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ANTIOXIDATIVE EFFECT OF SPICING BY ONION ON OXIDATION OF FAT MINCED MEAT DURING STORAGE.

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ABSTRACT: Certain spices prolong the storage life of food by their antioxidant properties. Onion (*Allium cepa*) of four different types (Saaidy, Giza$_6$, Shandweel$_1$ and Pehairy) were used during preparation of minced meat. Raw and broiled minced meat stored at (- 20 °C) for 4 months and analyzed for peroxide value (PV); thiobarbituric acid (TBA); acid value (AV); antioxidant effectiveness (AE) and oxidation rate ratio (ORR). Chlorogenic acid is a main phenolic compound separated and identified from Saaidy, Giza$_6$, Shandweel$_1$ and Pehairy onions methanolic extract among other phenolic compounds. The total phenolic content determined according to the Folin-Ciocalteu method varied from 785-966 ppm of dry product as caffeic acid acid. Due to cooking some oxidation and hydrolysis of lipids occurred. Changes of lipids increased as the time of storage increased. Cooking enhanced the increase of (PV), (TBA) and (AV) during frozen-storage. A decrease in (PV), (TBA) and (AV) was noticed in minced meat treated with onion of four different types during storage at (- 20 °C) for 4 months compared with control and semi-equal synthetic antioxidant treated samples which means that onion showed strong antioxidative properties. The percentage of antioxidant effectiveness and oxidation rate ratio of spicing by Saaidy onion was more than other different types of onions. It could be concluded that the adding of onion at 1.5% improved organoleptic properties of fresh and frozen storage of minced meat.

Key words: Spicing; Onion; Antioxidant; Minced meat; Cooking.

INTRODUCTION

In food processing, lipid oxidation not only causes a loss in nutritional and gustative oxidized products such as free radicals which led to various undesirable, chemical reactions. Also, oxidation can cause other degradation effects such as discoloration, vitamins

destruction, nutritional losses and polymerization (Pokorny, 1987). To avoid or delay this autoxidation process, antioxidants have been used.

Recently, there is an increasing international concern about the toxic adversity of malonaldehyde for humane health and the formation of that compound in foods during cooking, processing and storage as the result of the oxidation of the unsaturated fatty acids in their lipids. The harmful effect of malonaldehyde on human health has been reported by many authors as mutagenic and carcinogenic agents. This compound is responsible not only for deterioration of foods as the result of the oxidative rancidity and formation of off-flavor and unpleasant taste but also for damage of some human tissues, where it may be a cause of cancer inflammatory disease, mutagenicity, atherosclerosis, aging, etc. (Murray et.al., 1993).

Duh et al., (1992). Indicated that the efficiency of the solvents on the extraction was in the order of methanol > acetone > chloroform > n-hexane for the yields and antioxidative activities from two peanut hulls.

Recently, consumers interest in "natural" products, they prefer natural antioxidative substances to replace conventional synthetic antioxidants such as (BHT) Butylated hydroxytoluene and Butylated hydroxyanisol (BHA). Also δ-tocopherol, which in naturally occurring antioxidant, is a safe food additive and had little effect on its flavor (Whang, et al., 1986 and Emmons and Peterson, 1999). As reported by Campos, et al., (2003) onion is the bulb of the well known plant of the lily family, *Allium cepa*.

Polyphenolic compounds such as flavonoids, phenolic acid and proanthocyanidins, which are of great interest for their radical-scavenging activity, complexing with prooxidant metals, reducing agents and quenchers of singlet-oxygen formation are expected to be effective I the prevention of many diseases and morbid states by inhibiting lipid oxidation and the inhibition of human low density lipoprotein (LDL) (Robert, 1994), a reaction that initiates atherosclerosis and heart diseases, thereby decreasing the risk of heart diseases (Frankel, et al., 1998 and Heinonen, et al., 1998). They also displaying antimutagenic properties and treating microcirculatory disorders and eye conditions (Foster, 1997 and Frankel, 1999).

Aruoma (1999) reported oxidative degradation of lipids is a major factor limiting the shelf life of food. The free radical reaction of lipid peroxidation is generally responsible for the determination

of lipid containing food. Use of antioxidants during the manufacturing food process can minimize the extent of lipid peroxidation. Increasingly, there is a tendency towards the use of natural antioxidants of plant origin, extracts of some herbs and spices possess very useful antioxidant properties.

The aim of this investigation is to:

1- Evaluate the efficiency of the phytochemicals (phenolic compounds) of fresh onions of different types as a new sources of natural antioxidants for inhibition the rancidity of raw and cooked fat minced meat during storage at – 20 °C for 4 months.
2- Evaluate the separated and identified total phenolic compounds by HPLC analysis from different types of onions.
3- Investigate effect of spicing by different types of onion on organoleptic properties and stability of raw and cooked fat minced meat during storage at – 20 °C for 4 months.

MATERIALS AND METHODS

Materials:

The onion (*Allium cepa*) samples (Saaidy; $Giza_6$; $Shandweel_1$ and Pehairy) were obtained from the local market at El-Mansoura city, Egypt.

Fresh minced meat beef was purchased from the local market and mixed with 1.5% Nacl and 1.5% onion for 5 min. Control sample was prepared without onion.

Minced meat were cooked in a preheated gas oven for 30 min. to 170 °C, then allowed to cool at room temperature for about 15 min. Uncooked and cooked minced meat, were packaged in polyethylene bags and stored at –20 °C. Samples were taken for analysis monthly during storage.

Methods:

Extraction of polyphenolic compounds:

20g different onion types (Saaidy; $Giza_6$; $Shandweel_1$ and Pehairy) were extracted overnight with 200 ml methanol at room temperature according to the method described by Duh and Yen (1997). The extracts were filtered and the residue was re-extracted under the same conditions and the combined filtrates were evaporated to 5 ml by rotary evaporator at 40 °C under vacuum. The extracts were evaporated to dryness under vacuum and kept at – 4 °C till analysis.

Determination of total phenolic compounds:

The total phenolic compounds presented in Saaidy; $Giza_6$; $Shandweel_1$ and Pehairy onions

were determined spectrophotometrically using Folin-Ciocalteau reagent according to the method described by Duh and Yen (1995). The methanolic extracts (0.1 ml) of samples in a volumetric flask were diluted with glass-distilled water (75 ml). Folin-Ciocalteau reagent (5 ml) was added and the content of the flask mixed thoroughly. After 3 min., sodium carbonate (Na_2Ca_3) solution (10 ml, 10% w/v) was added and finally quantified to 100 ml glass-distilled water and then the mixture was allowed to stand for 30 min. with intermittent shaking. The blue color was measured with a UV-V is spectrophotometer. The concentration of total phenolic compounds in samples, mg/kg of dry product, were determined as caffeic acid.

Qualitative and quantitative determination of phenolic compounds by High Performance Liquid Chromatography (HPLC):

A Hewlett-Packard series 1, 100 liquid Chromatographic system (Waldbronn, Germany loop 20 µl) equipped with a diode array detector and a lichrosorb RP 18 column (4.0 mm id X 250 mm; partical size 5 µm) (Merck, Darmstadt) was used. Elution was performed at a flow rate of 1.0 ml/min. with mobile phase of water / acetic acid (98:2, v/v, solvent A) and methanol / acetonitril (50:50, v/v solvent B), starting with 5% B and increasing B to levels of 30% at 25min., 40% at 35 min., 52% at 40 min.,70% at 50 min., 100% at 55 min. and kept at this stage for 5 min. A reequilibration time of 15 min. was then required. Quantitation was achieved at 280 nm by internal standard method (Evangelisti, et al., 1997).

Chemical analysis:

Samples were taken for chemical analysis after 0; 1; 2; 3 and 4 months of storage. Peroxide value (PV) meq/kg and acid value (AV) were determined using the methods given by the A.O.A.C (1995). Thiobarbituric acid value (TBA) as an index of fat oxidation was determined as described by Pearson (1970). Measurements were carried out colorimetrically at 538 nm. Malonaldehyde content calculated by multiplying absorbance (D) at 538 nm by 7.8:
TBA no. (as mg malonaldehyde/kg sample) = 7.8 X D.

Increase percent to initial value (%):

The percent of initial value was calculated according to method of Penazzi, et al., (1997). using the equation:

$$\% = \frac{\text{(PV or TBA or AV) of test samples}}{\text{(PV or TBA or AV) of zero time}} \times 100$$

%= Percent of initial value.

PV= Peroxide value (meq/kg sample).
TBA= Thiobarbituric acid value.
AV= acid value.

Antioxidant effectiveness (AE):

The percentage antioxidant effectiveness (AE) was calculated according to method of Adegoke and Krishna (1998) and El-Shawaf (2000) using the equation:

$$AE = \frac{(PV) \text{ of control} - (PV) \text{ of test sample}}{(PV) \text{ of control}} \times 100$$

PV= Peroxide value (meq/kg sample).
AE= Antioxidant effectiveness.

Oxidation rate ratio (ORR):

The third method of expression based on the oxidation rate ratio (ORR) was calculated according to method of Marinova, et al. (1994) using the equation:

ORR= (PV) of test sample / (PV) of control

Where (PV) of test sample and (PV) of control are the same as in the previous equation.

Organoleptic Evaluation:

Organoleptic properties of appearance, color, odor, juiciness and texture of prepared products was carried out by aid of 10 panelists according to Klein and Bardy (1984), who recommended the following judging scale:

Very good	8-9 score
Good	6-7 score
Fair	4-5 score
Poor	2-3 score
Very poor	0-1 score

Statistical analysis:

Data were statistically analyzed according to procedure described by O'Mahoney (1986).

RESULTS AND DISCUSSION

Table (1) shows the total phenols of Saaidy; $Giza_6$; $Shandweel_1$ and Pehairy onions extract. The concentrations of total phenols were determined by the Folin-Ciocateu method varied from 664 to 1100 mg/kg of dry product as caffeic acid acid. The highest phenolic content was presented in Saaidy onion (966 mg/kg) followed by $Giza_6$ onion (923 mg/kg); $Shandweel_1$onion (826 mg/kg); whereas the lowest phenolic content was presented in Pehairy onion (785 mg/kg).

The levels total phenol in the methanolic extracts from the four above mentioned samples determined according to the Folin-Ciocalteu method are not absolute measurements of the amounts of phenolic materials but are in fact based on their chemical reducing capacity relative to an equivalent reducing capacity of caffeic acid acid. Various phenolic compounds have different responses in this assay. The molar response of this method is roughly proportional to the number of phenolic hydroxy groups in a given substrate, but the reducing capacity is enhanced when two phenolic hydroxy groups

are oriented ortho or para. Since these structural features of phenolic compounds are reportedly also responsible for antioxidant activity in fat systems (Frankel et.al., 1995).

Table (1): Total phenols (mg/kg of dry product as caffeic acid) in the methanolic extract from the tested onion samples.

No	Samples	Total phenols (mg/kg)
1-	Saaidy onion	966
2-	$Giza_6$ onion	923
3-	$Shandweel_1$ onion	826
4-	Pehairy onion	785

The aforementioned set of experiments relevant to the antioxidant efficiency of the total polyphenols extracted from Saaidy; $Giza_6$; $Shandweel_1$ and Pehairy onions demonstrated that the total polyphenols compounds possessed remarkable antioxidant activity. Therefor, it is quite necessary to characterize the phenolic compounds of total polyphenols. High performance liquid chromatography (HPLC) was used for the qualitative and quantitative determination of the total polyphenols. In the present study, only five phenolic compounds were identified, i.e., chlorogenic acid; caffeic acid; ferulic acid; elagic acid and protocatechuic acid due to the lack of other standard phenolic compounds. Table (2) show the chemical composition of polyphenols extracted from Saaidy; $Giza_6$; $Shandweel_1$ and Pehairy onions.

Data from results of HPLC analyses presented in Table (2), could be noticed that, cholorogenic acid was the major phenolic compounds and identified in different onion samples extracts, followed by caffeic; ferulic; protocatechuic acids and elagic acid; the smallest phenolic compounds identified in the tested samples.

The HPLC analysis of the phenolic constituents presented in Table (2) show that the concentration of chlorogenic acid, the major phenolic compound ranged from 39.50% in Saaidy onion extract to 42.25% in $Shandweel_1$ onion extract. Caffeic acid was the most abundant phenolic determined by our HPLC assay, and the levels of this component ranged from 30.95% in

$Giza_6$ onion extract to 33.23% in $Shandweel_1$ onion extract. While ferulic acid was the second most abundant phenolic compound ranged from 8.18% in Pehairy onion extract to 14.01% Saaidy onion extract. Protocatechuic acid varied from 5.71 in $Shandweel_1$ onion extract to 7.63 in $Giza_6$ onion extract. Elagic acid was a minor phenolic compounds presented only in Saaidy onion extract with a minor content of 4.11%. These results were in agreement with that obtained by Samah and Amany (2001) Arboleda-Florez (2003) they reported that chlorogenic acid is a main phenolic compound separated and identified from red onion extract among other phenolic compounds

Table (2): HPLC of total polyphenolic compounds of onion samples.

Samples / Polyphenols	SA	GI	SH	PE
Unknown (1)	2.60	1.85	1.82	1.14
Unknown (2)	1.20	0.65	2.65	2.16
Unknown (3)	1.02	4.21	--	3.51
Chlorogenic acid	39.50	41.92	42.25	40.02
Caffeic acid	31.51	30.95	33.23	31.81
Ferulic acid	14.01	6.84	9.14	8.18
Elagic acid	4.11	5.95	5.20	5.95
Protocatechuic acid	6.05	7.63	5.71	7.23

SA= Saaidy onion; GI= $Giza_6$ onion; SH= $Shandweel_1$ onion and PE= Pehairy onion.

The peroxide value is known as indicator of the extent of forming the hydroperoxides; the primary products of lipid oxidation in food stuffs. The oxidation of lipid during cooking leads to the development of rancidity and formation the undesirable off-flavor in food. Therefore, it seems reasonable to determine the concentration of hydroperoxides as a measure of the oxidation extent of lipids. The present data in Table (3)showed that the peroxide value of raw minced meat was the for different treatments (1.08 – 1.09). The same was found for cooked samples (1.35), therefore, cooking increased the (PV) of fat minced meat which indicated that some

oxidation of lipids may be occurred during broiling by the effect of heating.

Peroxide value reflecting fat oxidation of minced meat progressively increased during frozen-storage and at any giving time of storage, cooked samples had higher (PV) than the raw ones (Table 3). These data were agreed with that obtained by (Salama, 1983).

Table (3): Effect of spicing by different types of onion on PV (meq/kg fat) in raw and cooking minced meat during storage at – 20 °C for 4 months.

Sample	Time of storage (months)								
	0	1	%*	2	%	3	%	4	%
	Raw minced meat								
Control	1.08	1.81	167	2.06	190	2.70	250	3.05	282
SA	1.08	1.56	144	1.79	165	2.43	225	2.78	257
GI	1.08	1.59	147	1.82	168	2.45	226	2.80	259
SH	1.08	1.61	149	1.84	170	2.48	229	2.84	262
PE	1.09	1.62	148	1.85	169	2.51	228	2.88	264
	Cooked minced meat								
Control	1.35	2.29	169	2.49	184	2.99	221	3.89	288
SA	1.35	2.13	157	2.28	168	2.71	200	3.48	257
GI	1.35	2.16	160	2.29	169	2.73	202	3.50	259
SH	1.35	2.18	161	2.31	171	2.76	204	3.50	259
PE	1.35	2.18	161	2.33	172	2.79	206	3.52	260

Control= sample was prepared without onion; SA= Saaidy onion; GI= Giza$_6$ onion; SH= Shandweel$_1$ onion and PE= Pehairy onion. 0= Zero time; %* = Increase percent to initial value.

At any given time of storage (for both raw and cooked minced meat), (PV) as well as values calculated as percent of initial were highest for control sample (without onion), followed by treatments PE; SH; GI and SA. This indicated that highest

antioxidation effect was recorded for Saaidy onion (treatment SA), followed by $Giza_6$ and $Shandweel_1$ onions (treatments GI and SH). Actually, the antioxidation effect of Pehairy onion of treatment PE was slight. This might be due to variable contents of substances responsible for the retardation of lipids oxidation. But it should be noted that as flavor donor to minced meat, onion of treatment PE was of ordinary quality.

Table (4): Percentage of antioxidant effectiveness (AE) and oxidation rate ratio (ORR) of fat minced meat treated with different types of onion in raw and cooking minced meat during storage at – 20 °C for 4 months.

Sample	Time of storage (months)							
	1		2		3		4	
	AE	ORR	AE	ORR	AE	ORR	AE	ORR
Raw minced meat								
SA	13.81	0.86	13.10	0.86	10.00	0.90	8.85	0.91
GI	12.15	0.87	11.65	0.88	9.25	0.91	8.19	0.92
SH	11.05	0.88	10.67	0.89	8.14	0.91	6.88	0.93
PE	10.49	0.89	10.19	0.89	7.77	0.92	5.57	0.94
Cooked minced meat								
SA	6.98	0.93	8.43	0.91	9.36	0.91	10.53	0.89
GI	5.67	0.94	8.03	0.91	8.69	0.91	10.29	0.90
SH	4.80	0.95	7.23	0.92	7.69	0.92	10.02	0.90
PE	4.80	0.95	6.42	0.93	6.68	0.93	9.51	0.90

SA= Saaidy onion; GI= $Giza_6$ onion; SH= $Shandweel_1$ onion and PE= Pehairy onion.
AE= antioxidant effectiveness, ORR= oxidation rate ratio.

Data in Table (4) illustrate the percentage of antioxidant effectiveness (AE) and oxidation rate ratio (ORR) of fat minced meat treated with different types of onion in raw and cooking minced

meat during storage at – 20 oC for 4 months. Data showed that antioxidant effectiveness (AE) decrease for (13.81 to 8.85) during storage from 1-4 months in raw minced meat while oxidation rate ratio (ORR) increased from (0.86 to 0.91) for spicing by Saaidy onion. On the other hand (AE) were decrease from 12.15 to 8.19, 11.05 to 6.88 and 10.49 to 5.57 for spicing by (GI, SH and PE), while (ORR) were increase from 0.87 to 0.92, 0.88 to 0.93 and 0.89 to 0.94 for spicing by (GI, SH and PE) during storage respectively. Also, data in Table (4) showed that cooking affect on (AE) by decreasing it and (ORR) by increasing it for minced meat for all adding onion as spicing agent than raw minced meat. While, data in the same Table (4) showed that (AE) were increased and (ORR) were decreased for cooked minced meat for all onion spicing during storage periods.

Also, data in Table (4) showed that the percentage (AE) of Pehairy Shandweell and $Giza_6$ onions lower effect than Saaidy onion. From these data, it could be noticed that minced meat spicing by Saaidy onion at 1.5% concentration was more effective as natural antioxidant than other different types of onion, may be due to high total phenols in Saaidy onion than other samples onions.

The TBA value is considered as an indicator for the amount of malonaldehyde which is the most predominant secondary oxidation products of food lipids, hence it is considered a good chemical test for measuring the extent of the secondary oxidation of edible lipids during cooking and processing (Rodriguez-Estrada et.al., 1997). Data given in Table (5) showed that cooking caused some oxidation of lipids. During frozen-storage cooking enhanced the increase of TBA value which was progressively during storage. In this connection, TBA value confirmed the results obtained with PV (Table 3). Moreover, onion of treatment PE slight show antioxidation effect, which was highest for treatment SA, followed by GI, SH and PE. Control sample showed highest TBA value at any given time of storage in the case of both raw and cooked minced meat. TBA at late periods of storage, the calculated values of malonaldehyde as percent of initial value was higher for cooked than raw minced meat. Therefor, it might be concluded that at late periods of storage of cooked breakdown of peroxides to form aldehydes and other lipids oxidation products occurred and malonaldehyde took place. These results are in agreement with those reported by Shobana and Naidu, (2000).

Table (5): Effect of spicing by different types of onion on TBA (mg malonaldehyde/kg) in raw and cooking minced meat during storage at – 20 °C for 4 months.

Sample	Time of storage (months)								
	0	1	%*	2	%	3	%	4	%
	Raw minced meat								
Control	0.43	0.49	113	0.56	130	0.71	165	0.84	195
SA	0.43	0.43	100	0.44	102	0.48	111	0.68	158
GI	0.43	0.43	100	0.45	104	0.50	116	0.74	172
SH	0.43	0.44	102	0.46	106	0.52	120	0.75	174
PE	0.43	0.45	104	0.46	106	0.55	127	0.77	179
	Cooked minced meat								
Control	0.47	0.55	117	0.70	148	0.87	185	0.99	210
SA	0.47	0.47	100	0.58	123	0.78	165	0.84	178
GI	0.47	0.48	102	0.61	129	0.79	168	0.85	180
SH	0.47	0.49	106	0.65	138	0.79	168	0.86	182
PE	0.47	0.51	108	0.72	153	082	174	0.88	187

Control= sample was prepared without onion; SA= Saaidy onion; GI= $Giza_6$ onion; SH= $Shandweel_1$ onion and PE= Pehairy onion. 0= Zero time; %* = Increase percent to initial value.

In general, results with TBA value confirmed the conclusions revealed with PV, particularly with regard to antioxidation effect of onion treatments

The acid value is considered of the most chemical constants for quality assurance of both raw and cooked minced meat during storage at – 20 °C and as a good indicator for the hydrolysis extent takes place in these lipids of samples during storage at – 20 °C. As illustrated in the obtained results of Table (6), it could be indicated that the AV of raw and cooked minced meat samples increased by stored at – 20 °C for 4 months.

Table (6): Effect of spicing by different types of onion on acid value (AV) in raw and cooking minced meat during storage at – 20 °C for 4 months.

Sample	Time of storage (months)								
	0	1	%*	2	%	3	%	4	%
	Raw minced meat								
Control	0.18	0.37	205	0.58	322	0.71	394	0.80	444
SA	0.18	0.29	161	0.41	227	0.53	294	0.62	344
GI	0.18	0.34	188	0.45	250	0.56	311	0.64	355
SH	0.18	0.36	200	0.46	255	0.59	327	0.66	366
PE	0.18	0.35	194	0.48	266	0.60	333	0.67	372
	Cooked minced meat								
Control	0.22	2.17	986	2.95	1340	3.56	1618	4.77	2168
SA	0.22	1.84	836	2.67	1200	3.37	1531	4.44	2018
GI	0.22	1.88	854	2.68	1218	3.40	1545	4.49	2040
SH	0.22	1.89	859	2.70	1227	3.44	1563	4.50	2045
PE	0.22	1.90	863	2.75	1250	3.46	1572	4.53	2059

Control= sample was prepared without onion; SA= Saaidy onion; GI= Giza$_6$ onion; SH= Shandweel$_1$ onion and PE= Pehairy onion. 0= Zero time; %* = Increase percent to initial value.

From Table (6) it can be seen that cooking increased the acid value (AV) of fat minced meat, it indicated that heating caused some hydrolysis of lipids too. Moreover, AV increased continuously during frozen-storage for both raw and cooked samples. According to some authors, lipids oxidation caused the rise of AV due to increase of free fatty acids. This lipids oxidation might be the reason for more rate of AV increase in cooked than raw minced meat, because in the former cause lipids oxidation was more pronounced than in the latter one (Tables 3; 5 and 6). The influence of lipids oxidation on the rate of AV increase might be confirmed when samples arranged with regard to AV. Highest AV

Table (7): Effect of spicing by onion of different types on the organoleptic properties of raw treated minced meat during storage at – 20 °C for 4 months.

Time of storage (months)	Samples	Organoleptic properties					
		Appearance 20*	Color 20	Odor 20	Juiciness 20	Texture 20	Total score 100
0	Control	18.0 ± 0.6	18.0 ± 1.4	18.5 ± 1.1	16.5 ± 0.6	18.1 ± 0.8	89.1
	SA	18.2 ± 0.9	17.0 ± 1.2	19.0 ± 1.4	18.4 ± 0.5	18.3 ± 0.5	90.9
	GI	18.0 ± 0.7	17.0 ± 0.9	18.5 ± 0.9	18.3 ± 0.5	18.0 ± 0.8	89.8
	SH	18.0 ± 0.8	17.2 ± 1.8	18.4 ± 0.8	18.4 ± 0.7	18.0 ± 0.6	90.0
	PE	18.0 ± 0.6	17.1 ± 1.3	18.7 ± 1.3	18.5 ± 0.7	18.2 ± 0.6	90.5
SA	Control	17.0 ± 0.8	17.8 ± 1.4	17.9 ± 1.2	16.4 ± 0.8	17.8 ± 0.7	87.1
	SA	17.5 ± 0.9	16.6 ± 0.8	18.4 ± 1.0	18.1 ± 0.7	18.0 ± 0.6	88.6
	GI	17.6 ± 0.6	16.5 ± 1.5	18.0 ± 1.5	18.0 ± 0.5	18.0 ± 0.8	88.1
	SH	17.5 ± 0.7	16.4 ± 1.8	18.2 ± 1.2	18.0 ± 0.5	18.1 ± 0.6	88.2
	PE	17.4 ± 0.7	16.5 ± 1.6	18.3 ± 0.9	18.2 ± 0.6	18.0 ± 0.5	88.4
GI	Control	16.8 ± 0.9	17.2 ± 1.7	17.5 ± 1.3	16.0 ± 0.5	17.5 ± 0.5	85.0
	SA	17.1 ± 0.8	16.1 ± 1.0	17.7 ± 1.2	17.8 ± 0.6	17.9 ± 0.6	86.6
	GI	17.0 ± 0.6	16.0 ± 1.3	17.8 ± 1.1	17.7 ± 0.7	17.8 ± 0.8	86.3
	SH	17.2 ± 0.5	15.9 ± 1.6	17.7 ± 1.1	17.8 ± 0.5	17.9 ± 0.7	86.5
	PE	17.0 ± 0.8	16.0 ± 1.1	17.5 ± 0.8	17.6 ± 0.8	17.8 ± 0.5	85.9
SH	Control	15.4 ± 0.9	17.0 ± 1.2	13.9 ± 1.6	15.5 ± 0.6	17.0 ± 0.8	78.8
	SA	16.8 ± 0.7	15.8 ± 0.8	17.5 ± 1.4	17.7 ± 0.7	17.8 ± 0.8	85.6
	GI	16.7 ± 0.6	15.5 ± 1.4	17.4 ± 1.4	17.4 ± 0.5	17.7 ± 0.7	84.7
	SH	17.0 ± 0.6	15.4 ± 1.1	17.0 ± 1.2	17.6 ± 0.6	17.8 ± 0.6	84.8
	PE	16.9 ± 0.8	15.5 ± 1.5	16.8 ± 1.1	17.5 ± 0.5	17.4 ± 0.9	84.1
PE	Control	12.9 ± 0.5	16.0 ± 0.9	11.5 ± 1.3	15.0 ± 0.9	16.8 ± 0.8	72.2
	SA	16.5 ± 0.6	15.8 ± 1.4	17.5 ± 1.1	17.3 ± 0.5	17.4 ± 0.5	84.5
	GI	16.4 ± 0.5	15.6 ± 1.1	17.0 ± 1.0	17.1 ± 0.7	17.3 ± 0.7	83.4
	SH	16.1 ± 0.6	15.7 ± 1.6	16.5 ± 0.9	17.0 ± 0.6	17.1 ± 0.6	82.4
	PE	16.3 ± 0.7	15.3 ± 1.3	16.0 ± 0.9	16.8 ± 0.7	17.4 ± 0.5	81.8

Control= sample was prepared without onion; SA= Saaidy onion; GI= $Giza_6$ onion; SH= $Shandweel_1$ onion and PE= Pehairy onion.
0= Zero time; * = Max. score; ± = Means standard deviation.

Table (8): Effect of spicing by onion of different types on the organoleptic properties of cooked treated minced meat during storage at – 20 °C for 4 months.

Time of storage (months)	Samples	Organoleptic properties					
		Appearance 20*	Color 20	Odor 20	Juiciness 20	Texture 20	Total score 100
0	Control	18.2 ± 0.7	18.1 ± 1.4	18.2 ± 1.2	16.9 ± 0.7	18.6 ± 0.9	90.0
	SA	18.5 ± 0.9	17.9 ± 1.3	19.8 ± 1.1	18.3 ± 0.6	18.6 ± 0.5	93.1
	GI	18.1 ± 0.7	17.8 ± 1.4	18.6 ± 1.4	18.5 ± 0.8	18.5 ± 0.7	91.5
	SH	18.2 ± 0.6	17.7 ± 1.3	18.5 ± 1.2	18.5 ± 0.7	18.7 ± 0.7	91.6
	PE	18.1 ± 0.6	17.7 ± 1.1	18.8 ± 1.2	18.3 ± 0.6	18.6 ± 0.6	91.6
SA	Control	17.2 ± 0.7	17.8 ± 1.4	17.7 ± 1.3	16.6 ± 0.9	17.9 ± 0.6	87.2
	SA	17.6 ± 0.8	16.9 ± 1.2	18.6 ± 1.1	18.3 ± 0.6	18.2 ± 0.6	89.6
	GI	17.6 ± 0.6	16.8 ± 1.5	18.3 ± 1.2	18.2 ± 0.5	18.3 ± 0.5	89.2
	SH	17.4 ± 0.6	16.7 ± 1.4	18.3 ± 1.1	18.3 ± 0.7	18.2 ± 0.6	88.9
	PE	17.5 ± 0.7	16.8 ± 1.2	18.5 ± 0.9	18.2 ± 0.6	18.1 ± 0.5	89.1
GI	Control	16.9 ± 0.5	17.7 ± 1.1	17.5 ± 1.1	16.6 ± 0.5	17.7 ± 0.9	86.4
	SA	17.3 ± 0.7	16.9 ± 1.2	17.9 ± 1.1	17.7 ± 0.7	17.9 ± 0.5	87.7
	GI	17.3 ± 0.6	16.8 ± 1.4	17.8 ± 1.4	17.8 ± 0.9	17.6 ± 0.7	87.3
	SH	17.1 ± 0.6	16.5 ± 1.1	17.6 ± 0.9	17.8 ± 0.5	17.8 ± 0.8	86.8
	PE	17.2 ± 0.7	16.6 ± 1.2	17.7 ± 0.7	17.5 ± 0.7	17.8 ± 0.5	86.8
SH	Control	15.7 ± 0.8	17.2 ± 1.4	13.5 ± 1.4	15.9 ± 0.6	17.3 ± 0.8	79.6
	SA	16.9 ± 0.7	16.1 ± 0.9	17.6 ± 1.3	17.5 ± 0.5	17.9 ± 0.6	86.0
	GI	16.7 ± 0.6	15.9 ± 1.4	17.6 ± 1.2	17.5 ± 0.7	17.6 ± 0.9	85.3
	SH	17.3 ± 0.7	15.8 ± 1.3	17.3 ± 1.1	17.7 ± 0.7	17.8 ± 0.6	85.9
	PE	16.8 ± 0.5	15.9 ± 1.2	16.9 ± 1.4	17.4 ± 0.6	17.6 ± 0.8	84.6
PE	Control	12.6 ± 0.5	16.0 ± 1.0	11.1 ± 1.2	15.4 ± 0.8	16.6 ± 0.6	71.7
	SA	16.8 ± 0.8	15.9 ± 1.6	17.4 ± 1.1	17.4 ± 0.6	17.5 ± 0.5	85.0
	GI	16.6 ± 0.5	15.8 ± 1.1	17.3 ± 1.2	17.3 ± 0.5	17.4 ± 0.7	84.7
	SH	16.3 ± 0.5	15.8 ± 1.4	16.9 ± 0.6	17.2 ± 0.5	17.3 ± 0.5	83.5
	PE	16.4 ± 0.6	15.7 ± 1.2	16.8 ± 0.8	16.9 ± 0.8	17.6 ± 0.6	83.4

Control= sample was prepared without onion; SA= Saaidy onion; GI= Giza6 onion; SH= Shandweel1 onion and PE= Pehairy onion.
0= Zero time; * = Max. score; ± = Means standard deviation.

was recorded for control samples, followed by minced meat prepared with onion of treatment PE; SH; GI and SA. Thereby, the higher the oxidation of lipids, higher the AV was found in different treatments.

Tables (7 and 8) shows the effect of spicing by onion of different types on the organoleptic properties (appearance, color, odor, juiciness and texture) of raw and cooked treated minced meat during storage at – 20 °C for 4 months. It could be concluded that no obvious differences obtained between raw minced meat with onion of different types (SA, GI, SH and PE) during storage at – 20 °C for 4 months. Samples SA, GI, SH and PE were more than control for (AV) during storage at – 20 °C for 4 months, as means standard deviation.

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التأثير المضاد للأكسدة للتتبيل بالبصل على أكسدة الدهن فى اللحم المفروم أثناء التخزين

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تســتخدم بعــض التوابل لإطالة فترة التخزين للأطعمة لما تحتويه من الخصائص المانعــة للأكســدة. حيــث تم استخدام أربعة أنواع مختلفة من البصل عند إعداد اللحم المفــروم. وقد خزنت عينات اللحم المفروم النيئة والمطهى فى الفرن لمدة أربعة أشهر علــى –٢٠ °م، وأثــناء ذلــك تــم تقديــر رقــم البيروكســيد (PV) وقيمة حامض

الثيوباربتيوريك (TBA) ورقم الحموضة (AV) وفاعلية مضادات الأكسدة (AE) ونسبة الأكسدة (ORR) والخواص الحسية. كما تم التعرف على المركب الفينولى الأساسى ضمن المركبات الفينولية الأخرى المفصولة من المستخلص الميثانولى لعينات البصل الصعيدى، والجيزة٦، والشندويل١، والبحيرى.

وقد أظهرت النتائج أن الفينولات الكلية المقدرة باستخدام طريقة فولين تتراوح من ٧٨٥-٩٦٦ جزء فى المليون مقدرة كحامض كافييك، وتم تفريد هذه المركبات باستخدام جهاز التحليل السائل فائق الأداء (HPLC)، وتم التعرف على المركب الأساسى لها وهو حمض الكلوروجينيك.

كما أوضحت النتائج حدوث بعض الأكسدة والتحلل المائى للبيبدات نتيجة للطهى. كما كان هناك زيادة مطردة فى أكسدة الدهون مع زيادة مدة التخزين، كما اتضح أن الطهى يشجع على ارتفاع رقم البيروكسيد (PV) وقيمة حامض الثيوباربتيوريك (TBA) ورقم الحموضة (AV) أثناء التخزين بالتجميد. كما وجد تناقص فى كل من رقم البيروكسيد (PV) وقيمة حامض الثيوباربتيوريك (TBA) ورقم الحموضة (AV) فى عينات اللحم المفروم المعامل بالمقارنة بعينة الكنترول أثناء التخزين على -٢٠ °م ولمدة أربعة أشهر، مما يوضح أن الأصناف المختلفة للبصل كان لها تأثير مضاد للأكسدة قوى، وإن كانت النسبة المئوية لتأثير مضادات الأكسدة عند تتبيل اللحم المفروم بصنف البصل الصعيدى أعلى من كل أصناف البصل الأخرى موضع الدراسة. كما لوحظ أن إضافة البصل بأنواعه المختلفة أدى إلى تحسين الخصائص الحسية لعينات اللحم المفروم الطازج والمطهى وكذلك خلال فترة التجميد حيث يساعد على ثبات الدهن من التزنخ.

لذا توصى الدراسة: باستخدام البصل بنسبة ١,٥ % فى تتبيل اللحم المفروم وكمضاد طبيعي لأكسدة الدهون أثناء التخزين بالتجميد والطهى، حيث يعمل على تحسين الخواص الحسية للمنتج النهائي لدى المستهلك.