classical Islamic scholars, like Imam alNawawi and Ibn Qudama in *AlMughni*, have delved deeply into what Khamr means and its implications. The general agreement in Islamic law is that Khamr refers to any substance that can intoxicate the mind, no matter where it comes from or how much there is. Ibn Taymiyyah also pointed out that the legal ruling is based on the underlying cause ('Illah) rather than just the physical characteristics of the substance. Linguistically, the Arabic word Khamr is derived from the root khamara ya khmiru, meaning to cover or veil, reflecting the substance's effect of veiling or covering the mind and consciousness. According to Hunt (2007), the term as used in the Quran encompasses any fermented juice of grape, barley, dates, honey, or any other ingredient that produces intoxication after consumption ⁶. The Prophet Muhammad (S.A.W.) further clarified this in a well-known Hadith: "Every intoxicant is Khamr, and every Khamr is forbidden" ⁷. Caliph 'Umar ibn alKhattab (R.A.) provided one of the most comprehensive definitions when he declared from the pulpit: "Khamr is everything that dulls the faculty of thinking" ⁸. This definition is remarkable for its functional rather than material basis, anticipating the modern pharmacological understanding that the prohibition targets the neurological effects of intoxicants, not merely their origin or form ⁸. Islamic scholars categorise intoxicants into two broad groups ¹ fermented beverages derived from grapes, barley, dates, honey, and other sugary or starchy substrates; and ² solid or inhaled intoxicants such as hashish and hard drugs. Ibn Taymiyyah, as cited by al Qaradawi (1984), explicitly ruled that hashish is similarly prohibited, whether it induces observable intoxication, because it impairs moral judgment and willpower in ways analogous to wine. This categorical breadth reflects the functional definition of Khamr: it is the physiological effect on the intellect, not the

chemical class or production method, that determines the ruling. As al Qaradawi (1984) summarises, the prohibition extends to any substance that “impairs the faculty of reasoning and decision making” ⁹. From a food science perspective, this juristic framework maps directly onto the concept of psychoactive metabolites: ethanol is prohibited because it is the prototypical agent that satisfies the definition of Iskaar (intoxication), whereas nonintoxicating fermentation byproducts such as lactic acid and acetic acid do not.

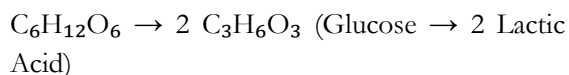
2.3 The Concept of 'Illah in Islamic Legal Methodology

In Islamic jurisprudence, known as Usul al Fiqh, the term 'Illah refers to the underlying legal cause or reasoning that supports a divine ruling. If the 'Illah is present, then the ruling is applicable; if it's absent, the ruling doesn't hold. This concept is a key element of analogical reasoning, or Qiyas, in Islamic law, as discussed by Al Shatibi in his work *Al Muwafaqat* ¹⁰. When it comes to alcoholic drinks, scholars agree that the 'Illah is Iskaar, which means intoxication or the ability to impair human judgment.

3. Biochemical Analysis of Fermentation Pathways

3.1 Lactic Acid Fermentation

Lactic acid fermentation is a fascinating process where lactic acid bacteria break down glucose through glycolysis, resulting in lactic acid as the main product. To put it simply, the reaction looks like this:

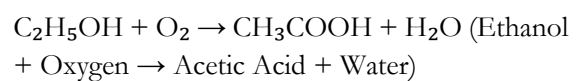


What's interesting is that this pathway doesn't produce any ethanol. The lactic acid that forms lowers the pH of the food, creating an acidic environment that helps keep harmful bacteria at bay and preserves the food. At the levels found in fermented foods, this metabolite doesn't have any psychoactive, intoxicating, or neurological effects. You can find lactic acid in a variety of fermented products, like cucumber pickles (*Lactobacillus plantarum*), sauerkraut, yogurt, kefir, and many traditional fermented foods enjoyed in

the Muslim world. The safety of these products is well documented in food science and consuming them is linked to several probiotic health benefits, such as better gut microbiota and immune system support ¹¹.

3.2 Acetic Acid Fermentation

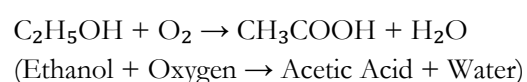
Vinegar production is an interesting process that involves two stages of fermentation, which holds particular significance in Islamic law. First, yeast takes sugars and ferments them into ethanol, a process known as alcoholic fermentation. Then, in the second stage, *Acetobacter* bacteria come into play, oxidizing that ethanol into acetic acid:



This chemical reaction is crucial from an Islamic jurisprudential perspective. The ethanol, which can be intoxicating, is completely transformed into acetic acid, a substance that doesn't have any intoxicating effects. Acetic acid (CH_3COOH) is a mild organic acid that plays a key role in the human citric acid cycle (also known as the Krebs cycle). It's naturally produced during human metabolism and doesn't have any psychoactive effects. The complete breakdown of ethanol during vinegar production can be confirmed using standard analytical chemistry techniques. Typically, commercial vinegar contains less than 0.1–0.5% residual ethanol, which is far below any level that could have a pharmacological effect, while the acetic acid content usually ranges from 4–8% ¹². This biochemical change aligns perfectly with the Islamic ruling: the intoxicating agent has been eliminated.

3.3 Alcoholic Fermentation: The Science of Wine

Vinegar production is an interesting process that involves two stages of fermentation, which holds particular significance in Islamic law. First, yeast takes sugars and ferments them into ethanol, a process known as alcoholic fermentation. Then, in the second stage, *Acetobacter* bacteria come into play, oxidizing that ethanol into acetic acid:



This chemical reaction is crucial from an Islamic jurisprudential perspective. The ethanol, which can be intoxicating, is completely transformed into acetic acid, a substance that doesn't have any intoxicating effects. Acetic acid (CH_3COOH) is a mild organic acid that plays a key role in the human citric acid cycle (also known as the Krebs cycle). It's naturally produced during human metabolism and doesn't have any psychoactive effects. The complete breakdown of ethanol

during vinegar production can be confirmed using standard analytical chemistry techniques. Typically, commercial vinegar contains less than 0.1–0.5% residual ethanol, which is far below any level that could have a pharmacological effect, while the acetic acid content usually ranges from 4–8%¹³. This biochemical change aligns perfectly with the Islamic ruling: the intoxicating agent has been eliminated.

3.4 Comparative Summary Table

Feature	Lactic Acid Fermentation (Pickles)	Acetic Acid Fermentation (Vinegar)	Alcoholic Fermentation (Wine)
Microorganism	Lactobacillus spp.	Acetobacter spp.	Saccharomyces cerevisiae
Primary Substrate	Glucose	Ethanol (from stage 1)	Glucose
End Product	Lactic Acid	Acetic Acid	Ethanol + CO_2
Ethanol Produced?	No	No (destroyed)	Yes — primary product
Intoxicating Effect	None	None	Yes — CNS depressant
Islamic Status	Halal	Halal	Haram
'Illah Present?	No	No	Yes

4. The 'Illah Framework: Mapping Biochemistry to Islamic Law

4.1 Definition and Application of 'Illah

'Illah (علة) refers to the underlying legal cause or reasoning in Islamic law that supports a divine ruling. Scholars from the classical Usul al Fiqh tradition describe it as the characteristic of a case that a ruling depends on using the method of Qiyas (analogical reasoning), if the same 'Illah appears in a new situation that isn't directly mentioned in the primary texts, the same ruling

can be applied. On the other hand, if the 'Illah is missing, the ruling is put on hold. For instance, when it comes to the prohibition of wine (Khamr), Islamic scholars have pinpointed Iskaar, the quality that leads to intoxication (which affects the mind), as the key 'Illah. This is backed by the Prophetic saying: "Every intoxicant is Khamr, and every Khamr is forbidden" (Sahih Muslim, 2003). So, the 'Illah isn't about the fermentation process, the flavour, or the colour of the drink, but rather its specific ability to cause intoxication.

4.2 Application to Fermented Products

Product	'Illah (Iskaar) Present?	Biochemical Reason	Islamic Ruling
Wine	Yes	Ethanol is produced and retained	Haram
Beer	Yes	Ethanol is produced and retained	Haram
Vinegar	No	Ethanol chemically destroyed → Acetic acid	Halal
Pickles	No	No ethanol has ever been produced	Halal
Yoghurt/Kefir	No	Lactic acid only	Halal

4.3 The Threshold Principle

An additional jurisprudential principle relevant to this discussion is the Prophetic ruling: "Whatever intoxicates in large quantities, a small amount of it is also forbidden" ¹³. This ruling reflects a precautionary principle; if a substance is inherently intoxicating, its threshold effect does not remove the prohibition.

From a pharmacological perspective, this principle aligns with the dose-response relationship of ethanol. Although a small amount of wine may not produce observable intoxication, ethanol acts cumulatively and dose dependently on GABA receptors. The compound is inherently psychoactive regardless of dose. By contrast, lactic acid and acetic acid have no intoxicating dose; they are endogenous metabolic compounds that the human body processes through normal cellular respiration. No quantity of acetic acid or lactic acid from dietary sources causes intoxication, and the Prophetic threshold principle therefore has no application to them.

The Prophetic threshold principle has found contemporary regulatory expression in modern halal certification frameworks. The Indonesian Ulema Council (Majelis Ulama Indonesia, MUI) formally codified an ethanol threshold of 0.5% in Fatwa MUI No. 10 of 2018, stipulating that foods and beverages with ethanol content at or below this level retain their halal status, provided the ethanol is an incidental byproduct of fermentation and not derived from intentional khamr production ¹⁴. This regulatory standard operationalises the 'Illah-based reasoning: trace ethanol arising from spontaneous fermentation in products such as yogurt, certain fruit-based drinks, or kombucha does not constitute the presence of Iskaar at pharmacologically relevant levels. However, this threshold is not a licence for laxity in production.

5. Vinegar as a Case Study: A Hadith-Endorsed Product with a Chemical Basis

5.1 Hadith Evidence on Vinegar

Vinegar holds a unique and insightful spot in Islamic food law because it has a historical and material link to wine, both of which originate

from grape juice in their traditional forms, but vinegar is clearly allowed. Several well-documented narrations highlight this:

5. Sahih Muslim (2051): The Prophet Muhammad (ﷺ) referred to vinegar as a blessed condiment (nima aludm alkhal) ⁸.

6. Sunan Abu Dawud (3820): Vinegar is noted as the finest of condiments ¹⁴.

7. Ibn Majah (3329): It's reported that the Prophet (ﷺ) mentioned that vinegar was used by the prophets before him, underscoring its longstanding acceptance in prophetic tradition (7).

5.2 The Classical Jurisprudential Debate

A fascinating debate has unfolded among classical Islamic scholars about what happens when wine naturally turns into vinegar. Imam Malik and Imam al-Shafi'i argued that if wine transforms into vinegar on its own without any human effort to ferment it, then that vinegar is considered Halal. This view has gained traction and is now widely accepted by most scholars, and it makes sense scientifically: the process involves *Acetobacter* bacteria converting ethanol into acetic acid, which effectively removes the issue of intoxication. On the other hand, some Hanafi scholars have taken a more cautious stance, suggesting that wine that is intentionally turned into vinegar (by promoting *Acetobacter* growth) might still be seen as impermissible. Yet, even within this minority viewpoint, the focus isn't on the chemistry of the final product but rather on the legal implications of how the transformation was carried out. Despite these differing opinions, all major schools of thought agree that properly made vinegar, whether it comes from grapes, dates, apples, or other sources, is Halal, as long as there's no ethanol left in the final product.

5.3 Food Science Validation

Modern food science backs up the traditional Islamic view quite well. When we look at gas chromatography results for commercial vinegar, we consistently find ethanol levels under 0.5% which is way below any level that could have a pharmacological effect. The acetic acid content, ranging from 4% to 8%, along with the minimal

residual ethanol, comes from a thorough microbial oxidation process. Whether using the Orleans method, the Frings Acetator, or traditional pottery fermentation, all these vinegar production techniques lead to the same result: the ethanol is broken down, and acetic acid is produced ¹⁴. In the end, the 'Illah is clearly not present in the final product.

5.4 Nabeez: Spontaneous Fermentation and the Temporal Threshold of Prohibition

A particularly instructive case for understanding the boundary between permissible and prohibited fermented beverages is Nabeez a drink prepared by soaking dates or raisins in water. Nabeez was among the Prophet Muhammad's (S.A.W.) favoured beverages and is sometimes misidentified as a form of Khamr; however, the two are fundamentally different in their fermentation dynamics. Fresh Nabeez is essentially an infused water: the dissolved sugars from dates or raisins are present in the soaking liquid, but no deliberate inoculation of yeast has taken place. At this stage, the drink is nonintoxicating and is clearly permissible. The critical transformation occurs through spontaneous fermentation. Wild yeast strains present in the environment, primarily species of the genus *Saccharomyces*, colonise the sugar-rich soaking liquid and initiate alcoholic fermentation. Within approximately three days, measurable ethanol is produced, and the drink transitions from a permissible infused beverage to an intoxicating one. This is why the Prophet (S.A.W.) explicitly forbade consuming Nabeez after three days. The jurisprudential significance of this ruling is substantial; it demonstrates that Islamic food law operates not on fixed material categories but on biochemical outcomes. The same liquid, from the same ingredients, crosses the threshold of prohibition at the point when ethanol the 'Illah of Iskaar is generated in intoxicating quantities. Khamr, by contrast, is distinguished from Nabeez precisely by intent and method. Khamr is produced by deliberately inoculating a sugar medium with yeast to maximise and accelerate ethanol production, often achieving intoxicating concentrations within six hours of inoculation ¹⁶.

The Nabeez case thus serves as a micromodel of the broader 'Illah framework. The ingredient (dates), the process (fermentation), and the vessel (water infusion) are all permissible in themselves; what triggers prohibition is exclusively the accumulation of the psychoactive metabolite ethanol. This aligns with the Prophetic principle "Whatever intoxicates in large quantities, a small amount of it is also forbidden" ¹⁴. Nabeez, as a time-sensitive case, also anticipates modern concerns about fermented probiotic beverages such as kombucha, certain kefir, and fruit-based probiotic drinks, which may accumulate small amounts of ethanol through spontaneous yeast activity. The temporal threshold governing Nabeez provides a jurisprudential precedent for evaluating these contemporary products: the decisive question remains the ethanol concentration in the final consumed product.

5.5 The Dual Role of Yeast (Khamir): A Halal Perspective

An important nuance arising from the Khamr-fermentation discussion concerns the organism most central to both prohibited and permissible fermentation: yeast (Khamir in Arabic). *Saccharomyces cerevisiae*, the principal industrial yeast, has been employed for thousands of years in the production of both wine and bread, the former prohibited, the latter universally accepted as Halal. This apparent contradiction is fully resolved by the 'Illah framework. When *S. cerevisiae* ferments sugars in a dough matrix under the aerobic and limited sugar conditions of bread production, the primary metabolic products are carbon dioxide (responsible for leavening) and only trace amounts of ethanol that are almost entirely volatilised during baking. The 'Illah of Iskaar is absent in the finished bread.

Beyond bread and alcoholic beverages, yeast contributes to a wide spectrum of permissible foods and industrial applications. Yeast extract derived from the cellular contents of *S. cerevisiae* is employed as a nutritional growth medium in microbiological industries and as a flavouring agent providing a distinctive umami profile in seasonings and soups. Ribotides and nucleotides isolated from yeast serve as flavour enhancers.

Additionally, yeast cells are a rich source of high-quality protein, B-complex vitamins, and trace minerals, including zinc, chromium, and selenium, all of which are used in dietary supplements and functional foods ¹⁶. Industrial ethanol produced by yeast from agricultural byproducts such as sugar cane molasses serves as a solvent, antiseptic, or biofuel application entirely distinct from the production of intoxicating beverages and not subject to the prohibition on Khamr. As it is evident in this study that it is the level of fermentation, the pharmacological effect of the final product that Islamic law regulates, not the organism or the biochemical mechanism of fermentation itself.

6. Discussion

The analysis in this article highlights a fascinating connection between Islamic jurisprudential methodology and modern biochemistry. The Islamic ban on fermented drinks isn't just a blanket dismissal of fermentation itself—if it were, we'd have to consider vinegar and pickles off limits too. Instead, it specifically targets the pharmacological effects of alcoholic fermentation, particularly the psychoactive substance ethanol. This connection isn't just a coincidence. Islamic jurisprudence is grounded in the idea that divine laws are meant to bring about clear human benefits and to ward off specific harms (known as Maqasid alShariah, or the objectives of Islamic law). One of these core values is 'Aql, which refers to human intellect and rational thinking. The prohibition of intoxicants falls under the protection of 'Aql (as noted by AlShatibi in AlMuwafaqat). The biochemistry of ethanol its GABAergic effects that depress the prefrontal cortex, hippocampus, and motor cerebellum directly illustrates the harm that Islamic law aims to prevent: the impairment of rational judgment, decision making, and self-control. The discussion around fermented foods highlights a key principle in Islamic legal reasoning: it's not just about rigid categories, but rather about how things function in relation to human needs. When we classify a substance, it's not simply about whether it's "fermented" or "nonfermented"; it's about how it affects people's wellbeing. This functionalist view in Islamic law

is like the principle of mechanism of action in pharmacology, where a drug's classification both legally and medically depends on its effects on the body, not just its chemical makeup or where it comes from. This perspective is particularly relevant today. With modern food technology creating a variety of new fermented products, functional drinks, and probiotic options, the 'Illah based analytical framework of Islamic jurisprudence offers a clear and scientifically sound way to assess these items. The key question remains whether the final product has enough ethanol or any other intoxicating substance to affect a person's ability to think clearly.

A particularly illuminating dimension of the halal fermentation debate emerges from the internal diversity of Islamic jurisprudential opinion on alcoholic beverages. As Sheikh and Islam (2018) ² demonstrate through close textual analysis of Hanafi primary sources spanning from Muhammad ibn Hasan alShaybani's Kitab alathar (8th century CE) to Ibn 'Abidin's Radd almuhtar (19th century CE), the Hanafi school consistently maintained a principled distinction between khamr (grape wine, prohibited absolutely) and nabadh (nongrape fermented beverages, prohibited only at the threshold of intoxication). This position of "narrow prohibition," defended across twelve centuries of Hanafi scholarship against the "general prohibition" advocated by Maliki, Shafi'i, and Hanbali scholars, rests upon precisely the same analytical logic as the 'Illah of Iskaar articulated in the present paper: the decisive legal criterion is not the presence of any fermented substance, nor any concentration of ethanol, but the pharmacologically significant onset of intoxication. What is especially noteworthy from a food science perspective is that classical Hanafi jurists developed a detailed typology of alcoholic beverages preserved in the Appendix of Sheikh and Islam (2018) ² classifying over a dozen distinct products by substrate (grapes, dates, raisins, honey, grain), production method (cooked vs. uncooked, degree of reduction, presence or absence of secondary fermentation), and intoxicating potential. This taxonomy maps directly onto the kind of ethanol concentration and substrate-specific analysis that

modern halal auditing requires. The Hanafi Kitab alashriba tradition is thus the most systematic premodern framework for the byproduct halal assessment of fermented beverages, and its core evaluative criterion, the functional effect on human cognition rather than the categorical identity of the substance, is identical to the 'Illah-based methodology proposed in this article. This convergence between classical jurisprudential reasoning and modern food biochemistry is not coincidental; it reflects the enduring rationalist character of the Hanafi school's engagement with dietary law and further strengthens the thesis that Islamic food jurisprudence is inherently compatible with, and in many respects anticipates, the evidence-based standards of contemporary food science.

The significance of this jurisprudential heritage extends to the contemporary halal beverage industry. The Hanafi typology demonstrates that Islamic scholars did not treat fermentation as a binary or monolithic phenomenon; they recognised, centuries before the advent of analytical chemistry, that the halal status of a fermented product depends on measurable, product specific outcomes rather than on the nature of the fermentation process itself. This historical precedent provides a powerful jurisprudential basis for the granular, critical point-based halal assessment frameworks that modern regulators and producers require. When Pintaito and Hanafiah (2025) identify fermentation duration, inoculum concentration, substrate type, and raw material sourcing as independent halal critical control points for kombucha, kefir, and fermented milk, they are, in effect, operationalising in laboratory terms the same variables that Hanafi jurists evaluated through textual reasoning and empirical observation of beverages consumed in 8th century Kufa and 19th century Istanbul ¹⁴. The continuity between classical Islamic jurisprudence and contemporary halal food science is thus not merely rhetorical; it reflects a shared commitment to determining the permissibility of a substance by its actual physiological and biochemical consequences for the human consumer.

This study recognizes a few limitations. First off, the jurisprudential views discussed mainly reflect mainstream Sunni Islamic scholarship; while Shia jurisprudence generally agrees on the prohibition of alcohol, it might use different analytical approaches. Secondly, the fast-changing world of functional fermented foods like kombucha, kefir, and probiotic drinks that could have tiny amounts of ethanol from fermentation calls for more specialized jurisprudential analysis based on the 'Illah framework introduced here. Future interdisciplinary research should bring together food chemists and Islamic jurists to tackle these new questions, especially concerning ethanol levels in naturally fermented probiotic beverages.

Recent research by Pintaito & Hanafiah (2025) offers a practical halal critical point framework for three of the most commercially significant fermented beverages kombucha, kefir, and fermented milk that substantiates and extends the 'Illah-based analysis presented in this article (14). Their systematic study identifies four categories of halal critical points common to all three beverages: (1) raw materials and auxiliary ingredients, (2) microbial starter sources and growth media, (3) fermentation conditions, and (4) final ethanol content. Each category maps directly onto the jurisprudential concept of 'Illah: a critical point becomes legally significant precisely when it introduces the risk of generating or incorporating a substance whose presence constitutes Iskaar or another form of haram contamination.

7. Conclusion

This article has shown that the Islamic distinction between what's allowed and what's not when it comes to fermented products like pickles and vinegar versus wine has a solid scientific basis and a clear methodology. The key difference isn't the fermentation process itself, but rather the biochemical nature of what fermentation produces. Lactic acid fermentation (like in pickles) results in lactic acid, which is a natural substance in the human body and doesn't cause intoxication. There's no 'Illah here. Acetic acid fermentation (as in vinegar) breaks down ethanol through microbial oxidation, turning it into acetic

acid, which is also nonintoxicating. Any potential 'Illah that might have existed in the intermediate stage is completely removed. Alcoholic fermentation produces ethanol, which is a central nervous system depressant and has well-documented psychoactive, neurological, and behavioural effects. Here, the 'Illah (Iskaar) is present and integral to the process. The Islamic legal concept of 'Illah acts as a kind of chemical test that predates modern analytical chemistry: if a substance causes intoxication, it's forbidden; if it doesn't, it's not prohibited solely based on fermentation. This perspective shows that Islamic food law isn't just a random set of dietary

rules, but rather a thoughtful framework aimed at preventing harm, a logic that modern biochemistry, pharmacology, and food science fully support. Vinegar serves as a particularly striking example. It's closely related to wine in both origin and production, yet it's specifically praised by the Prophet Muhammad (ﷺ) as a blessed condiment. Food chemistry confirms that in vinegar, the intoxicating agent has been completely and irreversibly eliminated. In this case, Islamic jurisprudence and food science reach the same conclusions through different, yet equally thorough, analytical methods.

References

- The Holy Quran. Surah Al-Maidah (5:90). Saheeh International, translator.
- Al-Qaradawi Y. The Lawful and Prohibited in Islam. Kuwait: International Islamic Federation of Students' Organisation; 1984.
- Al-Tirmidhi MI. Sunan al-Tirmidhi. Hadith nos. 1861, 3681. Beirut: Dar al-Gharb al-Islami; 9th century CE.
- Doyle MP, Beuchat LR. Food Microbiology: Fundamentals and Frontiers. 3rd ed. Washington, DC: ASM Press; 2007.
- Salminen S, von Wright A, Morelli L, Marteau P, Brassart D, de Vos WM, et al. Demonstration of safety of probiotics -- a review. *Int J Food Microbiol.* 1998 Oct 20;44(1-2):93–106.
- Janin H, Kahlmeyer A. Islamic Law: The Sharia from Muhammad's Time to the Present. Jefferson, NC: McFarland & Company; 2007.
- Ibn Majah MY. Sunan Ibn Majah. Hadith no. 3329. Beirut: Dar al-Fikr; 9th century CE.
- Muslim ibn al-Hajjaj al-Naysaburi. Sahih Muslim. Hadith nos. 2003, 2051. Beirut: Dar Ihya al-Turath al-Arabi; 9th century CE.
- Abdillahi JA, Zakari G. Juristic approach to the concept of intoxicant (Khamr) and its punishment. *Int J Res Innov Soc Sci.* 2023;7(7):1938–1946. doi:10.47772/IJRISS.2023.70852
- Al-Qaradawi Y. The Lawful and Prohibited in Islam. Lebanon: The Holy Quran Publishing House; 1984.
- Al-Shatibi IM. Al-Muwafaqat fi Usul al-Shariah. Saudi Arabia: Dar Ibn Affan; 14th century CE.
- Hill C, Guarner F, Reid G, Gibson GR, Merenstein DJ, Pot B, et al. Expert consensus document: The International Scientific Association for Probiotics and Prebiotics consensus statement on the scope and appropriate use of the term probiotic. *Nat Rev Gastroenterol Hepatol.* 2014;11(8):506–514.
- Adams MR. Vinegar. In: *Microbiology of Fermented Foods*. Vol. 1. Boston, MA: Springer; 1998. p. 1–44.
- Abu Dawud SI. Sunan Abu Dawud. Hadith nos. 3681, 3820. Beirut: Dar al-Kitab al-Arabi; 9th century CE.
- De Ley J, Gillis M, Swings J. Family VI. Acetobacteraceae. In: *Bergey's Manual of Systematic Bacteriology*. Vol. 1. Baltimore: Williams & Wilkins; 1984. p. 267–278.
- Syamsu K. All about Khamar and Khamir (yeast) [Internet]. LPPOM MUI Halal Article; 2025 Feb 13 [cited 2025 Apr 10]. Available from: <https://halalmui.org/en/allaboutkhamarandkhamiryeast/>
- Ibn Qudama al-Maqdisi. Al-Mughni. Vol. 9. Cairo: Maktabat al-Qahira; 13th century CE.