

Effect of Cooking and Packaging Methods on the Thiobarbituric Acid Reactive Substances and Cholesterol Oxidation Products of Turkey Thigh Meat Patties During Storage

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가열방법과 포장조건이 칠면조육 패티의 저장중 지방산화와 콜레스테롤 산화물에 미치는 효과

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적 요

가열방법과 포장방법이 저장기간 동안 칠면조육 패티의 지방산화(TBARS)와 콜레스테롤 산화물 함량에 미치는 효과를 조사하기 위하여, 칠면조 다리육을 분쇄하여 패티를 제조하였다. 칠면조육 패티는 5가지 가열방법(oven cooking, pan frying, deep frying, boiling, microwaving)으로 가열한 후 각각 합기포장과 진공포장한 후 저장하면서 시험에 공시하였다. 지방산패도는 합기포장과 진공포장 모두 저장초기에는 boiling 방법이 유의적으로(P<0.05) 높게 나타났으나, 저장 말기에는 microwaving 방법이 가장 높은 지방산패도를 나타내었다(P<0.05). 또한 oven cooking 방법은 전 저장기간동안 합기포장과 진공포장 모두에서 가장 낮은 지방산 패도값을 나타내었다(P<0.05). 총 콜레스테롤 산화물의 양은 전 저장기간동안 boiling 방법이 가장 낮은 함량을 나타내었고(P<0.05), microwaving 방법이 가장 높은 함량을 나타내었다(P<0.05). 각각의 콜레스테롤 산화물의 함량을 보면, 7 α -hydroxycholesterol은 pan frying 방법이 가장 낮은 함량을 나타내었고(P<0.05), microwaving 방법이 가장 높은 함량을 나타내었다(P<0.05). α -epoxide의 양은 boiling 방법이 가장 낮은 함량을 나타내었으며, pan frying 방법에서 가장 높게 나타났다(P<0.05). β -epoxide 함량은 pan frying 방법이 가장 낮은 함량을 나타내었으며(P<0.05), deep frying 방법과 microwaving 방법에서 가장 높은 함량을 나타내었다(P<0.05). 또한 7-ketocholesterol의 함량은 microwaving 방법에서 가장 높게 나타났다(P<0.05).

(주요어 : Turkey, TBARS, Cholesterol oxidation products, Cooking method, Packaging methods)

I INTRODUCTION

Meat is a complex food with a highly structured nutritional composition and major source of cholesterol in the diet. It becomes edible and more digestible when it is subjected to cooking. However, heat treatment can lead to undesirable modifications, such as the loss of the nutritional value of meats mainly due to lipid oxidation and

changes in some components of the cholesterol. The degree of oxide formation is related to processing temperature, heating time, storage conditions, level of activator present, packaging and most of the oxides found in foods were subjected to processing conditions or exposure to heat(Paniangvait et al., 1995). cholesterol oxidation products(COPs) have been known to be more injurious to arterial cells than pure

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cholesterol and are more directly connected to the development of atherosclerosis and coronary heart disease (Addis, 1986). COPs deteriorated the bioavailability of cholesterol by inhibiting cholesterol biosynthesis (Lund and Bjorkhem, 1994) and dietary uptake of cholesterol (Peng et al., 1985). COPs also impaired a membrane function, which results in altered membrane permeability (Hennig and Boissonneault, 1987). On the other hand, natural cholesterol had no atherogenic or hypercholesterolemic effect and had a much lower influence on the activities of most enzymes than COPs (Smith, 1987). The most predominant oxidized cholesterol detected was 7-ketocholesterol, as well as β -epoxycholesterol and α -epoxycholesterol. Many studies demonstrated that the amount of COPs in foods could frequently reach 1% of total cholesterol and occasionally 10% or more (Addis, 1986). The lipid oxidation has been associated with quality deterioration caused by the development of off-flavors and off-odors during storage (Kumar and Singhal, 1992). More recently, interest in the possible toxicological effects of lipid oxidation products, particularly COPs has increased. These researches are important for human health and meat quality. Turkey is major animal in poultry industry. However, turkey is not much consuming in our meat markets, and no study was conducted on the turkey. The object of this study is to investigate the effects of cooking and packaging methods on the TBARS and cholesterol oxidation products of turkey thigh meat patties.

II MATERIALS AND METHODS

1. Sample preparation

The White Holland turkey thigh meats with skin were ground twice through a 3-mm plate and patties were prepared without additives. Patties (contain 15% fat) were approximately 9cm

in diameter, 1.5cm in thickness and weight 100g. Patties were cooked using 5 different methods (oven cooking, pan frying, oil deep frying, boiling, and microwaving) to an internal temperature of 85~)°C (internal temperature checked by internal thermometer).

1) Oven cooking. The patties were placed in an electric oven and cooked. The electric oven utilized a heating bar heat to cook the top and bottom surfaces as each patty turned over twice.

2) Pan frying. The patties were placed on the electric pan and cooked. Each patty was turned over twice.

3) Oil deep frying. The patties were submerged into the hot corn oil (160~ 30°C and cooked).

4) Boiling. The patties were put into the zipperbag and boiled (100°C 0min) in a water bath (Fisher 120V 50/60Hz, Springfield, USA)

5) Microwave. The patties were placed in a glass dish and cooked (the patty was turned over twice between cycles) in a microwave oven (General Electric JE 1590WC, 2450MHz, Louisville, USA).

Five cooking treatment samples were vacuum packaged in a high oxygen impermeable PVDC bag (9.3mL O₂/m²/24h at 0°C Koch, Kansas City, USA) and stored at 4°C luring 0, 1, and 2 weeks and also aerobic packaged in oxygen permeable PVC zipperbags (polyethylene, Associated Bag Company, Milwaukee, USA) and stored at 4°C during 0, 3, and 7 days.

2. Lipid oxidation (TBARS)

Lipid oxidation was determined by the modified TBARS method of Buege and Aust (1978). Five grams of meat were weighted into a 50mL test tube and homogenized with 15mL of deionized distilled water (DDW) using a polytron homogenizer (Type PT 10/35, Brinkman Instruments Inc., Westbury, NY) for 10 s at the highest speed.

One mL of meat homogenate was transferred into a disposable test tube (3 × 100mm) and butylated hydroxyanisole (50 µL, 7.2%) and thiobarbituric acid/trichloroacetic acid (TBA/TCA; 2mL) were added. The mixture was vortexed and then incubated in a boiling water bath for 15min to develop color. Then the sample was cooled in cold water for 10min, vortexed again, and centrifuged for 15min at 2000g. The absorbance of the resulting supernatant solution was determined at 531nm against a blank containing 1mL of DDW and 2mL of TBA/TCA solution. The amounts of TBARS were expressed as milligrams of malondialdehyde per kilogram of meat.

3. Cholesterol oxidation products (COPs)

The COPs in samples were determined by the method described by Ahn et al (1999). The dried lipid by method of Folch et al (1957) were dissolved with an aliquot of hexane to make 0.1g fat/mL hexane and used for the next step. Silicic acid (100mesh), celite-545, and CaHPO₄ (10:9:1, w/w/w) mixture in chloroform was prepared and packed into a glass column. The columns were washed with 10mL of hexane: ethyl acetate (9:1 v/v, solvent 1) before loading sample. Lipid sample (0.2g) dissolved in hexane were added with an internal standard (5- α -cholestane) and loaded onto the silicic acid column. Neutral lipids, cholesterol, and phospholipid were eluted by passing hexane: ethyl acetate (9:1, v/v) and hexane: ethyl acetate: diethyl ether (4:1:2, v/v/v) through the column. Then cholesterol oxides were eluted with acetone: ethyl acetate: methanol (10:10:1) and dried under nitrogen. The dried cholesterol oxides were added with 200 µL pyridine and 100 µL BSTFA + 1% TMCS and derivatized by heating in a dry bath (80°C for 1hr) and analyzed using a GC (Hewlett Packard 6890) equipped with an on-column capillary injector and a flame ionization detector (FID). A

ramped oven temperature condition (180°C for 2.5 min, increased to 230°C at 2.5°C/min, then held at 230°C for 7.5min) was used. Temperatures of both the inlet and detector were 280°C. Helium was the carrier gas with linear flow at 1.1mL/min. Detector (FID) air, H₂, and make-up gas (He) flows were 350, 35, and 43mL/min, respectively. Fatty acids were identified by comparison of retention times of known standards. Relative quantities were expressed as weight percent of total fatty acids.

4. Statistical analysis

Data were analyzed using the generalized linear model procedure of SAS software (1996) Student-Newman-Keuls multiple range test. Significance was defined at $P < 0.05$.

III RESULTS AND DISCUSSION

1. TBARS values

Effects of cooking and packaging methods on the TBARS are shown in Table 1. A significant increase ($P < 0.05$) in the TBARS values of all cooked samples by storage, which is in agreement with the finding of Kesava et al (1996). It is well known that, even during storage periods after heating, lipid oxidation does occur. At the 0 day of storage, both aerobically packaged and vacuum packaged TBARS value was no significant. In contrast, the levels of TBARS significantly ($P < 0.05$) increased with storage periods and vacuum packaged thigh meat produced less TBARS than the aerobically packaged samples. At the beginning of storage, aerobically packaged meat cooked by boiling method produced significantly ($P < 0.05$) higher TBARS than that of others. However, the TBARS of microwaved meat with vacuum packaging significantly ($P < 0.05$) increased rapidly after 1 week of storage and also aerobically packaging significantly ($P < 0.05$) increased although

Table 1. Effect of cooking and packaging methods on the thiobarbituric acid reactive substances of turkey thigh meat patties during storage

Treatments	Storage period(days)							
	Aerobic packaging				Vacuum packaging			
	0	3	7	SEM	0	7	14	SEM
 MA ¹⁾ mg/kg meat							
Oven cooking	3.29 ^{Cc}	14.28 ^{Db}	14.79 ^{Da}	0.062	3.24 ^{Cc}	4.43 ^{Cb}	4.95 ^{Da}	0.050
Pan frying	3.94 ^{Bb}	14.89 ^{Ca}	15.18 ^{Ca}	0.113	4.02 ^{Bb}	4.48 ^{Ca}	5.02 ^{Da}	0.076
Deep frying	4.14 ^{Bc}	15.07 ^{Cb}	15.36 ^{Ca}	0.068	4.14 ^{Bc}	4.92 ^{Cb}	5.28 ^{Ca}	0.101
Boiling	4.52 ^{Ac}	16.72 ^{Bb}	17.55 ^{Ba}	0.088	4.65 ^{Ac}	5.29 ^{Bb}	5.59 ^{Ba}	0.051
Microwaving	4.20 ^{Bc}	17.54 ^{Ab}	18.59 ^{Aa}	0.102	4.29 ^{Bb}	5.95 ^{Aa}	6.06 ^{Aa}	0.050
SEM	0.086	0.080	0.099	–	0.062	0.072	0.072	–

^{a,b,c} Different letters within a row are significantly different(P < 0.05).

^{A,B,C,D} Different letters within a column are significantly different(P < 0.05).

¹⁾ MA : Malonaldehyde.

storage period was 3 days. At the end of storage, microwaved sample was the highest and oven cooked sample was the lowest than the other samples in both aerobically and vacuum packaging samples. Paniangvait et al(1995) reported that the degree of oxide formation is related to processing temperature, length of heating time, storage conditions, level of activator present and packaging. Most of the oxides found were in foods are subjected to processing conditions or exposure to heat(Paniangvait et al., 1995). Monahan et al(1992) found that lipid oxidation in raw samples was low compared to processed samples and may account for the low rates of cholesterol oxidation. The rate and the extent of lipid oxidation are dependent on several factors, the most important being the level of polyunsaturated fatty acids present(Allen and Foegeding, 1981). Apte and Morrissey(1987) clearly showed that the ferritin fraction contributed significantly to lipid oxidation in heated meat systems. In present study, we found that the cooking methods and packaging methods influenced the levels of lipid oxidation and the increased lipid oxidation is probably related to membrane damage. Especially, microwaving produced higher level of TBARS than those of other because the microwaving

method should be easily infiltration into meat core. Thus, we assumed that easy and quick cooking method should be inducing the lipid oxidation easily and quickly.

2. Total cholesterol oxidation products

The amounts of total COPs by cooking methods and packaging methods shown in Table 2. The amount of total COPs in cooked thigh meat increased with storage and the increase was linear with storage time. Due to the presence of one double bond, cholesterol is susceptible to oxidation when exposed to light and molecular oxygen. Pie et al(1991) reported that total COPs increased after storage and cholesterol-7 oxidized products were predominant with 7-ketocholesterol the most abundant. COPs have been detected in a variety of processed food products, including powdered milk, grated cheeses, butter and spray-dried egg products. Several researchers(Higley et al., 1986; Park and Addis, 1987) have been detected COPs in raw, cooked, and processed meats. Pie et al(1991) also found that COPs increased significantly on cooking of meats and during subsequent refrigerated storage. The levels of total COPs in aerobically packaged cooked

Table 2. Effect of cooking and packaging methods on the total cholesterol oxide products of turkey thigh meat patties during storage

Treatments	Storage period(days)							
	Aerobic packaging				Vacuum packaging			
	0	3	7	SEM	0	7	14	SEM
µg/kg meat.....							
Oven cooking	4.64 ^{Cc}	14.91 ^{Bb}	21.18 ^{Ca}	0.104	4.69 ^{Cc}	6.77 ^{Ab}	7.51 ^{Ba}	0.140
Pan frying	5.20 ^{Bc}	14.96 ^{Bb}	20.32 ^{Da}	0.141	5.14 ^{Bc}	5.74 ^{Cb}	6.22 ^{Da}	0.101
Deep frying	5.78 ^{Ac}	14.58 ^{Cb}	21.46 ^{Ba}	0.126	5.84 ^{Ac}	6.30 ^{Bb}	7.28 ^{Ca}	0.167
Boiling	4.59 ^{Cc}	12.27 ^{Db}	19.98 ^{Ea}	0.130	4.55 ^{Cb}	4.70 ^{Dab}	5.64 ^{Ea}	0.199
Microwaving	5.88 ^{Ac}	15.55 ^{Ab}	22.85 ^{Aa}	0.146	5.69 ^{Ac}	6.34 ^{Bb}	7.88 ^{Aa}	0.104
SEM	0.110	0.140	0.150	–	0.196	0.163	0.180	–

^{a,b,c} Different letters within a row are significantly different(P < 0.05).

^{A,B,C,D,E} Different letters within a column are significantly different(P < 0.05).

meat were higher than the vacuum-packaged meat. At the beginning of storage, microwave and deep fried samples had significantly(P < 0.05) higher total COPs than those of others, but the microwaving produced highest level of total COPs in meat than other cooking methods during storage. At the end of storage, the levels of total COPs in turkey thigh meat was in decreasing order as follows: microwaving, deep frying, oven cooking, pan frying, boiling in both aerobically and vacuum packaging samples. Use microwaving for heating meat is an extremely rapid cooking method. Heating results from conversion of microwave energy to heat by friction from internal molecular rotations caused by interactions of

molecules in a rapidly fluctuating electromagnetic field. Thus, microwaving method should be easily induced damage of cholesterol structure. Our results demonstrate that the rate of cholesterol oxidation in turkey is greatly accelerated during storage following cooking and appears to follow the same trend as lipid oxidation in general.

3. Cholesterol oxidation products

Data presented in Table 3 to 6 show that the amount of 4 COPs(7 α -hydroxycholesterol, α , β -epoxide and 7-ketocholesterol) by cooking methods and packaging methods. The levels of 4 COPs in cooked thigh meat increased with storage and the

Table 3. Effect of cooking and packaging methods on the 7 α -hydroxy cholesterol of turkey thigh meat patties during storage

Treatments	Storage period(days)							
	Aerobic packaging				Vacuum packaging			
	0	3	7	SEM	0	7	14	SEM
µg/kg meat.....							
Oven cooking	1.76 ^{Cc}	5.89 ^{Bb}	7.92 ^{Ba}	0.091	1.79 ^{Cc}	2.38 ^{Ab}	2.68 ^{ABa}	0.053
Pan frying	1.70 ^{Dc}	5.75 ^{Cb}	6.94 ^{Da}	0.168	1.67 ^{Db}	1.73 ^{Cb}	2.01 ^{Ca}	0.120
Deep frying	1.92 ^{Bc}	5.57 ^{Db}	7.53 ^{Ca}	0.114	1.94 ^{Bc}	2.09 ^{BCb}	2.51 ^{Ba}	0.055
Boiling	1.59 ^{Ec}	4.58 ^{Eb}	7.48 ^{Ca}	0.130	1.62 ^{Db}	1.66 ^{Cb}	2.13 ^{Ca}	0.111
Microwaving	2.14 ^{Ac}	5.98 ^{Ab}	8.27 ^{Aa}	0.137	2.10 ^{Ac}	2.18 ^{Bb}	2.85 ^{Aa}	0.069
SEM	0.076	0.085	0.102	–	0.074	0.095	0.128	–

^{a,b,c} Different letters within a row are significantly different(P < 0.05).

^{A,B,C,D,E} Different letters within a column are significantly different(P < 0.05).

Table 4. Effect of cooking and packaging methods on the α -epoxide of turkey thigh meat patties during storage

Treatments	Storage period(days)							
	Aerobic packaging				Vacuum packaging			
	0	3	7	SEM	0	7	14	SEM
 $\mu\text{g}/\text{kg}$ meat							
Oven cooking	0.53 ^{Bc}	1.98 ^{Bb}	2.81 ^{Ba}	0.097	0.55 ^{Bb}	0.63 ^{Ba}	0.60 ^{BCa}	0.084
Pan frying	0.72 ^{Ac}	2.17 ^{Ab}	3.46 ^{Aa}	0.103	0.69 ^{Ac}	0.91 ^{Ab}	1.08 ^{Aa}	0.106
Deep frying	0.54 ^{Bc}	1.77 ^{Cb}	2.64 ^{Ca}	0.110	0.51 ^{BCc}	0.57 ^{Cb}	0.63 ^{BCa}	0.071
Boiling	0.49 ^{Cc}	1.53 ^{Eb}	2.57 ^{Ca}	0.098	0.48 ^{Ca}	0.51 ^{Da}	0.52 ^{Ca}	0.120
Microwaving	0.51 ^{Cc}	1.69 ^{Db}	2.94 ^{Ba}	0.087	0.47 ^{Cb}	0.48 ^{Db}	0.67 ^{Ba}	0.067
SEM	0.089	0.116	0.138	–	0.088	0.080	0.119	–

^{a,b,c} Different letters within a row are significantly different ($P < 0.05$).

^{A,B,C,D,E} Different letters within a column are significantly different ($P < 0.05$).

Table 5. Effect of cooking and packaging methods on the β -epoxide of turkey thigh meat patties during storage

Treatments	Storage period(days)							
	Aerobic packaging				Vacuum packaging			
	0	3	7	SEM	0	7	14	SEM
 $\text{MA}^1/\text{mg}/\text{kg}$ meat							
Oven cooking	0.77 ^{Bc}	3.55 ^{Ab}	4.22 ^{Ba}	0.087	0.74 ^{Bb}	1.32 ^{Aa}	1.37 ^{ABa}	0.148
Pan frying	0.83 ^{Ac}	3.17 ^{Bb}	4.01 ^{Ca}	0.105	0.89 ^{Ab}	0.96 ^{Ba}	0.97 ^{Ca}	0.085
Deep frying	0.82 ^{Ac}	3.03 ^{Cb}	4.54 ^{Aa}	0.099	0.85 ^{Ac}	0.93 ^{BCb}	1.41 ^{Aa}	0.109
Boiling	0.76 ^{Bc}	2.71 ^{Db}	3.86 ^{Da}	0.111	0.74 ^{Bb}	0.76 ^{Cb}	1.19 ^{Ba}	0.094
Microwaving	0.74 ^{Bc}	3.49 ^{Ab}	4.46 ^{Aa}	0.100	0.70 ^{Cc}	0.99 ^{Bb}	1.43 ^{Aa}	0.080
SEM	0.087	0.086	0.104	–	0.069	0.118	0.77	–

^{a,b,c} Different letters within a row are significantly different ($P < 0.05$).

^{A,B,C} Different letters within a column are significantly different ($P < 0.05$).

Table 6. Effect of cooking and packaging methods on the 7-ketocholesterol of turkey thigh meat patties during storage

Treatments	Storage period(days)							
	Aerobic packaging				Vacuum packaging			
	0	3	7	SEM	0	7	14	SEM
 $\text{MA}^1/\text{mg}/\text{kg}$ meat							
Oven cooking	1.58 ^{Dc}	3.49 ^{Cb}	6.23 ^{Ca}	0.141	1.61 ^{Eb}	2.44 ^{Ba}	2.46 ^{Ca}	0.172
Pan frying	1.95 ^{Bc}	3.87 ^{Bb}	5.91 ^{Da}	0.187	1.89 ^{Cb}	2.14 ^{Ca}	2.16 ^{Da}	0.087
Deep frying	2.50 ^{Ac}	4.21 ^{ABb}	6.75 ^{Ba}	0.235	2.54 ^{Ab}	2.71 ^{Aa}	2.73 ^{Ba}	0.081
Boiling	1.75 ^{Cc}	3.45 ^{Cb}	6.07 ^{Da}	0.179	1.71 ^{Dc}	1.77 ^{Db}	1.80 ^{Ea}	0.069
Microwaving	2.49 ^{Ac}	4.39 ^{Ab}	7.18 ^{Aa}	0.258	2.42 ^{Bc}	2.69 ^{Ab}	2.93 ^{Aa}	0.083
SEM	0.187	0.271	0.253	–	0.074	0.098	0.183	–

^{a,b,c} Different letters within a row are significantly different ($P < 0.05$).

^{A,B,C,D,E} Different letters within a column are significantly different ($P < 0.05$).

increase was linear with storage time. Smith et al (1981) postulated that the intermolecular free-radical processes, involving hydrogen extraction from cholesterol by peroxy or oxy radicals of polyunsaturated fatty acids, may promote cholesterol oxidation. It is conceivable, therefore, that cholesterol oxidation should proceed in a way analogous to lipid oxidation. The levels of these 7 α -hydroxycholesterol and 7-ketocholesterol were higher than β and α -epoxide and the change of 7 α -hydroxycholesterol and 7-ketocholesterol were in similar trend as TBARS and total COPs. At the end of storage, microwaving was significantly ($P < 0.05$) the higher in 7 α -hydroxycholesterol, closely followed by the oven cooking, also, 7-ketocholesterol in microwaving was significantly ($P < 0.05$) the highest than other samples in both aerobically and vacuum packaging samples. Park and Addis(1986) showed that the level of 7-ketocholesterol increased linearly with heating time but not with temperature in heated fats. They found that the formation of 7-ketocholesterol was nearly linear with heating time, reaching about 10% of the initial cholesterol content for 376 hr heating at 155°C (Park and Addis, 1985). They also suggested that cholesterol was oxidized to isomeric 7 α -hydroxycholesterols, 7-ketocholesterol and epimeric epoxides in tallow heated at 155°C for 376 hr. 7-ketocholesterol was produced without formation of epimeric 7-hydroxycholesterol as a decomposition product of 7-hydroperoxides because 7-hydroxycholesterol was readily dehydrated in the absence of water at elevated temperatures, such as 155°C. At the end of storage, deep frying has been shown to significantly the highest ($P < 0.05$) than other cooking methods in α -epoxide and the levels of β -epoxide in pan frying was significantly the highest ($P < 0.05$) that of other samples in both aerobically and vacuum packaging samples. Paniangvait et al(1995) reported that the most predominant oxidized cholesterol detected was 7-ketocholesterol, as well as 5 β -epoxycholesterol and 5 α -epoxycholesterol.

Rethwill et al(1981) reported that the cholesterol-7 COPs and α - and β -epoxide were noted at 3 and 8 days (confirmed by GC-MS), whereas TBARS were detected at 0 days and increased thereafter. 7-keto was the predominant COP formed, with 7 α , 7 β , and the epoxides following in decreasing order. Allen and Foegeding(1981) reported that turkey developed higher of both COPs and TBARS than beef and has higher levels of polyunsaturated membrane lipids. In this study, we found that the amount of 4 kinds of COPs(7 α -hydroxycholesterol, α , β -epoxide and 7-ketocholesterol) were little different following the cooking methods, respectively. Especially, pan frying methods increased the amount of α -epoxide, and 7 α -hydroxycholesterol, β -epoxide and 7-ketocholesterol increased by microwaving methods.

IV CONCLUSION

Conventional methods of thermal processing involve heat transfer by conduction, convection, and/or radiation. These difference of procedures should be influence meat qualities. The results indicated that the progress of cholesterol oxidation in cooked meat was similar to that of lipid oxidation, and the formation of lipid and cholesterol oxidation products in cooked meat was closely related to cooking methods, storage time, and packaging methods. The level of TBARS in oven cooking method was lower than other cooking methods, and COPs level was lowest in boiling method during storage. Especially, microwaving produced higher levels of TBARS and COPs in turkey than those of other cooking methods during storage. More research is needed to determine the effects of cooking methods and packaging methods on TBARS and COPs in meats.

V ABSTRACT

Turkey thigh meats with skin were ground

twice through a 3-mm plate and patties were prepared. Patties were cooked using 5 different methods(oven cooking, pan frying, oil deep frying, boiling, and microwaving) to an internal temperature of 85~)°C and packaged in either oxygen permeable PVC zipperbags or oxygen impermeable PVDC bags. The samples were analyzed for thiobarbituric acid reactive substances(TBARS) and cholesterol oxidation products(COPs) after storage at 4°C. The TBARS of cooked meat increased during the storage regardless of cooking methods, vacuum packaged thigh meat produced less TBARS and COPs than the aerobically packaged samples. At the beginning of storage, aerobically packaged meat cooked by boiling method produced higher TBARS than that of others. However, the TBARS of microwaved meat with vacuum packaging increased rapidly after 3 days of storage at 4°C. The amount of total COPs in cooked thigh meat increased linearly with storage time. The level of total COPs in aerobically packaged cooked meat was higher than the vacuum-packaged meat. Microwave produced higher level of total COPs in meat than other cooking methods during storage.

(Key words : Turkey, TBARS, Cholesterol oxidation products, Cooking method, Packaging methods)

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