J. Agric. Sci. Mansoura Univ., 31 (12): 7809 - 7820, 2006

INFLUENCE OF FROZEN STORAGE ON THE STABILITY OF CHICKEN MEAT

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ABSTRACT

Frozen storage of chicken breast and thigh meat reduced their contents of moisture, total protein, total soluble protein (T.S.P)., soluble protein nitrogen (S.P.N)., soluble actomyosine nitrogen (S.A.N). and total lipids as the time of frozen storage progressed. On the other hand, at any time of frozen storage, chicken breast meat samples contained higher percentages of these constituents, except total lipids. Frozen storage also caused an increase in N.P.N. of both investigated chicken white and dark meat samples. The peroxide values for both investigated chicken meat samples were found to increase during the first 3 months of frozen storage, then decreased and after that increased again. Meanwhile, the acid and TBA values for the same samples were found to increase during 6 months of frozen storage. The unsaturated fatty acids, especially $C_{18:2}$ and $C_{18:3}$ were found to decrease during frozen storage in all the chicken meat samples. High losses were observed after 6 months of frozen storage for both white and dark meat samples. Comparatively, the values of the saturated fatty acids were found to increase during storage. Also, minimum unsaturated / saturated fatty acid ratios of both frozen stored white and dark meat samples were found after 6 months of frozen storage. A gradual decrease in all the amino acids of both white and dark meat samples during frozen storage was also observed, especially glutamic acid, arginine and lysine.

INTRODUCTION

Freezing is considered the most common and adequate method for long-term preservation and distribution of fresh meat causing least damaging effect as compared to other storage methods and preventing or minimizing many undesirable changes in meat such as microbial growth, metabolic processes, chemical reactions and enzymatic and non enzymatic reactions, which have a potential effect on the quality attributes of the frozen meat. Proteolysis occurs in frozen stored meat as a result of intrinsic enzymes, which remain active at below freezing temperature. In the mean time, some of the structured proteins appear to be modified during frozen storage probably due to proteolysis and are exuded in the drip (Shehata, 1974 and Moawad, 1987). Lipid oxidation has generally been accepted as one of the most serious problems involved in storage of poultry meat, Therefore, the control of lipid oxidation in poultry meat and poultry meat products has been increasingly important with the consumption of stored meat items for both institutional and home use (Igene *et al..*, 1981; Shams EL-Din and Bayoumy, 1990). Changes in the fatty acid composition of lipids provide an indirect measure of susceptibility to lipid oxidation (Keller and Kinsella, 1973). This oxidative deterioration of muscle lipids involves oxidation of the unsaturated fatty acids, especially the polyunsaturated members (Allen and Foegeding,

1981).During frozen storage, the total amino acids of meat decreases, while the total amino acids content of drip increases as the time of frozen storage progress (EL-Wakeil *et al.*, 1982; Ramadan, 1986 and Abd El- Gawad, *et al..*, 1988).

Thus, the present work was planned in order to determine the stability of chicken white and dark meats during frozen storage. Also, to estimate the influence of frozen storage on fatty and amino acids composition.

MATERIALS AND METHODS

Materials

Chicken broilers (8 weeks old, weight 1000-1200 g) were obtained from El-Zomor farm, Kalyoubia, Egypt. Brest (white meat), thigh (dark meat) were used in this study.

Methods

Technological Methods:

Preparation of chicken meat parts:

Chickens were slaughtered, plucked by hand, cleaned and washed with water. The wings, neck and heads were removed by hand. The carcasses were then cut into four parts (two breast pieces and two thighs).

Storage of chicken meat samples:

Fresh chicken unskinned thighs and breasts meat were packaged in polyethylens bags and frozen at -20°C. The chicken meat parts were held at -20°C for different storage periods up to 6 months. At designated storage periods, samples were removed monthly from frozen storage, thawed for 3 hrs at room temperature.

Preparation of chicken meat samples for analysis:

The raw, thawed and cooked chicken meat parts (thighs and breasts) were manually deboned, cut into pieces and ground twice using a Hobart meat grinder. The prepared samples were used for immediate analysis.

Analytical Methods:

Total lipids and total protein were determined according to the methods recommended by the A.O.A.C. (2000). All determinations were performed in triplicates and the mean values were reported.

Extraction of lipids from chicken meat samples:

Lipids were extracted from chicken meat samples by the method suggested and adopted by Bligh and Dyer (1959).

Chemical properties of chicken meat lipids:

Acid and peroxide values were determined according to the methods of the A.O.A.C. (2000).

Thiobarbituric acid (TBA) was determined according to the method described by Pearson (1981).

The TBA values (as mg malonaldehyde/kg sample) were calculated from the standard curve of malonaldehyde. All determinations were performed in triplicates and the mean values were reported.

Determination of fatty acids by G.L.C:

Preparation of the methyl ester:

The method described by Metcalfe *et al.*. (1963) and Metcalfe and Wang (1981) was applied for the preparation of fatty acids methyl esters. A Pye Unicum GLC apparatus (Series 104 Model 64, equipped with a hydrogen flame ionization detector available at the central lab., Faculty of Agriculture, Cairo University), was used for detecting the fatty acids. The following operating conditions were carefully selected to ensure precise calculations of the peaks and for separation of the peaks of the fatty acids.

Detector: Flame ionization.

Column: 1.5 m x 0.4 mm coiled glass column packed with 10% polyethylene glycol adipate on celite (100-120 mesh).

Carrier gas flow : - Nitrogen 30 ml./min. – Hydrogen 33 ml./min.
- Air 330 ml./min.

Injector temperature : 220°C ***Chart speed :*** 1 cm/2 min

Column temperature: Isothermal 190°C ***Attenuation :*** 32 x 10^2

Detector temperature: 200°C

The standard fatty acid mixture solution was used as primary reference during all the analysis carried out in this investigation. Relative percentage fatty acids were automatically calculated in the apparatus according to the area of each fatty acid to the area of the total fatty acids of sample.

Total nitrogen (T.N.):

Total nitrogen was determined in the studied chicken meat samples using the micro Kjeldahl procedure according to the method recommended in the A.O.A.C. (2000). Protein content was calculated by multiplying the nitrogen content by 6.25, and the results expressed as % protein.

Nitrogenous compounds:

Total soluble nitrogen, soluble protein nitrogen and soluble actomyosin nitrogen were determined according to the methods reported by El-Gharabawi and Dugan (1965). Total soluble nitrogen (T.S.N.), soluble protein nitrogen (SPN), and soluble actomyosin nitrogen (SAN) were determined according to the methods of the A.O.A.C. (2000). Non-protein nitrogen (N.P.N.) was calculated according to Bodwell and McClain (1971), using the following equation:

N.P.N. = T.S.N. - S.P.N.

Amino acids determination:

Amino acids, other than tryptophan, proleine, cystine and methionine, were determined at the Central laboratory for the Food and Feed belonging to the Agriculture Research Center of the Egyptian Ministry of Agriculture. Acid hydrolysis was performed in sealed ampoules for the determination of amino acids.

High Performance Amino Acid Analyzer (Beckman System 7300 and Data system 7000) was used as described by Moore *et al.*. (1958) and Widner and Eggum (1966)

RESULTS AND DISCUSSION

Effect of frozen storage on the chemical composition of raw chicken meat:

Moisturte, total protein, nitrogenous compounds and total lipids contents in chicken white and dark meat were determined during storage at -20 °C for 6 months. The obtained results are presented in tables (1 and 2) from which it could be observed that, the moisture content of chicken breast and thigh meat samples decreased from 74.15 to 69.60% and from 73.07 to 68.72%, respectively after 6 months of frozen storage. The loss of moisture content of both chicken meat samples increased as the time of frozen storage increased. For instance, the losses of moisture content after 6 months of frozen storage for chicken breast and thigh meat samples were 4.55 and 4.35%, respectively. Similar results were achieved by Moawad (1995), who concluded that the losses in moisture content were 5.61 and 5.13% for breast and leg samples respectively after 6 months of storage at -20°C. Earlier, Abd El-Baki *et al.*. (1983) pointed out that breast and leg muscles of Hubbard hens retained 92.45 and 92.14% of their original moisture content, respectively, after 6 months of frozen storage at -10°C. It could be concluded that the loss in moisture content of chicken meat during freezing and frozen storage might be due to the decrease of protein solubility and subsequently the reduction of water holding capacity of frozen chicken meat leading to higher amounts of drip loss, besides the evaporation process, especially at low relative humidity, that could prevail in the freezer atmosphere. Abo-Raya (1979); Miller *et al.*. (1980) and Moawad (1995) came to the same conclusion. Frozen stored chicken breast meat samples practiced higher loss of moisture content than chicken thigh meat samples, which could be explained by the higher fat content of thigh meat, which may protect meat from drying out during frozen storage.From the obtained results in the same tables, it could be also observed that the total nitrogen of chicken breast meat decreased from 13.27 to 11.75%, while for thigh meat samples, it decreased from 11.77 to 10.51%. These results are in agreement with those reported by Abd El-Wahed (1986) and Moawad (1995). The same trend was also noticed for the total protein. After 6 months of frozen storage at -20°C, raw chicken breast and thigh meat samples retained 88.55 and 89.30% of their original total protein, respectively. Likewise, Abd El-Wahed (1986) have earlier indicated that breast and leg muscles of chicken meat retained 89.05 and 91.69% of their original total protein, respectively, after 7 months of frozen storage at -20°C. Also, Moawad (1995) revealed that breast and leg meat samples retained 86.58 and 86.94% of their original total protein respectively, after 6 months of frozen storage at -20°C. Moreover, from the same obtained results, it is apparent that at any frozen storage time, breast meat samples showed higher protein content than thigh meat samples.These results are in

accordance with the findings obtained by Abd El-Wahed (1986) and Moawad (1995). During frozen storage at -20°C for 6 months, total protein gradually decreased at a higher rate in chicken breast meat than in thigh meat samples probably due to higher values of total volatile nitrogen and drip loss for breast meat than thigh meat. Abd El-Baki *et al.*. (1983); Abd El-Wahed (1986) and Moawad (1995) came to the same conclusions, however, the reverse was found by El-Ghazali (1981). The same results in tables (1 and 2) further indicate that chicken white and dark meat samples lost 9.50 and 7.87 % of their total protein content after 6 months of frozen storage, respectively. Besides, nitrogenous compounds of frozen stored chicken meat samples are given in the same tables (1 and 2). From which, it could be observed that the total soluble nitrogen (T.S.N.), soluble protein nitrogen (S.P.N.) and soluble actomyosin nitrogen (S.A.N.) of all the investigated frozen stored chicken meat samples decreased. Raw chicken breast meat samples retained 82.53; 77.13 and 80.63% of their original T.S.N.; S.P.N. and S.A.N., respectively after 6 months of frozen storage. The corresponding values of chicken meat samples retained 80.97; 75.44 and 79.36%, respectively. Similar results were achieved by Abd El-Wahed (1986) and Moawad (1995). Generally, it could be concluded, from the same results in the same tables (1 and 2), that T.S.N., S.P.N. and S.A.N. percentages of raw chicken white and dark meat samples markedly decreased as the time of frozen storage progressed and at any time of frozen storage and chicken breast meat samples contained higher T.S.N., S.P.N. and S.A.N. than chicken thigh meat samples. These results are in agreement with those found by Abd El-Baki *et al.*. (1983); Abd El-Wahed (1986) and Moawad (1995). The decrease in protein solubility during freezing and frozen storage could be in part due to the resulting denaturation and aggregation of protein associated with frozen storage as well as due to leaching of sarcoplasmic proteins in the drip, and also due to the reaction of proteins with malonaldehydes during frozen storage (Buttkus, 1967 and Morsi *et al..*, 1975). It could be observed from the results in tables (1 and 2) that frozen storage caused some increase in N.P.N. of both investigated chicken white and dark meat samples. The increase in N.P.N. fraction during freezing and frozen storage could be due to proteolysis and denaturation of muscles proteins (Khan *et al..*, 1963) or due to the transformation of some amino acids to non-amino acids nitrogenous compounds, which are completely biologically unavailable (Hegsted *et al..*, 1973). For instance, the N.P.N. fraction of chicken breast and thigh meat samples reached 1.86 and 1.53% (on dry weight basis) after 6 months of frozen storage, as compared with their corresponding percentages at zero time (tables 1 and 2). The N.P.N. fraction of chicken meat samples under investigation was found to increase as the time of frozen storage increased, with a higher rate in breast meat samples than in thigh meat samples. These results reflect higher proteolysis and protein breakdown products in breast meat than in thigh meat. Similar results were found by Abd El-Wahed (1986) and Moawad (1995). The data in tables (1 and 2) further cleared obvious gradual decrease in fat contents during frozen storage for both the investigated chicken white and dark meat samples. These results clearly agree with the results previously reported by Igene *et al.*. (1979) and Shams El-Din and Bayoumy (1990). Presumably,

these losses in fat contents during frozen storage could be atributed to both enzymatic and oxidative reactions (Awad *et al..*, 1968) or due to leaching in the drip (Morsi *et al..*, 1975).

Table (1): Effect of frozen storage on chemical composition of raw chicken white meat (breast) (on dry weight basis).

Constituents (%)	Storage periods (months)						
	0	1	2	3	4	5	6
Moisture	74.15	73.55	72.83	71.90	71.14	70.39	69.60
Total protein	82.94	81.50	79.56	77.13	75.81	74.71	73.44
Nitrogenous compounds							
Total Nitrogen (T.N.)	13.27	13.04	12.73	12.34	12.13	11.95	11.75
Total soluble nitrogen (T.S.N.)	10.59	9.46	9.32	9.15	8.97	8.83	8.74
Soluble protein nitrogen (S.P.N.)	8.92	7.71	7.55	7.36	7.14	6.98	6.88
Soluble actomyosin nitrogen (SA.N)	6.30	5.67	5.54	5.43	5.31	5.21	5.08
Non-protein nitrogen (N.P.N.)	1.65	1.75	1.77	1.80	1.83	1.85	1.86
Total lipids	12.18	12.05	11.83	11.42	11.14	10.90	10.55

Table (2): Effect of frozen storage on chemical composition of raw chicken dark meat (thigh) (on dry weight basis).

Constituents (%)	Storage periods (months)						
	0	1	2	3	4	5	6
Moisture	73.07	72.49	71.75	70.88	70.08	69.30	68.72
Total protein	73.56	72.38	70.81	68.69	67.56	66.75	65.69
Nitrogenous compounds							
Total Nitrogen (T.N.)	11.77	11.58	11.33	10.99	10.81	10.68	10.51
Total soluble nitrogen (T.S.N.)	8.83	8.64	8.27	7.80	7.47	7.24	7.15
Soluble protein nitrogen (S.P.N.)	7.45	7.24	6.84	6.33	5.97	5.72	5.62
Soluble actomyosin nitrogen (SA.N)	5.33	4.96	4.80	4.65	4.49	4.35	4.23
Non-protein nitrogen (N.P.N.)	1.38	1.40	1.43	1.47	1.50	1.52	1.53
Total lipids	21.65	21.35	20.78	19.57	18.83	18.20	17.39

Chemical properties of fat extracted from frozen stored chicken meat.

The effect of frozen storage of raw chicken white and dark meat samples on acid, peroxide and thiobarbituric acid values of extracted fat was studied and the obtained results are shown in table (3) from which it could be observed that there was a relationship between the initial free fatty acids content of the fresh raw chicken meat samples and the rate of increase during storage. The acid values of chicken white and dark meat samples, after 6 months of frozen storage, were 2.24 and 2.89 mg KOH/g fat, respectively. A correlation has been found previously between the acid value and the length of storage (Pokorny *et al..*, 1976). Lipolysis of phospholipids

and formation of free fatty acids during frozen storage of poultry was also reported by Davidkova and Khan (1967). Also, Shams El-Din and Bayoumy (1990), have reported a similar increase of free fatty acids during frozen storage of poultry meat. Besides, Fishwick (19) observed that lipases and phospholipases continued to be active in turkey muscles stored at –10 and -20°C. The peroxide values for both investigated chicken meat samples were found to increase during the first 3 months of frozen storage, then decreased and after that increased again (table 3). The increase in peroxide values during the first 3 months could be due to oxygen uptake by the unsaturated fatty acids to form peroxides. Awad *et al.*. (1968) had suggested that the decrease in peroxide value was due to peroxide decomposition or interaction with protein. The present changes in the peroxide values during frozen storage seemed to be dependant on the type of the stored sample. Thus, whereas the maximum peroxide value for chicken white meat after 3 months of storage was 24.93 meq/kg., the corresponding value for chicken dark meat reached 35.32 meq/kg, as compared with their corresponding values at zero time. It is worthy to notice that these mean values agree with those reported by Abd El-Wahed (1986). From the presented data in the same mentioned table (table 3), it could be noticed also that thiobarbituric acid (TBA) values of frozen stored chicken dark meat samples were higher than those for chicken white meat samples. Dawson and Schierholz (1976) and Pikul *et al.*. (1984), showed a direct correlation between total lipids level and TBA values. The TBA values for both investigated types of chicken meat increased during storage. Maximum increase of TBA values was attained after 6 months of frozen storage for both white and dark meat samples. Arafa and Chen (1976) found that the TBA values for chicken white and dark meat increased during the first 3-4 months of storage. In general, the increase of peroxide and TBA values of chicken meat samples, which occurred during frozen storage, might be the result of lipid oxidation.

Table (3): Acid, peroxide and thiobarbituric acid (TBA) values of fresh and frozen stored chicken meats.

Storage periods (months)	Chicken white meat (breast)			Chicken dark meat (thigh)		
	Acid value (mg KOH / g. fat)	Peroxide value (meq/kg. fat)	TBA (malonal-dehyde/kg . fat)	Acid value (mg KOH / g. fat)	Peroxide value (meq/kg. fat)	TBA (malonal-dehyde/kg. fat)
0	0.63	0.96	0.28	0.80	1.22	0.36
1	0.72	2.29	0.35	0.96	3.27	0.49
2	0.89	5.68	0.47	1.15	8.53	0.65
3	1.10	24.93	0.71	1.41	35.32	1.02
4	1.35	16.36	1.02	1.73	24.25	1.49
5	1.71	12.02	1.31	2.24	17.91	1.95
6	2.24	14.53	1.69	2.89	20.12	2.47

Effect of frozen storage on fatty acid composition of raw chicken meat:

The effect of frozen storage on fatty acid composition of the extracted fat from raw chicken meat samples was studied, and the obtained results are shown in table (4). From which it could be observed that the unsaturated fatty

acids, especially $C_{18:2}$ and $C_{18:3}$ were found to decrease during storage in all the investigated chicken meat samples. High percentage losses were observed after 6 months of frozen storage for both white and dark meat samples. The total unsaturated fatty acids of fresh raw chicken white and dark meat samples, at zero time of storage, were 66.11 and 67.83%, while they decreased to 64.81 and 66.00% as well as 63.82 and 64.58% after 3 and 6 months of frozen storage respectively. Comparatively, the values of the saturated fatty acids were found to increase during storage. These results coincide with those previously reported by Lee and Dawson (1973) as well as Shams El-Din and Bayoumy (1990). Also, Moerk and Ball (1974) reported on the decrease of levels of polyunsaturated fatty acids in chicken phospholipids during refrigeration or frozen storage. The unsaturated / saturated fatty acids ratios were calculated as shown in the same mentioned table (4). where chicken dark meat samples had relatively higher unsaturated / saturated ratios than chicken white meat samples during frozen storage. However, maximum ratios of both frozen stored white and dark meat samples were 1.76 and 1.82 after 6 months of frozen storage at -20°C.

Table (4): Changes in relative percentage of fatty acids composition of chicken meat during frozen storage (% of total fatty acids) at -20°C for 6 months.

Fatty acids (%)	Chicken white meat (breast)			Chicken dark meat (thigh)		
	Storage periods (months)			Storage periods (months)		
	0	3	6	0	3	6
$C_{12:0}$	--	--	--	0.10	0.20	0.22
$C_{14:0}$	1.10	1.26	1.32	1.18	1.29	1.44
$C_{14:1}$	0.20	0.25	0.20	0.30	0.30	0.35
$C_{16:0}$	24.27	24.91	25.78	22.91	23.79	24.75
$C_{16:1}$	5.83	5.30	5.02	7.21	6.61	6.37
$C_{18:0}$	8.12	8.76	8.98	7.46	8.52	8.86
$C_{18:1}$	42.07	41.82	41.67	40.82	41.01	40.57
$C_{18:2}$	16.91	16.44	16.02	18.20	17.03	16.39
$C_{18:3}$	1.10	1.00	0.81	1.30	1.05	0.90
$C_{20:0}$	0.40	0.26	0.10	0.52	0.20	0.15
Total saturated fatty acids	33.89	35.19	36.18	32.17	34.00	35.42
Total unsaturated fatty acids	66.11	64.81	63.82	67.83	66.00	64.58
Unsaturated / saturated, ratio	1.95	1.84	1.76	2.11	1.94	1.82

Effect of frozen storage on the amino acid composition of raw chicken meat:

The effect of frozen storage on amino acid composition of raw chicken meat samples was studied and the obtained results are shown in table (5). From which it could be observed that a gradual decrease took place in all the amino acids of both investigated chicken meat samples during frozen storage, especially for glutamic acid, arginine, leucine and lysine. These results are in agreement with those previously reported by Moawad (1987). The total amino acids, essential amino acids and non-essential amino acids of chicken white meat samples were 79.54, 34.29 and 45.25 g/16 g N.

respectively after 6 months of frozen storage and the corresponding values for chicken dark meat samples were 77.07, 31.50 and 45.57 g/16 g N. respectively. During frozen storage, the total amino acids of meat decreased, while the total amino acids content of drip increased as the time of frozen storage progressed (El-Wakeil *et al*.., 1982; Ramadan, 1986 and Abd El-Gawad, 1988).Besides, Shehata (1974) found that, during frozen storage of buffalo meat at -20°C, the free amino acids content increased due to proteolysis. On the other hand, Morsi *et al*.. (1975) reported that, freezing of fish caused a decrease of total determined amino acids by 40%. The total determined and essential amino acids of buffalo meat (Kandoz) during 30 days of frozen storage at -20°C decreased from 111.69 to 82.92 and from 53.55 to 39.25 g/16 g N., respectively (Abo-Raya, 1979). A decrease in arginine, glycine, proline and alanine were found during frozen storage. Meanwhile, a minor increase was noticed in lysine, histidine, methionine, iso-leucine, leucine and tyrosine of the frozen stored meat samples at -10°C. However, aspartic acid, threonine, serine, valine and phenylalanine were almost unchanged (Abd Allah, 1981). Also, Hegazy *et al*.. (1990) pointed out that, freezing and frozen storage of lamb meat at -20°C, up to six months markedly reduced its total amino acids.

Table (5): Changes in amino acids composition of chicken meat during frozen storage (g/16 g N) at -20°C for 6 months.

Amino acids	Chicken white meat (breast)		Chicken dark meat (thigh)	
	Storage period (months)		Storage period (months)	
	0	6	0	6
Essential amino acids				
Threonine	3.09	2.78	2.80	2.48
Valine	5.87	5.22	4.62	4.02
Methionine	2.92	2.24	2.50	1.86
Isoleucine	5.01	4.76	4.79	4.57
Leucine	7.65	6.89	7.30	6.52
Tyrosine	2.48	1.98	2.55	2.15
Phenylalanine	3.59	3.28	3.44	3.10
Lysine	7.85	7.14	7.74	6.80
Tryptohane	--	--	--	--
Total essential amino acids	38.46	34.29	35.74	31.50
Non-essential amino acids				
Aspartic acid	8.95	8.35	9.32	8.70
Serine	3.20	2.86	3.14	2.81
Glutamic acid	16.09	14.05	16.54	14.22
Proline	--	--	--	--
Glysine	5.23	4.96	6.56	6.14
Alanine	5.71	5.22	6.01	5.52
Histidine	3.87	3.53	2.75	2.41
Arginine	6.32	5.56	5.70	4.96
Cysteine	1.12	0.72	1.35	0.81
Total non-essential amino acids	50.49	45.25	51.37	45.57
Total determined amino acids	88.95	79.54	87.11	77.07

• **Not determined.**

So, it could be concluded that frozen storage of chicken meat caused losses in total lipids, protein, nitrogen, soluble protein nitrogen, soluble actomyosin nitrogen, unsaturated fatty acids (caused by both enzymatic and oxidative reactions) and total essential and non-essential amino acids. Also chicken white meat proved to be more stable than the chicken dark meat under same frozen storage conditions.

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تأثير التخزين على ثبات لحم الدجاج

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*** قسم الصناعات الغذائية- المركز القومي للبحوث- الدقى- جيزة-مصر**

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أدى تخزين كل من لحم صدر وفخذ الدجاج على-٢٠م إلى تخفيض محتوى كل من الرطوبة والنيتروجين الكلى والنيتروجين الكلى الذائب والنيتروجين البروتينى الذائب ونيتروجين الأكتوميوسين مع زيادة فترة التخزين. ومن ناحية أخرى فى أى وقت من التخزين كانت نسبة كل المكونات السابقة فى عينات الصدر أعلى منها فى عينات الفخذ فيما عدى الليبيدات الكلية. وقد لوحظ أيضا من النتائج المتحصل عليها أن التخزين أدى إلى زيادة المواد النيتروجينية الغير بروتينية لكل من عينات لحم الدجاج الفاتح والداكن. لوحظ أن رقم البيروكسيد قد ازداد خلال الثلاث شهور الأولى فى عينتى لحم الدجاج المختبرتين خلال التخزين ثم أنخفض ثم زاد مرة أخرى بينما ازداد كل من الرقم الحمضى ورقم الثيوباربيتوريك لنفس العينات خلال فترة التخزين الكلية.انخفضت الأحماض الدهنية غير المشبعة خصوصا اللينولينيك واللينوليك خلال فترة التخزين لجميع عينات الدجاج. ولقد لوحظ أن أعلى نسبة فقد كانت فى لحم الدجاج الفاتح والداكن بعد ستة أشهر من التخزين. وبالمقارنة انخفضت نسبة الأحماض الدهنية المشبعة. ولقد كانت أقل نسبة من الأحماض الدهنية غير المشبعة للمشبعة لكل من عينات لحم الدجاج الفاتح والداكن بعد ستة أشهر من التخزين.كما لوحظ انخفاض تدريجى فى جميع الأحماض الأمينية فى كل من عينات لحم الدجاج الفاتح والداكن أثناء التخزين بالتجميد خصوصا حمض الجلوتاميك - الأرجينين - الليوسين الليسين.