



Incorporation of Herbal Plants in the Diet of Ruminants: Effect on Meat Quality: Review

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A B S T R A C T

The use of herbal plants as food additives in animal nutrition to enhance meat processing efficiency and meat quality has been reviewed. Today, the consumer demand is safety, nutritive value, taste, uniformity, meat variety, and good appearance of meat products. Thus, to meet the consumers' demand, development of product and research should be improved. Studies have been shown that the use of herbs, spices, and their extracts are of the major interventions, which were adopted in the industry of the meat for improving its quality traits. In the present paper, the most recent literature about use of bioactive compounds in herbal plants for evaluating a number of parameters related to meat quality, including fat content and distribution, water content, water holding capacity, collagen content, pH, tenderness color, lipid oxidation and flavor were reviewed.

Keywords: Ruminants, herbal plants, lipid oxidation, meat pH and meat quality

INTRODUCTION

Increasing the awareness of consuming red meat and its products were observed recently. For instance, World Health Organization (WHO) reported the characterization of the red meat intake "probably carcinogenic to humans" (1). While number of gaps of the knowledge concerning this topic was referred by others (2). In addition, consumption of red meat has been associated with a greater incidence of chronic diseases (3). As a result, new breeding techniques like adding herbal plants as antioxidant have been increased interest which provides potential benefits of health to consumer. Thus, dietary supplemented with natural antioxidants for

example, rosemary, curcuma, oregano, and Thyme are considered a most effective techniques for modifying and improving composition of fatty acid in ruminant's meat to reach the consumer demands (4). Nutritional unsaturated fatty acids have accentuated as an active way of adjusting the fatty acid composition of ruminants' meat (5). Nevertheless, unsaturated dietary fats in ruminants can cause oxidative stress (6). It can also predispose meat to lipid or protein oxidation (7) that could influence shelf life, nutritional value and sensory properties in ruminants' meat (8). Consequently, improving unsaturated fatty acids in the meat of ruminants needs concomitant antioxidant improvement to attenuate protein oxidation or lipid oxidation; thus, food industry has been required to use

natural antioxidants such as *Nigella sativa*, Curcumin and *Andrographis paniculata* in different products to enhance food quality and nutrition value, substitute synthetic antioxidants and delay oxidative of lipid degradation (9).

Case in point, compared with the direct addition to meat products, the muscle foods stability greatly improved, after the incorporation of food additives in ruminants' feed, because antioxidants are deposited where they are most required. The best available technology is the use of natural antioxidants in animal feed to modify the stability of oxidative of intact muscle food. In addition, the beneficial effects of including natural antioxidants in the feed on health of man because they protect important biological cellular components from reactive oxygen species (ROS) attacks including proteins, membrane lipids and DNA (10). Thus, natural antioxidants such as spices, herbs and their extracts has been added to a multiplicity of foods to enhance their sensory characteristics and increase shelf-life (11). The opportunity of ruminants has been also feeding diets provides with medicinal plant and aromatic like sage, thyme leaf and rosemary as natural antimicrobials and antioxidants a very intriguing prospect to substitute synthetic antioxidants (12).

The primary aim of this paper is a review of the most recent literature about use of bioactive compounds in herbal plants on consumer acceptability of ruminant meat, including the fat content and distribution, water content, water holding capacity, collagen content, pH, tenderness color, lipid oxidation and flavor.

The Impact of Red Meat Eating on Human Health

Meat consumption has markedly increased in latest years. Food Agriculture Organization statistics (FAO) showed that meat consumption has risen worldwide from ~30 kg/person/year in the 80's to ~43.4 kg/person/year in 2015 (13), with values in the USA as high as ~125 kg/person/year (14). Despite this, the 2016 US Dietary Guidelines for Americans recommend that red meat and its products can be consumed in moderation (15). These guidelines are based in part on epidemiological evidence linking to high red meat consumption to an increased risk of type 2 diabetes and digestive system diseases, potential risk for stroke, cancer, and cardiovascular disease (16, 17). Health status as regards red meat consumers has always been a scientific field of much interest. Nonetheless, consumers have already become more health-conscious, so they concerned about cholesterol and saturated fat intake, as well as a high acid load from meat consumption (18, 3). As it is well-known, cholesterol is an important lipids factor that has a bad image due to its negative health effects. According to the American Heart Association (19) for humans with normal cholesterol levels in blood, daily fat intake should not exceed 30% of total calories and also cholesterol consumption should be less than 300 mg/d, as elevated levels of (LDL-C) low-density lipoprotein cholesterol as well as levels of plasma triglycerides are linked to an increased risk of (CVD) cardiovascular disease

(20). In fact, the proximate composition of red meat is highly encouraging such as the fat and fatty acid content which could be one of the factors causing cardiovascular disease (CVD) (21). Several studies have confirmed that it is possible to change the meat image and meat products from commonly known image to one of healthy living, elimination fats, reduction saturated fatty acid and adding herbs, fibers, spices, and extracts, etc., by modifying the ruminants 'diet (22, 23). In the case of meat, the purpose of using functional ingredients in the diets is not only to provide the meat some attractive qualities, as well as to improve its picture during these health-conscious times. However, meat is beneficial to one's health with respect to obesity for instance, and it has satiating properties. This aspect is very significant in the production of functional meat products that are tasty and satisfying (22). Fatty acid and vitamin E content can be changed through modify the ruminant's feed (23) for example adding herbal plants to the diets could improve fatty acid profile in muscle in lambs (24). It should be possible to create new meat products with potential health benefits by incorporating natural bioactive compounds. These meat products would create a whole new market for the meat industry (12).

Certain Factors Have an Effect on Ruminant Meat

Ruminant meat is influenced by myriad factors, which can be broadly categorized as intrinsic and extrinsic factors. The intrinsic (Genetic tools) factors include breed, age, species, sex etc. while the extrinsic (non-Genetic tools) factors include, diet, weather condition, physical activities, slaughter weight and others (23).

Among the various extrinsic factors, diets are the primary factor that affects the flavor of ruminant meat. Various tissue components are affected by diets and influence the taste, with fatty acids consider an important element (25). The carcass conformation, physicochemical characteristics and meat quality organoleptic parameters like tenderness, proximate analysis, color and fatty acid profile can be modified by the diet (26, 27). Meat of grain fed ruminants contained additional linoleic, n-6 poly-unsaturated fatty acids and oleic acids, whereas meat of forage fed ruminants contained additional linoleic acid, but also additional n-3 poly-unsaturated fatty acids (28, 29). This indicated that the difference in flavor score between grain fed and forage fed ruminants is due to higher levels of oleic acid in grain fed ruminants' meat, as opposed to higher levels of linoleic acid in forage fed ruminants' meat. Pelleted total mixed rations have been reported for enhance the meat quality and animal performance at fattening lambs compared with non-pelleted total mixed ration (30). Lastly, there are rising interest in bioactive substances in several plants as potential instruments that enhance the quality of lambs. This is the case of point, phenolic compounds, like saponins, essential oils rich in terpenes and condensed tannins (31, 32). The scarce information available, (33) indicated that the content of trans-11, C18:1 trans-11and

CLA cis-9 are unsaturated fatty acid in sheep could be increased by inhibiting biohydrogenation of ruminal fatty acids caused by tannin as well as Improve stability of color in fresh lamb meat (34). Furthermore, supplemented diets with naturally derived lovastatin at a rate of 4 mg/kg live weight may be a viable feeding method for producing tender meat with lower cholesterol levels (35). Odhaib et al. (2018) (24) showed that adding *Rosmarinus officinalis* leaves or *Nigella sativa* seeds to the lambs' diets had beneficial effects on meat quality in which herbs reduced oxidation of the lipid. The reason can be attributed contents of polyphenols in the herbal plants.

Red Meat Fat and Fatty Acid Composition

The major source of protein in human food is meat of ruminants (36). Recently, incidence of chronic diseases in humans was associated with ruminant meat that contains a high number of saturated fatty acids (36, 1). So, the primary aims in new research are improving the unsaturated fatty acid content and decrease the saturated fatty acids content in meat of ruminants to enhance its healthiness (37, 38). Several studies indicated that ruminant meat content is high saturated fatty acids result from unsaturated fatty acids as bio hydrogenated extensively in the rumen (39, 40). The fats in an animal can be classified as intramuscular and depot fats. Intramuscular fats are present in muscle tissues while depot fats are present in adipose tissues (Error! Reference source not found.). Typically, the depot fats are found in the visceral organs like gonadal, retroperitoneal, epicardial, perirenal, mesenteric and omental (42) and subcutaneous layer while some can be found in intermuscular depots (44). The intramuscular fat comprises of lipids obtained of lipid that membrane bound or adipose cells in muscle "marbling" (Error! Reference source not found.). However, the "intramuscular fat" typically describes marbling in red meat. Triacylglycerol is the major fat component of depot lipids in raw red meat (44). Marbling differs from subcutaneous fat such that it comprises of higher phospholipids related with proteins as lipoproteins or proteolipids than subcutaneous fats (Error! Reference source not found., 44). In highly marbled meat, triacylglycerols are predominant while cellular phospholipids constitute one-third of fat content in very lean meat (43). In red meat, lipids differ in the type of bonding between carbons and carbon chain length with fatty acids present in triacylglycerol (Error! Reference source not found.). In animal fats, most fatty acids contain an even number of carbons. Branched chain and an odd number of carbon fatty acids are present in ruminants at low levels. The main fatty acids in red meat are C18:0, C14:0, and C16:0, as saturated fatty acids (SFA), C18:1 n-9 and C16:1 n-7, as monounsaturated fatty acids (MUSFA), and C18:3 n-3, C18:2 n-6, and C20:4 n-6, as polyunsaturated fatty acid (PUFA) (44, 45). Therefore, researchers are trying to discover a way to improve meat by increasing its content of unsaturated fats compared to

saturated fat, which is harmful to human health; for example, rosemary, anise, cumin, *Nigella sativa* and turmeric (46) herbal plants to the animals feed (35). Discovered that the cholesterol content in meat goats fed naturally produced lovastatin [incubated Palm kernel cake for 10 days with 40 mL of *Aspergillus terries* spore suspension as described by (47) and modified for PKC by (48) was decreased positively ($P < 0.05$) compared to the control. As a result, it is suggested that lovastatin dietary supplementation may be a viable feeding technique for generating less cholesterol in meat which could boost consumers' status of health. Moreover, (4) observed that the major fatty acids in the muscles were C18:1n-9, C18:0 and C16:0. Similar findings were observed in beef (48), mutton (50) and chevon (51). (Error! Reference source not found.) confirmed that dietary supplementation of thyme leaves in lambs feed led to decrease in the percentage of saturation index (S/P), SFA, and thrombogenic (IT) indices and atherogenic, while importance rises in MUFA and PUFA levels have been observed in fresh meat of lamb. This effect generally was more pronounced at the higher thyme leaves level 7.5 percent. On the other hand, meat fatty acids profile was not affected by dietary coriander seed up to 5% in the diets ($P \geq 0.05$) (53).

Meat Eating Quality Influence by Herbal Plant

Eating quality of meat is mostly determined by sensory characteristics. The inability to satisfy and anticipate consumer demands regarding sensory attributes lead to economic loss by the producer. Meat sensory traits are affected by several factors which occur at pre and post slaughter stages. Modification of these factors could more promote quality properties (54). Meat eating quality is influenced by a number of factors like pH of meat, color, water holding capacity, tenderness, lipid and oxidation and flavor, the latter being composed in turn of the two distinct factors taste and odor (Error! Reference source not found., 55).

Meat pH

The postmortem acidification of muscle measured in terms of pH is one of the underlying biochemical changes in muscle-to-meat conversion (56). The pH value has a significant impact on color, storage time, texture in meat and its products; thus, it is one of the most essential attributes within the production of meat (57, 58). The pH value of meat determines its environmental microbial balance where a low pH has a bacteriostatic effect on the meat. Frequently, during the storage the changes of pH occur of raw meat are related with nitrogen compounds or structure of lactic acid by bacteria causing putrefaction and acidification; therefore, the lower glycogen content at slaughter may result in a reduced glycolysis rate, and thus slower accumulation of lactic acid and eventually slower rate of pH decline during the postmortem period (57, 58). Major factors influencing meat pH in ruminants are the

amount of muscle glycogen prior to slaughter (59). Diets can affect muscle glycogen in ruminants (60). This was attributed to the utilization of dietary energy or pre-existing reaction to the stress of slaughter, muscle fiber types (red and white) or activity of specific (fast and slow) muscle enzymes including SOD and GSH-Pxin the animals (61). Generally, the pH in the muscle decreases from pH 7.0 upon slaughter to approximately pH 5.3- 5.8 (56) 24 h after slaughter and this range is considered to be normal (62). The effects of dietary medicinal plants on muscle pH in ruminants varied between studies. (63) Confirmed that the female lamb meat pH is higher after inclusion of dietary oregano essential oil. Besides, dietary quercetin in Hanwoo cattle increased the loin pH (64). In comparison, (65) found that both storage period and lamb diet, no mean pH variations are absorbed, staying constant during storage. Similarly, dietary quercetin had no effect on muscle pH in Hanwoo beef (66). Also, (Error! Reference source not found.) indicated that thyme leaves feeding did not significantly affect ($P \geq 0.05$) moisture and pH values. Moreover, (67) observed that storage affect glycogen content and pH muscle have been affected. The glycogen and pH in muscle at day 0 was higher than on day 7 and day 14. Postmortem glycolysis may be the explanation for this result. The main change in the muscle-to-meat conversion is the conversion of muscle glycogen into lactic acid, which induces muscle acidification. The concentration of muscle glycogen at the time of slaughter is affected by dietary energy and antemortem stress (37). Similarly, (24) reported that no significant effect ($P \geq 0.05$) indifferent lamb's muscles fed *Rosmarinus officinalis* leaves or *Nigella sativa* seeds. The pH muscles and glycogen were similarity in glycolysis at days 7 and 14 is a sign that the postmortem was done in day one. In conclusion that dietary supplementation and Postmortem storage may be significantly influenced muscle pH in ruminant.

Color

Color of meat one of the most reliable criterions and an important quality parameter, in which consumer can use to judge the acceptability of meat at purchase (68). The major factors of determining meat color are the amount and chemical state of myoglobin, type of myoglobin molecule and the physicochemical conditions of other components in meat such as pH value and postmortem ageing. The aforementioned factors are in turn influenced by the age and sex of animal, intramuscular fat, moisture content, pre-slaughtering conditions and treatments, processing (56) and storage time (51). Dietary supplementation of herbs can influence meat color in ruminants. Dietary supplementation of oregano essential oil improved redness and reduced the formation of metmyoglobin in lambs (68). Similarly, dietary supplementation of *Moringaoleifera* leaves (69), and turmeric leaves (70) improved redness in different

muscles in chevon. Contrarily, dietary quercetin had no effect on color coordinates in beef (64). Nonetheless, (71) reported that meat color parameters are not affected by rosemary essential oils administration ($P \geq 0.05$). Some authors (67) described that adding different parts of *Andrographis Paniculate* in goat's diets on the lightness and yellowness had no significant effect on *Longissimus thoracis et lumborum* muscle. Besides, redness values were greater in the (*Longissimus thoracis et lumborum*) muscle of goats fed diet supplemented with *Andrographis Paniculate* leaves or *Andrographis Paniculate* whole plant than those in control group. This finding could be attributed to the phytochemicals that exhibited antioxidant characteristics in the dietary supplement which decreased myoglobin oxidation in ruminant's meat. (72) reported that diet supplemented with quercetin had significantly improved in redness in muscles of Merino lamb. In contrast, (73) observed that non-significantly effects on color in animals that fed supplemented diet with rosemary extract and green tea catechins in beef. Over chill storage, redness values reduced whereas lightness heightened. These observations were indicative on heightened the oxidation of myoglobin and formation of metmyoglobin (37). Aged for 7 days, similar observations were reported in lambs fed herbal plants (24). Based, (74) showed that increased redness value ($P \leq 0.01$) and reduced yellow appearance and lightness values ($P \leq 0.05$) of both *semimembranosus* (SM) and *longissimus thoracis et lumborum* (LTL) muscles of lambs infected with gastrointestinal nematodes fed white-rot fungi-pretreated corn straw. Dietary coriander seeds made a significant different for lightness and yellow appearance parameters. Hence, by adding coriander seeds, lightness and yellow appearance parameters decreased. There was not any significant difference for redness parameter ($P \geq 0.05$) in Sanjabi lambs was seen (53). The most significant parameters of colors were redness to evaluation oxidation of meat (51, 75). With postmortem storage days, the value of lightness had a positive correlation, whereas the value of redness had a negative correlation which was reported by (76). This indicated that over the period of storage, samples have become less red and lighter (75). Thus, ageing Enhanced lightness of meat.

Water Holding Capacity (WHC)

Weight loss and cook yield, sensory characteristics as well as visual acceptability of the meat and meat products were determined by Water-holding capacity (77) during application of external forces, such as heating, cutting, pressing or grinding. Because of reduced weight loss during cutting and storage, and improved ability of the meat to retain water during processing, superior water-holding capacity (WHC) is one of the most important quality parameters of meat. WHC can also have an effect on the quality of meat consumed (78). Water holding capacity in meat can be expressed as drip loss and cooking loss.

Drip Loss

Drip loss, as an indicator of the meat WHC, is one of the important parameters for both the meat industry and the consumer to evaluate meat quality. For the meat industry, drip loss of meat is known to influence its technological quality (such as processing yield) and economic benefits (79). For the consumer, higher drip loss reduces the tenderness, juiciness and sensory quality of the meat, causing lower consumer acceptance (80, 81). Drip loss can make up about 1-3% loss in weight when meat is cut into chops and can be up to 10% in pale soft and exudative (PSE) meat (56, 82). Moreover, drip loss induces great loss of nutrients through passage of particles with the water and loss of nutrients. The major physiological and structural postmortem changes associated with drip loss are post slaughter decrease of myofibrillar lattice postmortem in shrinkage and temperature. It is due to decrease cross-bridges of actomyosin and pH, myofibrillar contraction and shrinkage; and denaturation of myosin; structural changes in muscle fiber leading to an increase in extra cellular space, and changes in cell and basement membrane water permeability (83). (84) indicated that drip loss of longissimus thoracis muscle increased with storage days ($P \leq 0.05$) while after storage for 7 days, significantly lower drip loss of meat was found in fed the lycopene-supplemented diet ($P \leq 0.05$). Thus, studies confirmed that with storage continued, the drip loss has been increased. These results may be the proteins weakening of myofibrillar by enzymes of proteolytic through postmortem, thus affecting the capacity of myofibrillar proteins to retain water (57, 54). Decrease of Water-holding capacity of meat has also linked with Increase in oxidation of protein.

Cooking Loss

Cooking loss is described as the shrinkage of meat as a result water loss and soluble substances from meat due to cooking (85). Cooking loss is very essential for its contribution to the physical appealing of meat to the consumer for acceptance in terms of flavor, size, and tenderness. The age, sex and breed of an animal, time of cooking, rate of cooking, type of the muscles, storage process and days of storage can influence cooking loss (86). The term "cooking loss" is affected by the quality of the raw meat, end-point center temperature, cooking procedure and time. The effect of cooking procedure is lost as the center temperature reaches 80 °C but there is significant though small effect of raw meat quality because of the juiciness of meat (87). The effects of dietary medicinal herbs on water holding capacity of ruminant meat varied between studies. Dietary quercetin did not affect significantly of cooking and drip loss in cattle (57). However, adding different parts of *Andrographis paniculata* to the goats' diets reduced drip or cooking loss in chevon; this could be due to the reduction in the

overlapping of myofibrillar proteins (actin and myosin) during storage (88, 67). In addition, (89) reported that no significantly affected variations in cooking loss in meat of pig fed diet supplemented with *Houttuynia cordata*, *Houttuynia cordata* and *Taraxacum officinale* extract powder. Supplementation diets with turmeric powder did not effect on cooking and drip loss as well as the moisture and drip loss affected significantly on the storage time (90). The meat aged (1, 7 or 14 days) had no effect ($P \geq 0.05$) on the cooking losses for beef from heifers supplemented with or without essential oils (clove and/or rosemary essential oil) and/ or active principal blend (eugenol, thymol, and vanillin) (91).

Tenderness

Tenderness of the meat is generally recognized as one of the most significant palatability traits for consumer preference and eating quality. Tenderness has traditionally been the subject of research on consumers demand for red meat, as it is a significant determinant of consumers' satisfaction and the probability of purchase (92). It is a multi-factorial sensory attributes, specified by the complex interaction between antemortem and postmortem factors. These factors range from practices used through the animal production chain, such as the animal husbandry, lair age, feeding resources, genetics transport, exsanguination and stunning via meat storage methods and procedures of cooking for the final product (93). The relative proportions, structure, and composition of intramuscular connective tissue (IMCT) in part, account for the relative toughness of meat (94). The IMCT varies depending on the muscle, animal age, breed, and species. Previous reviews have described the composition and structure of IMCT. Three layers of IMCT maintain the structural integrity of muscle fibers. These include the endomysium, which surrounds individual skeletal muscle fibers, the perimysium, which bundles group of muscle fibers and the epimysium, which wraps the whole muscle. Collagen is the main component of IMCT and more than 90% of intramuscular collagen is located in the perimysium (94-96). Yusuf et al. (2018) (67) observed that dietary supplementation of *Andrographis paniculata* leaves enhanced the tenderness of different muscles in goats. Dietary quercetin did not affect loin tenderness in Hanwoo cattle (64). It was also seen that adding white-rot fungi-pretreated corn straw to the diets has been improved tenderness of lamb meat (74). (67) reported that shear force values decreased significantly ($P < 0.05$) in meat of goats fed diet supplemented with various parts of *Andrographis paniculata* (APL) or *Andrographis paniculata* whole plant (APW) because Phenolic compounds could assist calpain activities through conditioning thereby endorsing tenderness of meat. Over chill storage, the shear force values of longissimus thoracis et lumborum (LTL) muscle was decrease in goats. This result may be due to the degradation proteins of myofibrillar through conditioning of postmortem. In

addition, the supplementation of carnosol acid in diet, reduced shear force values in Merino lambs (97). Finally, (35) showed that increasing lovastatin supplementation in the feed with the decreased shear force values ($P < 0.05$).

Lipid Oxidation

Major purpose by utilizing antioxidants in the meat and meat products for decrease influence the oxidation of lipid to improvement the shelf life and quality of product (98) during mechanisms of biochemical to breaking chain reaction, preventing chain inhibition, decomposing peroxides, binding chain initiating catalysts and reducing localized oxygen concentrations (99). There is a renewed interest in the use of natural antioxidants in foods (100). Plants produce phytochemicals for normal growth and resistance against pathogens and diseases (14) and the phytochemical have antioxidant and antimicrobial properties that can be utilized in food preservation. Natural antioxidants like medicinal plants in foods are favored due to the high cost, scarcity, and toxicity of synthetic antioxidants (101). Oxidation of lipids during the processing and storage of meat is major cause of quality deterioration (102). As well as heme pigments, metal catalyst, and myriad oxidizing agents in the muscle tissue are affected by the presence of unsaturated lipids and makes it susceptible to spoilage of oxidative (103). Quality deterioration in oxidized meat products is characterized by loss of nutrients, flavor deterioration and discoloration (104), and possible formation of toxic compounds that could have detrimental effects on consumers (105, 106). Dietary intervention remains the most effective strategy to modify the oxidative stability of intact muscle foods, where the use of exogenous antioxidant may be difficult or practically impossible (90). In addition, the effective method of application depends on the nature of antioxidants (103). For example, the scientific literature is replete with studies examining the effects of dietary supplementation of medicinal herbs as nature of antioxidants on the oxidative stability of ruminant meat. Thus, dietary supplementation with rosemary extract in sheep inhibited lipid oxidation significantly ($P < 0.05$) in mutton (107, Error! Reference source not found.). Dietary quercetin did not affect thiobarbituric acid reactive substances (TBARS) value in the longissimus dorsi muscle in Holstein-Friesian (64) and Hanwoo (66) and cattle. (69) showed that the lipid oxidation of longissimus thoracis et lumborum muscles decreased significantly ($P < 0.05$) in goats fed *Moringa oleifera* leaves. Nonetheless, there were significantly ($P < 0.05$) differences among the treatments during a storage time. Most significantly values of TBARS discovered in all muscles were 0.13–0.26 mg malondialdehyde (MDA)/kg meat were below the 0.5 mg MDA/kg meat. Garba et al. (2019) (35) reported that extremely low oxidation of lipid occurred in the meat, even at 7 days of storage, could be due to oxidation in meat happened 25 days later of storage. It was suggested that

Moringa oleifera leaf could be a potential source of compounds with strong antioxidant potential (108).

Flavor

Feeding is the main trait impact the flavor of the meat. Moreover, flavor is a vital element in consumers' palatability and acceptability of meat. Several factors impact meat eating quality. The major factor is 'flavor'. The most important precursor components in meat are low-molecular-weight water-soluble compounds and fat, which are responsible for meat flavor (Error! Reference source not found.). The relationship between unsaturated fatty acids (18:3, 18:2, 18:1, 18:0, 16:1, and 14:1) desired beef taste and fatty acids studied by (109). Species flavor, on the other hand, is primarily determined by ketones, saturated aldehydes, fatty acids, and unsaturated aldehydes, all of which play a significant role in meat flavor (24). (110) showed that fattening lambs fed diet with rosemary extracts was successful in delaying the flavor degradation of cooked and chilled lamb patties exposed to heavy oxidizing conditions, which are common in meat-serving systems. In the processed lamb meat, the muscle-deposited rosemary diterpenes and/or their metabolites acted as endogenous antioxidants. Thus, in cooked and chilled lamb, flavor stabilization during rosemary-based feed has been developed (53).

In conclusion, ruminant meat plays a major role in meeting consumer demands in maintaining providing of quality proteins. Studies with the use of herbal plants are relevant to livestock, seeking not only to reduce production costs, but also to improve the quality of the final product that reaches the consumer. Thus, all agents in the meat chain should be involved in order to obtain a high-quality ruminant meat product in terms of durability and acceptability. Feed type, on the other hand, has a significant impact on meat quality but a minor impact on carcass quality, affecting primarily conformation and fat content.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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استخدام النباتات العشبية في علائق المجترات: التأثير على جودة اللحوم: مراجعة علمية

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الخلاصة

تمت مراجعة استخدام النباتات العشبية كمضافات علفية في تغذية الحيوانات لتعزيز كفاءة معالجة اللحوم وجودتها. ان مطلب المستهلكين اليوم هو السلامة والقيمة الغذائية والنكهة والتوحيد وتنوع اللحوم والمظهر الجيد لمنتجات اللحوم. وبالتالي، لتلبية طلب المستهلكين، يجب تحسين البحث لتطوير المنتج. أثبتت الدراسات أن استخدام الأعشاب والتوابل ومستخلصاتها من أهم الإضافات المعتمدة في صناعة اللحوم لتحسين صفاتها النوعية. في هذه المقالة، مراجعة أحدث البحوث حول استخدام المركبات النشطة بيولوجيًا في النباتات العشبية لتقييم عدد من السمات المتعلقة بجودة اللحوم، بما في ذلك: محتوى الدهون وتوزيعها، ومحتوى الماء، والقدرة على الاحتفاظ بالماء، ومحتوى الكولاجين، والأس الهيدروجيني واللون والطراوة وأكسدة الدهون والنكهة.

الكلمات المفتاحية: المجترات، النباتات العشبية، أكسدة الدهون، الأس الهيدروجيني في اللحم، جودة اللحوم