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Halal and Kosher Gelatin perspectives in the food production

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Professional paper

A R T I C L E I N F O

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A B S T R A C T

The gelatin production is always remained a concern of great debate worldwide. The collagen found in animal bones, skins, and connective tissues is partially hydrolyzed to produce gelatin, a water-soluble protein. Gelatin has a wide range of uses in many different industries, including the food, pharmaceutical, and cosmetics industries. But in Halal and Kosher food industries, it is regarded as one of the most contentious components. The acceptability of items containing gelatin is determined by the animal from which it was derived, and it is impossible to determine the source animal from which the gelatin originated after it is combined with food or pharmaceutical products. As a result, there is a chance of financially motivated adulteration or mislabeling. In yoghurt production, milk is incorporated with gelatin to counter the syneresis problem during storage, but gelatin source is unknown which led to Halal or Haram ethical issues. This study focused on yoghurt production from plant enzyme extracted from plant source as gelatin replacer and to examine the rheological properties of yogurt. The effects of varied plant enzyme concentrations ranging with various setting temperatures and time treatments were evaluated. The enzymatic treatment of milk proved beneficial to retard the syneresis phenomenon during yogurt storage at 4^{o}C which improved water holding capacity during centrifugation. The post-acidification procedure and stability of yogurt samples were both effected by plant enzyme with milk protein that proved effective tool for improving functional properties of yoghurt. As consumer concerns about the authenticity of Halal and Kosher food and non-food products have grown. Therefore, origin of gelatin must be detected and quantified in order to ensure its integrity with regard to Halal and Kosher issues.

1. Introduction

Many dietary, medicinal, and cosmetic products use gelatin made from various animal sources. Gelatin species identification has become in significance for both health and religious grounds. For instance, the most popular form of porcine gelatin has a non-halal component that is expressly prohibited in Islam as a faith. Gelatin is a blend of polypeptides made from collagen that has been taken from animal hides, skin, and bones and partially hydrolyzed (Guo et al., 2018). Due to its low cost and gelling ability, it is frequently utilized as an ingredient in culinary, pharmaceutical, and cosmetic applications. Although there are additional

newly developing gelatin sources from fish and fowl, bovine and porcine gelatins are the main sources of commercial gelatins (Shabani et al., 2015). Due to a number of factors, including health and religious beliefs, the source of the gelatin in products has come under intense scrutiny. For instance, items containing swine derivatives are prohibited by Islam and are regarded as non-halal. Gelatin species authentication is so crucial to ensuring that the goods used by the Islamic community adhere to halal regulations. Gelatin species authentication is crucial to verify that the goods used by the Islamic community adhere to the halal laws of the countries in which they are produced (Uddin et al., 2021). With the Muslim population reaching over 1.7 billion people (more than 20% of the world's population), the demand for halal cuisine has grown concurrently. Globally, the halal market is worth roughly 2.1 trillion USD. According to Ahmad et al. (2013), the halal market is expanding at an estimated rate of 25% annually, making the production of halal food profitable both in Muslim-majority and non-Muslim nations. The halal food industry is expanding not just in Muslim nations but also in western markets with sizable and expanding Muslim populations, where halal observance is rising (Aziz and Chok, 2012). Around 12% of the total commerce in agri-food goods, or about 80 billion US dollars, is thought to be traded in halal food items globally. This percentage is bound to rise as Muslim customers' numbers and incomes are anticipated to rise. Halal goods could easily account for 20% of global trade in food products given that Muslims are expected to make up 30% of the world's population by 2025. (Karim and Bhat, 2008). Halal translates as permissible or legal in Islamic law (Riaz and Chaudry, 2004). The word "Halal" is frequently associated with food in the thoughts of most people. However, halal products can also refer to other parts of Islamic law and include cosmetics and medications (Regenstein et al., 2003). Muslims want their cuisine to be Toyyiban in addition to meeting the halal criteria (i.e., wholesome and of good quality).

Halal nutrition also places a high value on halal meals. In Turkey, a growing interest in halal cuisine developed in the 1970s. This orientation started with religious belief people having margarine suspicions, and it persisted to assure that the daily meat demand from religious butchers. A devoted Muslim has been looking for halal meals constantly for these reasons. They avoided any questionable situations. Islamic dietary laws permit the consumption of halal foods (Batu and Regenstein, 2014; Batu, 2015). The "halal industry," which spans numerous industries like food, textiles, transportation, finance, and tourism, has expanded swiftly. One of the key elements driving the expansion of the halal business is the need for "halal food, halal finance, halal transportation, and halal holidays" among Muslim customers. The idea of "halal tourism" has grown more popular throughout the world, including Turkey, due to expectations of Islamic lifestyle, hygiene, security, and services specifically for women. Thousands of food products use illegal gelatin around the world, and sadly, many of these haram food products are frequently tried to be sold to Muslims. This is despite the fact that there are some alternative gelling agents of botanical origin.

2. Potential solutions for Gelatin Issues in Muslim Culture

2.1. Gelatin from mammalian gelatin

Mammalian gelatins are produced using a process that includes washing, pretreatment, gelatin extraction, filtration, concentration, evaporation, sterilisation, and drying. Porcine and cattle hides are washed in water before processing. To remove minerals like calcium carbonate, bones are broken and placed in a 4-7% HCl solution for more than two days. The result is ossein, a bone substance that resembles a sponge. As previously noted, the input material can be processed with either acid or alkali before gelatin extraction. Depending on the collagen source, the quantity of covalent cross-linkages, which rises with animal age, and the desired quality of the final gelatin, the appropriate pretreatment will be used. For the less covalently cross-linked collagens present in young animals, a brief pretreatment with diluted acid (mild pretreatment) is commonly employed, whereas a more intense alkali pretreatment (severe pretreatment) is normally used for the more covalently cross-linked collagens seen in older animals. The pretreatment techniques alter the collagen molecules physically and chemically (Haug and Draget, 2009).

2.2. Fish or chicken gelatins

In addition to the ethical concerns, the 1980s mad cow disease outbreak (also known as BSE, or bovine spongiform encephalopathy) hastened

the hunt for a mammalian gelatin substitute. The characteristics of the gelatin made from the skin of a tuna fish differ from those of a tilapia or a nile perch. Currently, fish gelatin costs significantly more than conventionally made gelatin. This is primarily due to the high cost of transportation and poor collagen content of fish skins.

Due to potential allergic issues, fish gelatin is subject to various rules addressing the requirement to mention it on a label (Schrieber and Gareis, 2007).

With features including a lower melting point that causes rapid disintegration in the mouth without a lingering "chewy" feeling, fish gelatin has been cited as a superior option to mammalian gelatins in specific situations. Fish skin, a significant waste and pollution-producing byproduct of the fish processing industry, could be a useful source of gelatin (Nagai and Suzuki, 2000). Fish skin is typically used to extract fish gelatin, which can then be pre-treated with either acid or alkali. These skins are freezer-safe. The fish skins should then be defrosted, properly cleansed by washing in cold water to remove any remaining fat or muscle, and treated with alkali or organic acids, frequently both to remove proteins and to expand the collagen, for up to 24 hours. The final optimization may serve as the basis for the order. The skins are then removed, typically using water (over 40ºC). Following this, various cleanup procedures like filtering and contact with activated charcoal may be used. It can then be dried, typically using a vacuum (Schrieber and Gareis, 2007; Sebastian, 2014).
The cold-water fish gelatins are known for having good emulsifying and film-forming capabilities. As a result, the main application areas right now involve using various micro-encapsulation techniques or embedding oil-based vitamins during spray-drying. In contrast, the gelatin made from fish caught in warmer waters has excellent gelling qualities; in fact, it has a nature that is very similar to the more prevalent varieties of gelatin and is employed in the food and pharmaceutical industries (Sebastian, 2014).
If chicken is murdered according to Islamic law, chicken skin gelatin can be used as a replacement to mammalian gelatin. Gelatin is anticipated to be produced in the near future from poultry skin and bones, although commercial manufacturing is currently constrained by poor yields. There are, however, few peer-reviewed research on the manufacture of gelatin from chicken skins and none on the production of gelatin from chicken bones. When compared to stated fish gelatin qualities, chicken gelatin has better physicochemical properties and shares a chemical makeup with bovine gelatin. Both bovine and chicken gelatin developed stable structures after chilling, with chicken gelatin having a much higher gel strength. In comparison to bovine gelatin, chicken gelatin displayed greater gelling temperatures (Sarbon et al., 2013).

2.3. Different Gelatin Alternatives

There must be new methods used to provide gelatin substitutes for the food business (Morrison et al., 1999). Many of the polysaccharides that have been offered as gelatin substitutes for the food industry do not have the well-defined melt/set characteristics of gelatin and instead gel on the basis of cation-induced connection zones. Gels based on carrageenan, alginate, or gellan are a few examples. Alternatives to gelatin made of polysaccharides typically have molecular structures that are less flexible and have greater viscosities than gelatin. In applications where "melt-in-the-mouth" qualities are critical for product quality and where moderate acidity is acceptable or required, Agoub et al. (2007) proposed that combinations of pyruvatefree xanthan and konjacglucomannan (KGM) could provide a viable substitute. A perfect illustration of what makes gelatin special as a gelling ingredient is fruit gummies. They quickly absorb water in the mouth, the gel melts as the melting point drops to body temperature, and the flavours and smells are released. Other hydrocolloids do not exhibit this characteristic to the same degree. Glycerol syrup, sucrose, gelatin, and water make up the majority of the ingredients in fruit gummies (Schrieber and Gareis, 2007; Hasenhuettl and Hartel, 2008).

3. Gelatin applications in food industry

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(Schrieber and Gareis, 2007: 163; Hasenhuettl and Hartel, 2008: 70).

3.1. Ice cream and fermented milk

Casein may lose its stabilising qualities while being processed or stored for use in yoghurt and ice cream.

Gelatin makes the milk's fat droplets hydrophilic by reducing the aqueous phase's surface tension and encircling them with an incredibly thin coating (Schrieber and Gareis, 2007). Gelatin is a substance that works well with milk proteins and enhances sensory awareness by not overpowering the flavour of the product like some other gums. The manufacturer would have the option of generating a wide range of textures in food products by using various concentrations of gelatin.

If such tensions arise, gelatin can basically stop whey from being ejected. The gelatin in ice cream also affects how big and where the ice crystals are distributed. There are other colloids that can be employed to stabilise ice cream, and this is only one of them (Sebastian, 2014). However, the use of the various chemicals has declined as a result of consumer opposition, particularly for businesses trying to cater to Muslim customers (Demirhan et al., 2012).

"Gelatin is used to clarify beverages, such as fruit and vegetable juice, by fining and clarifying the juice. The goal of fining is to create a beverage that is almost flawless in terms of flavour, colour, scent, and clarity. In order to do this, undesirable colour, haze, bitterness, excessive astringency, off flavours, disagreeable aromas, etc. must be eliminated. In addition to clarifying and precipitating turbidity-causing chemicals, gelatin is employed in the manufacture of fruit juices to lower the content of polyphenols such tannins and anthocyanogens (Schrieber and Gareis, 2007). Gelatin stabilises and clarifies solutions by causing dissolved chemicals or suspended particles, typically tannins, to fully or partially flocculate or sediment. The tannins and gelatin interact to create a sedative combination. Gelatin should not be used in excess or insufficiently during the clarifying operations to avoid overgluing or stabilising the colloidal substances that need to be eliminated (Djagny et al., 2001).

Muslims and Jews have trouble determining whether unsuitable gelatins have been used because the source of the gelatin is not listed in the ingredient statement, much alone where it comes from.

Gelatin is exempt from the requirement to be listed in the ingredient statement since it may be categorised as a processing aid in particular applications. While many Jews and Muslims demand that food products be properly certified, some Muslims and Jews attempt to discern what is acceptable by reading labels. However, some chemicals are not shown on the label because they are referred to as "processing aids" (Al-Mazeedi et al., 2012).

3.2. Confectionary and snacks

"At first appearance, it would seem that soft caramel chews, nougat, and caramel fillings for candy bars are very different types of confections. One feature unites almost all of these, though: they all contain fat that has been emulsified in a supersaturated sugar solution. The emulsion may also incorporate air bubbles and solid ingredients like almonds or sugar crystals. Gelatin is primarily used in the confectionery business to promote emulsion and foaming capabilities, manage sucrose recrystallization, and improve chewability. In addition to its thermoreversible gelling properties, gelatin is utilised in the confectionery business for its foaming, foam-stabilizing, binding, and emulsifying properties as well as its ability to regulate crystallisation (Sebastian, 2014).

Gelatin is a thickening that can be found in yoghurt, soft gummy candies, and desserts with a concentration of 8–10% of the dry weight. Typically, 3% of marshmallows include gelatin (Igoe, 1983). The confectionery business uses gelatin's foaming and foam stability properties to create extruded, moulded, and recrystallized marshmallows, wafer and candy bar fillings, chews, and nougats. These goods come in a variety of textures, flavours, dry components, and levels of aeration. The best gelatin must be chosen in consideration of foaming behaviour, texture, and storage stability depending on the final product and the sales distribution channels involved, and must be executed in collaboration with the gelatin maker (Schrieber and Gareis, 200; Hasenhuettl and Hartel, 2008).

3.3. Desserts

The national dessert of the United States is still water dessert gels. In roughly two-thirds of all households, the 'Jell-O' (Kraft Foods, 2013) items made by the market leader alone are

consistently consumed. But even outside of America, gelatin desserts rank among the most common uses for the substance. In western nations, gelatin jellies come in a wide range of shapes, hues, and flavours and are used to make fruit cake, as well as breakfast dishes, snacks, and desserts (Schrieber and Gareis, 2007).

3.4. Meat and meat products

The meat business makes extensive use of edible gelatin in products including canned hams, meat jellies, meat loaves, sausages, and boned-cooked hams. The ultimate goal of using gelatin is to absorb the liquids that break out during cooking procedures and are used for coating. Gelatin offers the meat processing industry a wide range of intriguing opportunities to help it achieve these needs. Despite the fact that many of these products are not kosher or halal! However, gelatin and gelatin hydrolysates have various uses in the meat processing sector. The gelatin hydrocolloid's technological effects, such as its capacity to bind water and meat juice in the package while being frozen or cooked, as well as its texturizing and flavor-improving qualities, are also significant (Schrieber and Gareis, 2007; Sebastian, 2014).

3.5. Pharmaceutical products

The pharmaceutical sector is another area of interest, in addition to the food industry, where the usage of gelatin cannot be disregarded. Nearly 10% of the edible gelatin produced in developed nations is used in this industry, mostly for the production of capsules and emulsions. Despite the fact that gelatin has been shown to have little biological significance, this protein has been linked to a number of therapeutic outcomes, including enhanced serological specificity and surgical properties (Pilar et al., 1996: 1-3). Capsules are made using about 90% of the pharmaceutical gelatin manufactured. Single-dose solid medication formulations often come in gelatin capsule form. The gelatin capsule shell is appropriate for the intended use (Haug and Draget, 2009). Gelatin capsules shield their contents from the effects of light, ambient oxygen, pollution, and microbial development to a significant level. There are two different kinds of capsules: hard and soft. The shell of the capsule, the sorts of drugs they contain, and the manufacturing process employed vary amongst them (Bhatt and Agrawal, 2007).

4. Conclusion

Since fish gelatin satisfies the majority of consumer needs, it complements the growing global demand for gelatin while lowering waste from fish processing, opening the door for research and exploration of fish gelatin as an alternative to mammalian gelatins. Consumers are becoming more and more concerned about the origin of gelatins, mostly because of religious feelings and the possibility of virus and prions contamination given that it is frequently derived from animal sources. The availability of raw materials, along with the relatively poor yield and high cost, will be limiting considerations for the existing fish gelatin production, which may prevent it from increasing much, at least in the near future.

The characteristics of the commercially available fish gelatins need to be characterised and standardised, which will need extensive research. In situations when those qualities are crucial, the application of physical, enzymatic, and organic crosslinking agents may make fish gelatin more competitive by boosting its gel strength. Although fish gelatin won't ever totally replace mammalian gelatins, it is hoped that one day it will develop into a specialty product with distinguishing qualities that make it stand out from other biopolymers and satisfy the needs of the global halal/kosher market. In-depth research is also being done to determine whether mixed gelling systems made of plant-based ingredients like pectin, agar, carrageenan, etc. may replicate the special features of gelatin.

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Perspektive halal i košer želatina u proizvodnji hrane

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Stručni rad

P O D A C I O R A D U

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S A Ž E T A K

Proizvodnja želatine uvijek je bila predmet velike rasprave širom svijeta. Kolagen koji se nalazi u životinjskim kostima, koži i vezivnim tkivima djelomično se hidrolizira kako bi se proizveo želatin, vodotopivi protein. Želatin ima širok spektar upotrebe u mnogim različitim industrijama, uključujući prehrambenu, farmaceutsku i kozmetičku industriju. Međutim, u halal i košer prehrambenim industrijama smatra se jednom od najspornijih komponenti. Prihvatljivost proizvoda koji sadrže želatin određuje se životinjom iz koje potječe, a nemoguće je utvrditi izvor životinje iz koje je želatin potekao nakon što se pomiješa s prehrambenim ili farmaceutskim proizvodima. Kao rezultat toga, postoji mogućnost za finansijski motiviranu prevaru ili pogrešnog označavanja. U proizvodnji jogurta, mlijeko se kombinira sa želatinom kako bi se riješio problem sinereze tokom skladištenja, ali izvor želatina je nepoznat, što dovodi etičkih pitanja halala ili harama. Ova studija se fokusirala na proizvodnju jogurta iz enzima transglutaminaze dobijenog iz biljnog izvora kao zamjene za želatin i na ispitivanje reoloških svojstava jogurta. Ispitivali su se učinci različitih koncentracija enzima u rasponu od 0,02%, 0,03% i 0,04% s različitim temperaturama postavljanja od 35°C, 45°C i 55°C te različitim vremenskim tretmanima od 60, 90 i 120 minuta. Enzimatski tretman mlijeka pokazao se korisnim za smanjenje pojave sinereze tokom čuvanja jogurta na 4°C, što je poboljšalo sposobnost zadržavanja vode tokom centrifugiranja. Postupak naknadnog zakiseljavanja i stabilnost uzoraka jogurta bili su pod utjecajem umrežavanja transglutaminaze s mliječnim proteinima koji su se pokazali kao učinkovit alat za poboljšanje funkcionalnih svojstava jogurta. Kako su povećane zabrinutosti potrošača u vezi s autentičnošću halal i košer hrane i proizvoda, potrebno je otkriti i kvantificirati vrstu želatina kako bi se osigurala njegova cjelovitost u pogledu halal i košer pitanja.