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Meat Grade and Preservation Enhancement through Natural Substance Marinades: An Evaluation

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Abstract

Traditional methods of enhancing meat quality, such as marinating it have been altered as a consequence of people's desire to label goods. Meat marination is a culinary method that allows meat to be soaked or coated in a tasty concoction to improve its texture, flavor, and juiciness.The process of using several methods to keep meat products fresher longer and prevent them from spoiling or decomposing is referred as meat preservation.To focus on the effects of using marinades made of natural substances on the quality and preservation of meat.The analysis demonstrated that natural marinades increase the meats sensory appeal, enhance its culinary qualities, and lengthen its shelf life. Inhibit the metabolism of proteins and lipids, which has an impact on the healthiness of meat products. Also lessens the production of polycyclic aromatic hydrocarbons (PAHs) and heterocyclic aromatic amines (HAAs), as well as biogenic amines.An extensive analysis was carried out on articles using the natural ingredients in meat marinades that were covered in the years 2019 to 2023. In particular, it focused on the examination of a range of substances, such as wine and beer, as well as fruits, vegetables, spices, and fermented dairy products.It was shown that using natural marinades improves both the meat's flavor and texture while extending its preservation life. These marinates improve meat quality by avoiding lipid and protein oxidation.The competing microbiota from dairy products and physiologically active ingredients make this feasible. Nevertheless, some marinades, particularly those with acidic contents, result in an unfavorable color shift and a mildly acidic flavor. Research on the influence of organic marinates on nutrients and Promotes wellness properties of meat based goods are significantly absent.The findings demonstrated a substantial favorable relationship between the usage of natural ingredient marinades and overall meat grade improvement.

Keywords: Meat, Grade, Preservation, Natural Substance, Marinades.

INTRODUCTION

Meat preservation slows down the enzymatic process, stops the development of bacteria, and then stops the oxidation of fatty acids which causes rancidity. The period that meaty goods are capable of being stored without degrading either safety or quality is determined by a variety of factors. The number of microorganisms that develop in meat is influenced by its physical state (1). As an example, the process of beef increases its outermost area, removes water and vitamins among nerve cells, as well as disperses appear microorganisms across the flesh. The ability about microorganisms growing on flesh is regulated throughsubstance properties such as pH and moisture content (2). Natural protective tissues prevent dehydration, bacterial infection, and other detrimental changes. Meats are kept from growing equally dry or contaminated by microbes or protective plastic films. Global food industry advancements have increased the risk of food contamination from toxic substances, hazardous food additives, chemical residues, and pathogenic microbes (3).Food deterioration is necessary to control, as well as the

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development of dangerous bacteria.Meat preservation through freezer storage is a great option. To keep moisture from evaporating during storage, frozen meats are tightly wrapped in packaging that restricts air contact with the meat. Another factor affecting product quality is the duration that meats are kept in freezer storage (4). Preservatives made from natural sources have become preferred substitutes for artificial ones. It has been shown that using natural preservatives reduces harmful health consequences while continuing to have good antibacterial action. Artificial additives used in meat and animal products pose a serious threat to human health (5).The technique of marinating meat enhances its culinary qualities and its sensory appeal. It is a way of preservation as well. Marinating meat products is the process of infusing flavorings, spices, and other additions using liquids (6). Water oil emulsions, gathers, minerals, synthetic tenderizers, natural acids, citrus juices, vinegar, cultured dairy goods, wine, lemon juice, fragrant veggies, and soybean sauce are common marinade ingredients (7).The meat industry has been using marinades for many yearswith the process is refined through technological advancements, process control, and ingredient selection for the marinade formulation. Tenderness is the most desired quality attribute of the completed meat products. Then other tactics are chemical and mechanical approaches that are used to improve the softness of the flesh (8).Marinades' original purpose of flavoring and tenderizing meats provided a way to improve meat output and quality. Industrial marinating of broiler chickens is a renowned kind of chicken. The commercial procedure that was expanded to additional bird species, including geese and swans, as well as additional uses for fowl, such as Cornish game hens and wasted fowl (9). But only in the last several years has marinating especially by injection made significant technical advancements in the pig and, to a lesser degree, the beef industries.Several methods of marinating are used in the food business to speed up the absorption of marinade into the meat, such as multi-need injection, massage, tumbling, or vacuum tumbling (10).This review aims to offer a detailed combination of research applicable to the contents of marinades created from natural substances, the factors affecting the marination process, and the precise processes leading to changes in meat qualities.

Improvement of Meat Grade and Preservation

The search phrase executed over 94 indexed articles' descriptions, undefined, and author keyword fields. There 72 publications were returned with the inclusion of the marinade filter. Other elements of the bibliography, such as the publishing language (English) and the publication year (2019–2023), were also employed (Figure (1)). There are58 papers that were found through the pursuit were considered in this study. This study included dissertations on marinades using natural ingredients, marinade methods, marinate procedures, and marinating implications on security, taste quality, and durability (Table (1)).

Table (1). Meat Marinades based on ingredients (Source: Author)

Meat	Marinade based on ingredients	Type of marinade	Source	Image
Pork	jalapeno pepper	Marinade with jalapeno pepper extract	[11]	
Poultry	Lemon juice	Marinades with Apple and lemon juice	[12]	

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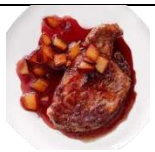
Pork	Plum Juice	Marinades with Plum Juice	[13]	
Beef	Honey	Marinades with honey	[14]	
Beef	balsamic vinegar	Marinades with balsamic vinegar	[15]	
Pork	Apple Vinegar	Marinades with fruit vinegar	[16]	
Beef	onion juice	Marinades with onion juice	[17]	
Goat	ginger and pineapple juices	Marinades with ginger and pineapple juices	[18]	
Chicken	Shallot, ginger, garlic, soy sauce	Marinades with Shallot, ginger, garlic, soy sauce	[19]	
Pork	kefir, yogurt, and buttermilk	Marinades with kefir, yogurt, and buttermilk	[20]	
Pork and chicken	Yogurt	Marinades with Yoghurt	[21]	
Chicken	Acid whey	Marinades with acid whey	[22]	
Beef	Red wine	Marinades with Red wine	[23]	
chicken	Pilsner beer	Marinades with Pilsner beer	[24]	

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Meet	red wine, salt, pepper, garlic powder	Marinades with red wine, salt, pepper, garlic powder	[25]	

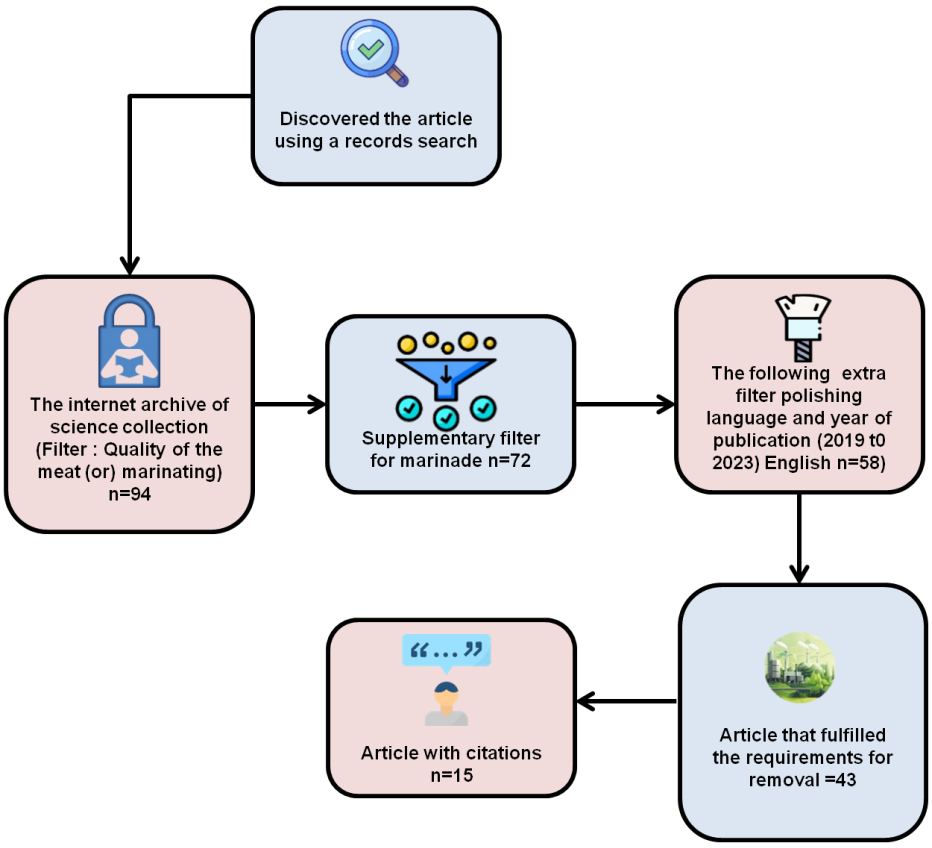

Figure (1). The evaluation and selection procedure (Source: Author)

Pork's hardness and pH were decreased when spice extracts including tamarind paste, jalapeno pepper, turmeric, black pepper, and bay leaf were added to marinades. This increased the color components of the pork (11).The poultry's technical and sensory qualities are improved while fowl is marinated in a mixture of ultra virgin olive oil with lemon juice, and beer that also extend the meat's shelf life to six days (12).Plum juice-infused pork marinades provide a mouthwatering blend of salty and sweet tastes that enhance the meat's flavor to new levels. Plum juice's natural sweetness adds a lovely undertone, and its sour flavor perfectly balances the richness of the pork (13).Every bite is very soft because the honey serves as a natural tenderizer. This beef marinade with honey is enhanced by a symphony of savory herbs, fragrant garlic, and a touch of smokiness. It promises to be a symphony of tastes, transforming a typical dinner into a gastronomic feast (14). Marinades made with balsamic vinegar provide a sophisticated touch to beef's naturally rich taste. The meat gains depth and complexity from the beautiful dance of tastes created by the balsamic vinegar' sweet and powerful overtones (15).Improve the tenderness of pork by marinating in a marinade that has tart and crunchy apple vinegar flavors. This marinade, which adds the ideal harmony of sweetness and acidity, promises to take pig dishes to new heights. To balance the richness of the pork and create a pleasing flavor profile, apple vinegar offers a refreshing touch (16).Toss steak with a delicious marinade

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that highlights the natural sweetness and richness of onion juice. Initially, the essence of fresh onions is extracted, giving the marinade a particular flavor and scent. This is a simple yet delectable combination (17).As opposed to wine-marinated beef, calcium chloride, goat marinated for seven days was noted for excellent levels of softness, juiciness, and overall appeal (18).Common seasonings like cumin, paprika, pepper, chili powder, garlic, ginger, and turmeric may enhance the flavor of chicken (19).Separate ingredients, mustard, such as onion, vinegar, cardamom, turmeric, curry, and salt, used marinades for chicken in addition to yogurt (20).As an alternative to marinating pork and chicken in lemon juice, using yogurt and acid whey preserves the product's excellent technical qualities while increasing its microbiological safety (21).Acid whey is a result of making yogurt and cottage cheese. It contains minerals for marinating chickens, considerable levels of tryptophan and cysteine, and whey proteins (22).Red wine-infused beef marinades improve the meat's taste profile and provide a hearty, flavorful meal. Red wines tannins give the steak a rich, nuanced flavor while helping to tenderize it (23).A delightful confluence of tastes is produced while the chicken is marinated in Pilsner beer, taking its traditional meal to new heights. The Pilsner's crisp, light flavor gives the chicken a delicate malty undertone, and its effervescence tenderizes the flesh for a luscious, delectable texture (24).Presenting a delicious marinade that elevates culinary forays to unprecedented levels. This is an amazing combination that perfectly balances salt, pepper, and a dash of garlic powder with the powerful and deep aromas of red wine (25).Beer is used as a marinade and seasoning with meat, standalone, Oder in conjunction with additional spice, as cooking at high temperatures, minimize oxidative stress and the development of hazardous compounds like HAAs and PAHs. Beer is a usual dietary component, which is high in antioxidants protect meat lipids from oxidation. The phenolic compounds present are the principal source of antioxidant action and contributeenergy protons and develop coalitions with generated lipids protons during oxidization.The presence of particular HAAs was shown to have a direct relationship with the antioxidant capacities of wine. Red wine marinades have been shown to reduce the production of some HAAs. The length of marinating had a variable effect on the formation or avoidance of particular HAAs in wine marinated fried chicken. While wine marinates contain more antioxidants that beer marinades, the effect on HAA formation is less clear. The ingredients of the marinades and the pH alter the physicochemical properties of meats while decreasing the quantity of PAHs in grilled items. A marinades with a pH that is alkaline that includes sodium bicarbonate was shown in experiments to increase the PAH material, especially elevated PAHs, in grilled chicken meat. As a result, adding juice lowers the pH and suppresses PAH production processes.

Background information and vocabulary related to marinating

A marinade is defined in a variety of ways in the scientific literature, which appear contradictory. Moreover, marinades are defined broadly and are distinct from each other on a cultural and geographical level (26).A marinates is a combination of no flesh ingredient that is applied to uncooked food, particularly meat, to enhance or soften its taste. It is available as a lump or a liquid mixture. It was frequently recognized that marinating meat improves its flavor and tenderness, making it a higher-quality meat product. Additionally, the softness of meat is impacted by marinating (27). This is particularly true with commercial marinades, which enhance or balance the flavor of the meat by adding flavoring ingredients. This helps to improve palatability. Like marinades, brines usually include water, salt, phosphates, and flavoring agents.

Preservation

High-quality goods are produced by reducing water activity through the use of salt and drying procedures, which enable preservation through curing processes. Nitrite, salt, sugar, curing accelerators, and spices are added to the curing brine to accomplish that (28). Perform carcasses or complete pieces of boneless meat, such as whole chickens, that are preserved with methods including vacuum-tumbling, injection, and soaking, which are comparable to marinatingas shown in Figure (2).

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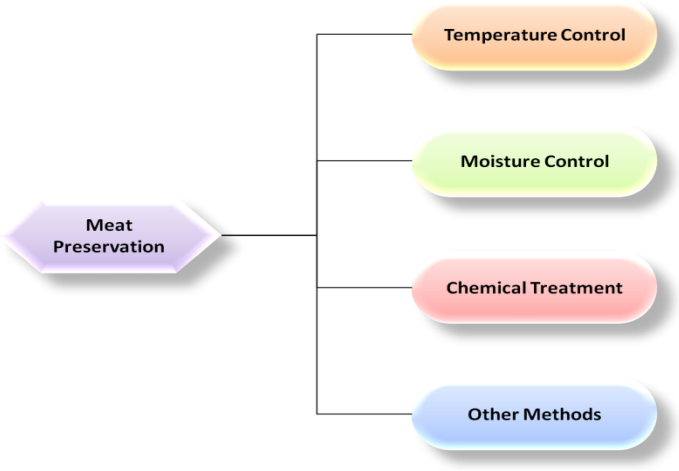

Figure (2). Meat preservation (Source: Author)

The marinating system absorbs and retains

Fresh meat has 75% water by nature, but handling, storing, and cooking lose a significant percentage of this water that is not handled carefully. Marinating is a multi-step, intricate procedure that currently lacks a clear explanation for each step. However, the marinade must first absorbed by the meat to help retain water (29).The extended and narrow myofibres, referred as muscle cells, present in chicken flesh are enveloped by connecting tissue, which allows the extra liquid added throughout the marinating to be received and held inside the tissue. This extra fluid is present in the myofibrils inside the cells of the muscle, the spaces that exist among the filaments and the mitochondrial membranes, and the muscle cells distinct from the tangles of muscle fibers (30).In a marinade system without phosphates, the main component in myofi bril solubilization is salt. To break down muscle fibers, remove myofibrillar proteins, and disrupt muscle cells, a particular viewpoint utilizes tumbling, rubbing, or mixing in the presence of salt. The majority of these changes take place on the meat pieces' surface (31).

Essential components for marinating

To develop the flavor, texture, and juiciness of beef, soaking is a method of ingredient delivery. The components used in the solution immediately affect the functioning of most marinades, which means that they also affect the deferred and general standards of the prepared products.Marinade ingredients are divided into two groups (32). Substances that caused the cationic strength of beef to bond with water and pH fall into the first group. These substances also alter the meat's textural qualities. Water, protein isolates, salt, phosphates, organic acids, hydrocolloids, enzymes, and curing agents are examples of ingredients that fit this description (33). The second group of components comprises items that have an impact on the marinated chicken's consumer appeal and quality of flavor. These auxiliary components include flavor extracts, sweeteners, and herbs and spices as depicted in Table (2) and Figure (3).

Table (2). Numerical outcomes of marinating and cooking yield (Source: Author)

Treatments	**Marinating and Cooking Yield (%)**	
	Tumbling yield (%)	**Cooking Yield (%)**
Tumbler	112	86

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Tenderizer	117	91
Injector	127	96

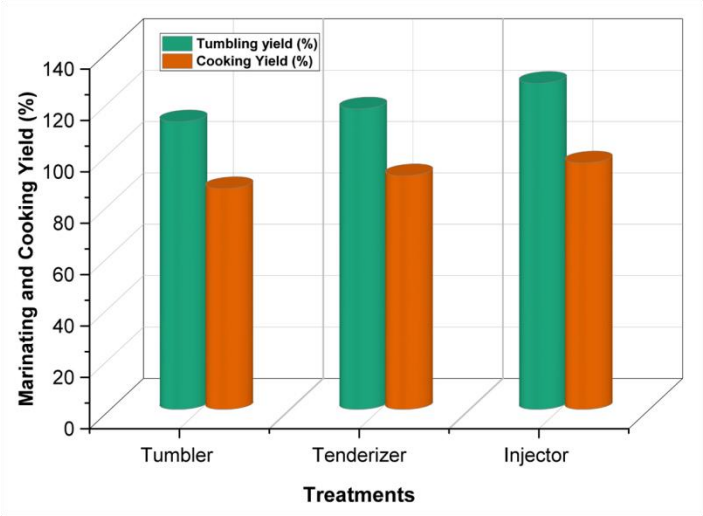

Figure (3). Marinating and cooking yield (Source: Author)

Alkaline phosphates and salt are the two most popular and significant components in marinades. By raising the pH, ionic strength, moisture content, and softness of the meat as well as binding proteins, through actomyosin dissociation (34).The excessive phosphate addition gives the meat an unwanted flavor, texture, and color, especially in meat products with mild spices. These effects include soapy, metallic, and rubbery flavors. To improve the yield, texture, and overall look of meat products, it is imperative to develop substitute meat marinades that exclude polyphosphates (35).Improving the flavor and softness of meat before grilling is a solid classic culinary method that involves the inclusion of natural acids in alkaline marinades. Popular acidic marinating solutions include vinegar, buttermilk, pineapples, lemon juice, Italian apparel, salsa, and yogurt. Marinades are made by combining water-binding substances such as hydrocolloids, gelatins, soybeans, milk protein, and altered dietary starch, providing a variety of alternatives for improving the taste and texture of meat meals.

Techniques for delivering marinade

The marinating process and delivery are required carefully chosen to impart flavor and increase the texture and moisture retention of animal products in marinade meats. Meat marinating techniques include tumbling, injection, immersion, and stroke. That is related to industrial marinating. Other techniques include paste and dry marinades, which are common in residences and the culinary industry (36).

Dehydrated marinades

A good's features in issue are occasionally graded with a tool to help the marinade penetrate the meat. The deep channels that are left behind enable the marinade to fill in the gaps and entrap the marinade. During cooking, the dry marinade stays on the meal, making it the most convenient kind of marinade. The dry marinade's salt extracts moisture from the meat's surface through osmosis as shown in Figure (4). The savory rub and dry surface combine to form a crust that gives the cooked meat more flavor, texture, and visual appeal (37).

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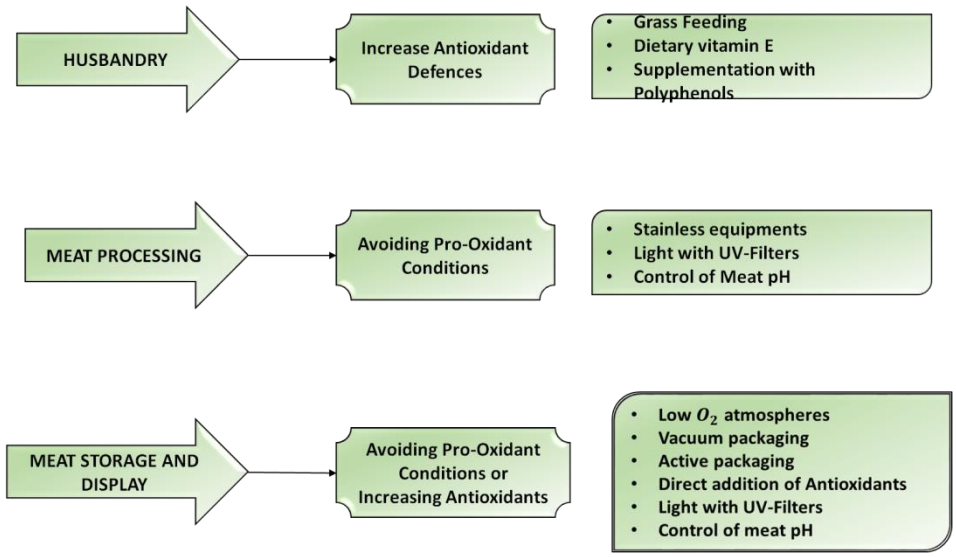

Figure (4). Marinate with Meat processing (Source: Author)

Developed marinating effects

To fulfill consumer demand for variety, new tastes, spiciness, and outstanding presentation, one option is to incorporate spice and flavors into marinades, hence increasing the creation of value-added items (38). Flavors and spices applied into marinates procedure increase the taste qualities of poultry products by increasing the core chicken flavor, restoring taste lost during processing, providing a unique flavor profile, avoiding and hiding warmed-over flavor.

Plant-Based Natural Preservatives and Their Use in Meat and Meat Products

Polyphenols, phenolics, and flavonoids are strongly linked to the antibacterial properties of natural preservatives obtained from plants. Phenolic acids, flavones, flavanols, isoflavones, coumarins, anthocyanins, quinones, alkaloids, and terpenoids are some of the classifications and structural variations of plant-derived polyphenols (39).The evergreen, pungent, and woody leaves of rosemary resemble needles. Rosemary is a perennial plant. It comes from the Mediterranean area, but it's found all across the world. In cuisine, rosemary has been used as a spice and seasoning. It is estimated that rosemary essential oil contains around fifteen different types of bioactive chemicals (40).The effects of rosemary essential oil on the prevention of spoiling and the inhibition of Salmonella Enteritidis in chicken flesh at 4 and 18 °C were studied.

To suppress food-borne pathogens in chicken filets kept in refrigeration for seven days, rosemary essential oil was sprayed together with modified environment packaging (41).The flavor, taste, medicinal benefits, and preservation qualities of sage, a member of the Lamiaceae family, have been used since ancient times. It is well known that sage contains significant concentrations of benzoic acid, p-coumaric acid, and rosemary acid (42).

One typical herb that goes well with meat and meat products is thyme. Thyme enhances beef products' sensory, antimicrobial, antioxidant, and shelf-life-extending qualities.The bactericidal properties of thyme essential oil encapsulated in casein and maltodextrin were assessed both in vitro and in situ.A common ingredient in Mediterranean cuisine is oregano. The antibacterial and antioxidant qualities of oregano essential oil are known to prolong its shelf life (43). Thymol and carvacrol are two bioactive polyphenols that are responsible for the

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antibacterial properties of oregano.Several phenolic chemicals and flavonoids, including procyanidin, citric acid, naringenin, epicatechin gallate, and catechin, are found in grapefruit seed extract (GSE). Wide-spectrum antibacterial, antiparasitic, and antifungal activities have been reported for GSE.The inner bark of the Cinnamomum genus is the source of cinnamon.In particular, turmeric has been used as a flavoring and coloring ingredient in cuisine as well as in traditional medicine to cure a variety of ailments. Turmeric's components, known as curcuminoids, are the source of its primary active ingredients (44). As an alternative to artificial preservatives, natural preservatives have gained popularity. It has been shown that natural preservatives have the ability to reduce harmful health consequences while having strong antibacterial activity. The health of people is very concerned about meat and meat products that include artificial additives. As a result, researchers and meat producers have begun to speculate about using natural preservatives rather than artificial ones depicts on Figure (5).Customers are beginning to accept and experience significant benefits from the substitution of natural preservatives for synthetic ones. Nonetheless, food manufacturers face other obstacles, such as a decline in their ability to compete on price because of the high cost of natural preservatives and a reduction in their ability to fight germs because of dietary components like fats, proteins, and carbs.

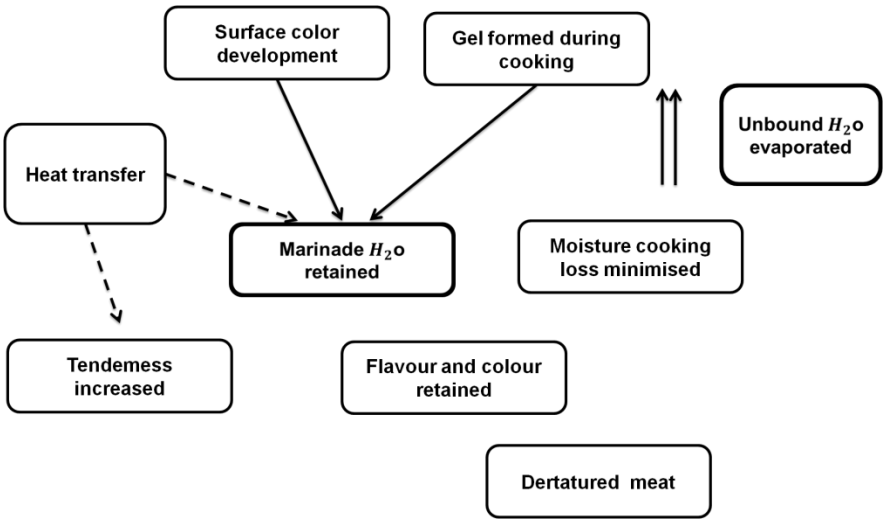

Figure (5). The absorption and retention of marinade during marinating and cooking (Source: Author)

Meat Quality Affected by Marinades Made with Natural Ingredients

Meat grading divides meat into many grades according to the anticipated quantity of salable meat from a carcass and its predicted eating quality. Unlike meat inspection protocols, meat-grading systems differ greatly across national borders. These variations are mostly caused by the fact that various nations have various requirements for the quality of their meat.The real decision is influenced by the availability of protein, crop production, and potential for protein extraction, despite the fact the selection of plant protein constituents is the foundation for product creation. The one feature of the most popular plant-based components have in common in food industry byproducts (45).Animal feed was formerly made from soy meals that were recovered after oil extraction. Not withstanding, soy's high protein content, well-balanced amino acid composition, widespread availability, affordable cost, and unique protein functions.

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CONCLUSION

Marinating meat remains a popular way to improve its quality. While a recent movement toward clean-label products has resulted in the replacement of synthetic substances with natural equivalents. Recent studies emphasize the importance of aspects such as sensible marinade component selection customized to certain meat varieties, the marination process, and circumstances such as duration, temperature, and meat-to-marinade ratio.Recognizing the interplay between marinade components is critical. The results show that natural ingredient-based marinades have an important role in enhancing the sensory qualities, gastronomic features, shelf life, and safety of meat. This enhancement is related to natural substances used by customer preferences, including phenolic compounds, organic acids, and these enzymes are derived from plants.As a consequence, this study provides essential perspectives into the creation of creative procedures that correspond with customer expectations for natural, superior meat products while preserving the lifetime of their freshness.

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