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ANTIOXIDANTS IN POULTRY MEAT PRODUCTS: QUALITY, SAFETY AND HEALTH ASPECTS

S u m m a r y

Background. There are projections that the global population might increase to around 10 billion people by 2050. This will lead to an increase in total global food demand of 35% to 56% between 2010 and 2050. Therefore, one of food producers' main goals should be to increase the quality of food products. Furthermore, current consumer income fluctuations may affect changes in the types of food purchased. The use of natural antioxidants may satisfy the growing interest of poultry consumers. In numerous literature studies, there is a trend toward utilizing natural antioxidants as replacements for synthetic ones. The aim of this study is to provide a review of recent studies which describe the use of natural antioxidants in poultry meat production and their effect on final product quality.

Results and conclusion. This review presents an overview of the latest advances in the application of natural antioxidant compounds in poultry meat and processed meat products to improve their quality and shelf-life. In human nutrition and health, antioxidant nutrition remains the topic of a continuing debate. Natural antioxidants efficiently increase the shelf-life of poultry products. Lipid peroxidation decreases in meat when natural antioxidants are supplemented in feed, and the use of natural antioxidants could be an effective strategy to maintain the optimal quality of processed poultry products.

Keywords: natural antioxidants, quality of poultry products, food demand

Introduction

Poultry meat is a popular source of animal protein. The European Union is one of the largest producers of poultry meat and is a net exporter of poultry products. Annual EU production is around 13.4 million tones [48]. A clear increasing tendency was observed in the production of poultry meat in Poland in the years 2001 ÷ 2019. An annual

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increase in production in this period was on average 110.5 thousand tones, i.e. production grew at the rate of 7.4 % p.a. This increase in the production of poultry in Poland resulted in an increase in the country's share of both world and EU production. Poland's share in the world production of poultry increased from 1 % in 2001 to 2.1 % in 2019, and in terms of EU-27 production from 7.2 % in 2001 to 20.6 % in 2019. Poland has one of the highest consumptions of poultry meat in the EU [35]. In the EU, poultry consumption in Poland was the greatest after Portugal, Spain, Ireland and Hungary in 2018 [52]. In addition, the Republic of Croatia has also seen an increase in poultry production; in 2020, around 13 million poultry were recorded [51]. According to Kralik et al. [15], poultry products are widely consumed by Croatian consumers because they are nutritionally valuable and the price of such products is relatively low. However, the possibility of an increase in the consumption of poultry meat in Poland in the coming years will be insignificant. This is also confirmed by European Commission projections. These show that increases in the consumption of poultry meat in the EU will gradually slow. In these conditions, the possibility of developing poultry meat production in Poland will depend mainly on foreign demand, i.e. from the EU and other countries. Therefore, competitiveness based on price and product quality will be of decisive importance in the development of Polish exports of poultry products [35]. Consumers pay great attention to the quality of poultry products and, according to Zdanowska et al. [47], improvement in meat quality is reflected in higher sensory scores for the meat. Indicators of meat quality depend on muscle biochemistry and modern processing technologies. One approach to increasing meat quality is to add antioxidants either during the period of feeding or directly during processing. The aim of this work is to provide a review of recent studies which describe the use of natural antioxidants in poultry meat production and their effect on final product quality.

Antioxidants

Antioxidants are compounds that are capable of donating hydrogen radicals. They can pair with other available free radicals to prevent propagation reactions during oxidation processes [4]. This effectively minimizes rancidity and suppresses lipid oxidation, without any damage to sensory or nutritional properties, resulting in maintenance of the quality of meat products. In live muscle, there are intrinsic factors that can prevent lipid oxidation. These factors are often lost after slaughtering during the processing or storage of meat products, necessitating further supplementation with extrinsic antioxidants. Antioxidants can be divided into two categories: primary and secondary [5]. Primary antioxidants react with free radicals directly, which can lead to the production of a more stable product. Hence, they diminish oxidative chain reactions. On the other hand, secondary antioxidants limit the oxidative process by various complex mechanisms, such as the chelation of metal ions, UV radiation absorption, oxygen depletion, inhibition of enzymes, and breakage of hydroperoxide. Many antioxidants belong to both categories [16]. Also, antioxidants can be classified as natural or synthetic [26]. Several studies have indicated possible harmful effects that may be related to the consumption of synthetic antioxidants [2, 4]. Natural antioxidants have generated growing interest owing to their roles in the protection of poultry meat products against oxidation. They can be added to either meat or meat products during processing to inhibit oxidation spoilage.

Natural antioxidants in poultry production

Antioxidants in animal feed can play an important role in the balance between antioxidants and pro-oxidants in tissue, and this is reflected in the quality of meat. The process of metabolizing nutrients invariably leads to the production of undesirable compounds, including pro-oxidative free radicals. It has been shown that cellular membranes, as well as DNA, are particularly vulnerable to free radical damage, and this may lead to severe neurological damage or genetic malfunction [19]. It is worth noting that the organism contains a great number of defense mechanisms against free radicals, among which are antioxidative enzymes, such as superoxide dismutase, glutathione peroxidase, and coenzyme Q10 (CoQ). These molecules donate electrons to scavenging free radicals. The need for this number of dedicated antioxidants is the fact that antioxidants are not interchangeable; this applies to those provided through feed ingredients [49].

Antioxidant systems, which are defense mechanisms against free radicals, have been developed and shaped, and they are responsible for the survival of higher eukaryotes in an oxygenated atmosphere. They include antioxidants from the fat-soluble group, such as vitamin E, certain carotenoids, CoQ, and the water-soluble group including ascorbic acid, glutathione, carnitine, taurine and antioxidant enzymes, such as superoxide dismutase, glutathione peroxidase and other selenoproteins, catalase, glutathione reductase or glutathione transferase. In general, the antioxidant system includes three major lines of antioxidant defense mechanism [38, 39]. The first line of defense starts from superoxide dismutase (SOD), which is responsible for the removal of superoxide radicals [39]. Hydroperoxide (H_2O_2), which is the product of SOD reactions, is still toxic and must be removed from the cell. Therefore, glutathione peroxidase and catalase are responsible for the detoxification of H_2O_2 by converting it to H_2O, and this is the first level of the antioxidant defense system in tissue. For tissue oxidation stability, it is important to keep transition metal bound to proteins, and therefore metal-binding proteins are also an important part of the first line of the antioxidant defense system [39]. Such antioxidants as carnitine, taurine and coenzyme Q10, which are involved in the maintenance of mitochondrial integrity, are also important elements of the first level of antioxidant defense. Also, selenoproteins regulating the redox balance of the cell can be a part of the first level of the antioxidant defense system [40]. Due to the great number of free radicals produced in biological systems, the first line of the antioxidant defense network is not able to stop the process of free radical production. Therefore, the second level of defense includes vitamins E and C, carotenoids, glutathione system, thioredoxin system, some selenoproteins, carnitine, betaine, taurine and others which can be classified as chain-breaking antioxidants. This second level of defense also includes various mechanisms. For instance, after reacting with a free radical, vitamin E is oxidized and loses its antioxidant protective activity. However, due to the presence of ascorbic acid, it can be converted back to a reduced active form, but the ascorbic acid is oxidized. Further, ascorbic acid is reduced by thioredoxin reductases (TR), and the system of recycling takes reducing equivalents from NADPH synthesized in the pentose phosphate cycle. This process connects antioxidant defense to the carbohydrate metabolism [37, 38]. To increase the protection of some molecules – including lipids, proteins and DNA – there is a third level of antioxidant defense, which includes heat shock proteins, methionine sulfoxide reductase, DNA repair enzymes and phospholipases [53]. To enhance the natural antioxidant system and the quality of meat, the addition of antioxidants to feed is being investigated. Table 1 shows data relating to the influence of dietary antioxidants on the quality and storage stability of poultry products.

In addition, there are more than 8,000 compounds possessing antioxidant and prooxidant properties, which could be classified as polyphenols. The main problem with these compounds is their low bioavailability. Their concentration in the diet can be very high, but their levels in the blood are low, and their concentration in target tissues (liver, muscles, egg yolk) is usually negligible [39]. For instance, Sharifian et al. (2019) found that pomegranate peel linearly reduced MDA concentration in breast muscle during refrigerated storage [33]. Saleh et al. (2017) observed that the inclusion of pomegranate peel at 100, 200 and 300 mg/kg significantly increased total phenolic contents and antioxidant activity in the breast meat of broiler chickens [29]. Table 2 shows data relating to natural sources of polyphenolic antioxidants used as feed additives and their effects found in final products.

Natural antioxidants in processed poultry meat products

Lipid and protein oxidation processes are the second important cause of spoilage of meat products [22]. Lipid peroxidation in poultry meat products occurs primarily through the radical chain reaction mechanism. An alternative pathway may be provided via a singlet oxygen reaction. The muscle proteins are also susceptible to both radical and non-radical ROS [45]. Protein oxidation is initiated by myoglobin, metallic catalysts or oxidizing lipids, which react with side chains of amino acids and cause protein

Table 1. The influence of selected dietary antioxidants on the quality and storage stability of poultry products.

Tabela 1. Wpływ suplementacji wybranych naturalnych przeciwutleniaczy na jakość i stabilność przechowywania produktów drobiowych.

Antioxidant Przeciwutleniacz	Product / Produkt	Effect / Wpływ	References Literatura
Vitamin E / Witamina E 0 ÷ 120 mg/kg	Chicken breast meat Mięsień piersiowy kurcząt	85 % lipid oxidation reduction 85 % redukcja utleniania lipidów	Lin et al. 1989 [18]
	Chicken thigh meat / Mięso udowe kurcząt	69 % lipid oxidation reduction 69 % redukcja utleniania lipidów	
Vitamin E / Witamina E 20; 300; 600 mg/kg	Turkey breast burgers Burgery z mięśnia piersiowego indyka (1 % NaCl)	lipid oxidation inhibition hamowanie utleniania lipidów 29 % reduction/ 29% redukcja 90 % reduction/ 90 % redukcja	Wen et al. 1996 [43]
Vitamin E / Witamina E 30; 200 mg/kg	Chicken, raw thigh patties Pasztet z mięsa udowego kurcząt niepoddany obróbce termicznej	66 % lipid oxidation reduction 66 % redukcja utleniania lipidów	
Vitamin E / Witamina E 0; 100; 500 mg/kg	Chicken thigh, precooked meat Mięso udowe kurcząt, poddane wstępnej obróbce termicznej	lipid oxidation reduction redukcja utleniania lipidów 39 %; 42 %	Jensen et al. 1995 [13]
β-carotene and vitamin E β-karoten i witamina E	Leg meat of broilers fed on different fats Mięso z nóg brojlerów żywionych paszą z dodatkiem wybranych tłuszczy	Beta-carotene at 15 mg/kg acted as an antioxidant in fresh and cooked meat, in stored meat, however, worsened the oxidative stability in stored meat at 50 mg/kg / Beta-karoten w dawce 15 mg/kg wykazywał działanie przeciwutleniające w próbach z mięsa świeżego i gotowanego, natomiast w próbach po przechowywaniu pogarszał stabilność oksydacyjną przy dawce 50 mg/kg	Ruiz et al. 1999 [27]
β-carotene β-karoten	Broiler breast meat Mięsień piersiowy brojlerów	In the breast meat of broilers, β-carotene in the diet tended to limit the vitamin E accumulation. The authors concluded that β-carotene can act as both an antioxidant and a pro-oxidant depending on the dose Obecność β-karotenu w diecie ograniczała akumulację witaminy E w mięśniach piersiowych brojlerów. Autorzy wskazali, że	Carreras et al. 2004 [6]

		β-karoten może działać zarówno jako przeciwutleniacz, jak i czynnik utleniający w zależności od dawki	
Lycopene (0 and 75 mg/kg) and vitamin E (0, 50 and 100 mg/kg) Likopen (0 i 75 mg/kg) i witamina E (0, 50 i 100 mg/kg).	Chicken leg meat Mięso nóg kurcząt	The synergism of both antioxidants improved the growth performance and oxidative stability of meat in fresh leg meat and in meat that had been stored for 3 days. In addition, lycopene reduced the cholesterol content of leg meat Synergizm obu przeciwutleniaczy poprawił wskaźniki wzrostu kurcząt i stabilność oksydacyjną mięsa w próbach ze świeżego mięsa udowego przechowywanego przez 3 dni. Ponadto dodatek likopenu w diecie wpłynął na obniżenie zawartości cholesterolu w mięsie nóg	Engelmaierová et. al. 2011 [9]
Se alone or in a combination with vitamin E (α-tocopheryl acetate) Se sam lub w połączeniu z witaminą E (octan α-tokoferylu)	Chicken meat Mięso kurcząt	Reported as the most efficient way of improving the oxidative stability of the meat during storage Wskazany jako najskuteczniejszy sposób poprawy stabilności oksydacyjnej mięsa podczas przechowywania.	Perez et al. 2010 [24]
Se	Chicken meat Mięso kurcząt	Improves its functional properties Poprawa właściwości funkcjonalnych mięsa kurcząt	Konieczka et al. 2015 [14]
Se yeast together with oils (rapeseed or linseed) Drożdże selenowe połączone z olejami (rzepakowym lub lnianym)	Chicken meat Mięso kurcząt	Meat rich in Se and polyunsaturated fatty acids (eicosapentaenoic and docosapentaenoic) Mięso wzbogacone w Se i wielonienasycone kwasy tłuszczowe (kwas eikozapentaenowy i dokozapentaenowy)	Haug et al. 2007 [12]
Vitamin E, Vitamin C and Se Witamina E, Witamina C i Se	Chicken meat Mięso kurcząt	Decreased the malondialdehyde (MDA) content in breast meat Obniżenie zawartość aldehydu dimalonowego (MDA) w mięśniu piersiowym	Pečjak et al. 2022 [23]
Bioactive peptides (derived from fish waste) Bioaktywne peptydy (pochodzące z odpadów rybnych)	Nuggets prepared from breast meat Nugetsy przygotowane z mięśnia piersiowego brojlerów	Effect on antioxidant status such as TPC, DPPH$^{\bullet}$ scavenging activity, and FRAP of broiler breast meat Wpływ na status oksydacyjny mięśnia piersiowego brojlerów wyrażony jako TPC, zdolność do zmiatania kationorodnika DPPH• i zdolność redukowania jonów żelaza FRAP	Aslam et al. 2020 [3]

Table 2. Natural sources of polyphenolic antioxidants used as feed additives and main effects found in final products.

Tabela 2. Naturalne źródła przeciwutleniaczy polifenolowych stosowanych jako dodatki paszowe i ich efekty na jakość mięsnych produktów drobiowych.

Poultry product Produkt drobiowy	Antioxidant source Źródło przeciwutleniaczy	Dose Dawka	Effect / Wpływ	References Literatura
Raw and cooked breast meat patties Surowy i poddany obróbce termicznej pasztet z mięśnia piersiowego	Grape pomace Wytłoki winogronowe	60 g/kg	Inhibitory effect on lipid oxidation; increase in radical scavenging capacity. / Redukcja utlenianie lipidów; wzrost zdolności wychwytywania rodników.	Sáyago-Ayerdi et al. 2009 [32]
Breast and thigh meats Mięsień piersiowy i udowy	Dry rosemary (*Rosmarinus officinalis* L.) leaves (R) and rosemary essential oil (RO) Suche liście rozmarynu (*Rosmarinus officinalis* L.) (R) i olejek eteryczny z rozmarynu (RO)	11.5 g/kg (R) 0.2 g/kg (RO)	Inhibitory effect on lipid oxidation (decreased MDA values) decrease in pH value, negative effect on the sensory analysis (taste, odor, and overall acceptability) Hamujący wpływ na utlenianie lipidów (obniżone ilości MDA), spadek wartości pH, negatywny wpływ na analizę sensoryczną (smak, zapach i ogólną akceptowalność).	Yesilbag et al. 2011 [46]
Minced thigh meat Mielone mięso udowe kurcząt	Pomegranate (*Punica granatum* L.) pomace extract (PPE) and pomegranate pomace (PP) Ekstrakt z wytłoków granatu (*Punica granatum* L.) (PPE) i wytłoków granatu (PP)	0.3 g/kg (PPE) 3 g/kg (PP)	Inhibitory effect on lipid oxidation (decreased TBARS values); increase in radical scavenging capacity; decrease of n-6/n-3 ratio Hamujący wpływ na utlenianie lipidów (obniżone zawartości związków TBARS); wzrost zdolności wychwytywania wolnych rodników; obniżenie stosunku kwasów tłuszczowych n-6/n-3.	Saleh et al. 2018 [29]

Breast muscle, fat, liver Mięsień piersiowy, tłuszcz, wątroba kurczat	Tea polyphenols Polifenole herbaty	15 g/kg	Inhibitory effect on oxidative stress induced by corticosterone; reduction of abdominal fat content, plasma triglyceride concentration and liver weight Hamujący wpływ na stres oksydacyjny wywołany przez kortykosteron; obniżenie ilości tłuszczu sadełkowego, stężenia trójglicerydów w osoczu i masy wątroby.	Eid et al.2003 [8]
Broiler meat Mięso z brojlerów	Quercetin Kwercetyna	0.5 and 1 g/kg	It prolongs meat shelf-life through reduced rate of lipid peroxidation Wydłuża okres przydatności do spożycia mięsa poprzez spowolnienie peroksydacji lipidów.	Goliomytis et al. 2014 [11]
Chicken breast meat Mięsień piersiowy kurcząt	Grape pomace Wytłoki winogronowe	7.5 and 10 g/kg	Decline in MDA in breast meat of broiler chickens Obniżenie zawartości MDA w mięsie piersiowym kurcząt brojlerów.	Aditya et al., 2018 [1]
Chicken meat Mięso kurcząt	Grape seed extract Ekstrakt z pestek winogron	125,250, 500, 1000 and 2000 mg/kg	Significant decrease in MDA level in meat tissue Znaczący spadek zawarości MDA w tkance mięśniowej.	Farahat et al. 2016 [10]

Table 3. The effects of selected antioxidants on poultry product quality.
Tabela 3. Wpływ wybranych antyoksydantów na jakość produktów drobiowych

Poultry product Produkt drobiowy	Antioxidant Przeciwutleniacz	Effect / Wpływ	References Literatura
Raw and cooked processed chicken meat stored at -18 °C for nine months Surowe i poddane obróbce termicznej mięso kurcząt przechowywane w temperaturze -18 °C przez dziewięć miesięcy.	Grape seed and peel extracts Ekstrakty z pestek i skórek winogron	Significant reduction in lipid oxidation Znaczące ograniczenie utleniania lipidów	Selani et al. 2011 [34]
Raw and cooked chicken breast hamburger Surowy i poddany obróbce hamburger z mięsa piersiowego kurcząt	Grape antioxidant dietary fiber Przeciwutleniacz z winogron: błonnik pokarmowy	Improvement in the oxidative status Poprawa statusu oksydacyjnego.	Sáyago-Ayerdi et al. 2009 [31]
Cooked chicken patties Pasztety z mięsa kurcząt poddane obróbce termicznej	Pomegranate peel Skórka granatu	Thiobarbituric acid reactive substances (TBARS) were significantly lower in the patties treated with BHT, pomegranate juice and pomegranate peel Odnotowano obniżenie ilości substancji TBARS w próbach pasztetów z dodatkiem BHT, soku z granatów i skórek granatu	Naveena et al. 2008 [22]
Irradiated (3 kGy) turkey breast rolls Poddane napromieniowaniu (3 kGy) roladki z mięśnia piersiowego indyka	Plum extract / Ekstrakt ze śliwki (California Dried Plum Board, Sunsweet Growers Inc., Yuba City, CA)	Reduction of lipid oxidation Ograniczenie utleniania lipidów.	Lee et al. 2005 [17]
Mechanically separated turkey Mięso oddzielone mechanicznie z indyka	The cranberry extract Ekstrakt z żurawiny	Lipid oxidation inhibition Ograniczenie utleniania lipidów	Raghavan et al. 2007 [25]

carbonylation [21]. Moreover, the oxidation of myoglobin (Mb) could be affected by lipid oxidation and other factors, such as pH, MetMb reduction and temperature. The stability of Mb directly determines the color and shelf-life of meat and meat products [44].

Food additives used as antioxidants should not present negative effects on product parameters, such as odor, and flavor, and color. On the other hand, such additives should be economical, effective at low concentrations, stable during processing and storage, compatible with foods and easily applied [38]. In animal products, there is an oxidative stability difference between the type of raw material used in production depending on animal species and muscle types. In addition, there are some endogenous factors that control oxidation, such as the presence of active antioxidants and oxygen deactivating enzymes, and on the other hand, pro-oxidants, such as iron and ascorbic acid. The stability of products is dependent on the balance between all the aforementioned factors. Additionally, within a species such as poultry, chicken meat is more stable than turkey meat. Moreover, white meat is more durable against oxidation than dark meat [38]. Herbs and spices present the highest antioxidant contents among all the animal- and non–animal-based foods [7]. Table 3 summarizes the effects of selected antioxidants on poultry product quality.

Health and safety aspects

Today's health problems are frequently complex, multifactorial, transboundary and cross-species, and require a cross-disciplinary approach, such as One Health, which cuts across animal, human and environmental health boundaries. This concept recognizes that people's health is closely connected with the health of animals [50]. The term 'One Health' was first used in 2003 ÷ 2004, and was associated with the SARS outbreak in early 2003, and subsequently, with the spread of H5N1 avian influenza, and the series of strategic goals known as the 'Manhattan Principles' elaborated at a meeting of the Wildlife Conservation Society in 2004. These principles clearly recognized the link between human and animal health, which can be connected with disease threats from food [20]. Natural antioxidants play important roles in maintaining chicken health and growing broilers. There is a wide range of antioxidant molecules in the chicken body: vitamin E, ascorbic acid, carotenoids, selenium, coenzyme Q, carnitine, taurine, antioxidant enzymes and others [36]. Moreover, several studies support the idea that in mammals, the administration of exogenous antioxidants, in optimal amounts and types, helps maintain health. In addition, some studies on poultry have indicated a positive effect of natural antioxidant supplementation. For instance, Sarica and Urkmez (2016) reported that feeding broiler chickens with pomegranate peel extract at 100 and 200 mg/kg resulted in improved performance and gut health [30]. The potential health benefits from the application of natural antioxidants in meat systems are not always proven. Therefore, the meat industry is mainly motivated by the positive effects of antioxidants on the shelf-life, quality and safety assurance of meat and meat products. Further clinical trials are necessary to evaluate the safety of natural antioxidant substances usage and to confirm health properties [21].

Antioxidants are added to fresh and processed meat and meat products to prevent oxidation processes, and this is connected with the development of off-flavors and product color changes [27]. There are many compounds that are able to inhibit oxidation processes, but only some of them are suitable for human consumption because of safety issues [42]. Food-grade antioxidants must be approved by regulatory bodies. In the European Union, the regulation of antioxidants is established by the European Parliament and Council Directive No. 1333/2008 of 16 December 2008 on food additives, which provides a list of approved additives and the conditions for their use and labeling. According to this regulation, extracts of rosemary (E 392), carotenes (E 160a), tocopherol-rich extracts (E 306), α-and γ-tocopherol (E307 and E 308), δ-tocopherol (E 309), annatto, bixin and norbixin (E 160b) and extracts of rosemary (E 392) are the natural antioxidants authorized as food additives by the EU. For meat, specific natural antioxidants such as rosemary extracts and carotenes are only allowed in processed meat products [21].

Conclusion

1. The application of antioxidants during feeding and processing is justified as it prevents economic losses in the meat industry owing to consumer rejection. Data shows that natural antioxidants efficiently extend the shelf-life of poultry products. Lipid peroxidation decreases in meat when natural antioxidants are supplemented to feed.
2. The use of natural antioxidants could be an effective strategy to maintain the optimal quality of poultry products. In particular, the application of antioxidants to process animal products is very useful due to the lack of a natural antioxidant system.
3. One of the major challenges for the wider application of natural antioxidants in poultry meat systems is the harmonization of methods with consumer demands and the poultry industry's capabilities, and an evidence-based exploitation of natural antioxidants is necessary to secure a transformation in the field.

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PRZECIWUTLENIACZE W MIĘSNYCH PRODUKTACH DROBIOWYCH: ASPEKTY JAKOŚCIOWE I ZDROWOTNE

S t r e s z c z e n i e

Wprowadzenie. Istnieją prognozy, że populacja ludzi może wzrosnąć aż do około 10 miliardów do 2050 roku. Może to doprowadzić do wzrostu całkowitego światowego zapotrzebowania na żywność od 35 % do 56 % w latach 2010 ÷ 2050. Dlatego jednym z głównym celem producentów żywności powinno być polepszenie jakości produktów spożywczych. Ponadto obecne zmiany poziomu dochodów konsumentów mogą wpływać na preferencje odnośnie kupowanej żywności. Stosowanie naturalnych przeciwutleniaczy może zaspokoić rosnące zainteresowanie konsumentów drobiu. W licznych opracowaniach literaturowych widoczna jest tendencja do wykorzystywania naturalnych przeciwutleniaczy jako zamienników syntetycznych. Celem pracy jest dokonanie przeglądu najnowszych badań opisujących zastosowanie naturalnych przeciwutleniaczy w produkcji mięsa drobiowego oraz ich wpływ na jakość produktu końcowego.

Wyniki i wnioski. W pracy przedstawiono przegląd aktualnych rozwiązań w stosowaniu naturalnych związków przeciwutleniających w mięsie drobiowym i w drobiowych przetworach mięsnych w celu poprawy ich jakości i trwałości. W zapewnieniu prawidłowego żywienia i zdrowia ludzi dodatek antyoksydantów pozostaje przedmiotem nieprzerwanej debaty. Naturalne przeciwutleniacze skutecznie wydłużają okres przydatności do spożycia produktów drobiowych. Peroksydacja lipidów w mięsie zmniejsza się, gdy w paszy dodaje się naturalne przeciwutleniacze. Ponadto stosowanie naturalnych przeciwutleniaczy można zaliczyć działań strategicznych ukierunkowanych na utrzymania optymalnej jakości przetworzonych produktów drobiowych.

Słowa kluczowe: naturalne antyoksydanty, jakość produktów drobiowych, popyt na żywność