Effect of Some Plant Extract on Oxidative and Microbial Stability of Meat

Amani M. Salem[1] , Nahla A.Shawky[2], Lamiaa M. Abo-Hussein[2]

[1]*Food Control Dep., Fac. Vet. Med., Benha Univ.*

[2]*Animal Health research institute, shebin el koom branch.*

A B S T R A C T

The study was designed to investigate antimicrobial and antioxidant activity of olive leaves , curcuma and ginger extracts on minced meat samples. Minced meat was divided into 4 groups, untreated (control) and 3 treated groups, the first treated group was homogenized with olive leaves extract(5% & 3%) & second group was homogenized with curcuma extract (1% ,2%) and third group was homogenized with ginger extract (0.4%, 0.6%). The minced meat samples were examined physically, bacteriologically and chemically to determine their keeping quality by aerobic plate, *Staphylococcal* and *Enterobacteriacae* counts, as well as measuring pH, TBA and TVN immediately after preparation (zero time) until 6 days of chilling storage (4±1°C). Olive leaves extracts were more effective at all concentrations followed by ginger then curcuma extracts. Which may be due to flavonoids and phenolic compounds obtained from olive leaf extracts that play an important role as antioxidant and antimicrobial agents in the stored meat .

Key words: Olive leaves, ginger, curcuma, antimicrobial, antioxidant, minced meat.

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1. INTRODUCTION

Meat and meat products are susceptible to variation in quality parameters and deterioration of their nutritional components (Shah et al., 2014). Meat is an important source for some micronutrients such as trace elements and vitamins. In addition, meat as a protein-rich and carbohydrate-low product contributes to a low glycemic index, which is assumed to be beneficial with respect to obesity, diabetes development and cancer (Biesalski, 2005). However, meat get easily contaminated by microorganisms present in animal prior to slaughter. It is therefore important to make meat safe for consumers in terms of stability, transportation and storage. Shelf-life and maintenance of meat quality are influenced by a number of interrelated factors including holding temperature, which can result in determinable changes in the quality attributes of meat. Spoilage by microbial growth is the most important factor in relation to keeping quality of meat (Lambert et al., 1991).

Moreover, spoilage of meat has remained a serious challenge in developing countries, including Egypt for decades, this has been due to poor storage systems in such countries where necessary facilities that could help to promote preservation are unavailable. (Olaoye and Onilude, 2010).

Lipid oxidation and the growth of undesirable microorganisms in food products results in the development of spoilage, off flavor, rancidity, and deterioration, rendering such products unacceptable for human consumption (Mielnik et al., 2008). An increased interest has been directed towards plant-based extracts as source of phenolic antioxidants and antimicrobials (Skerget et al., 2005). Recently, the use of plant extracts as natural antioxidants has gained increasing interest because of the global trend of restriction in use of synthetic substances, also antioxidant rich plant extracts have potential benefits in food preservations (Uhart et al., 2006). Some studies expressed that plant extracts and EO components appear to make the cell membrane permeable and are able to disintegrate the outer membrane of Gram-negative bacteria .These are slightly more active against Gram-positive than Gram-negative bacteria.(Abdollahzadeh et al., 2014)

Olive leaf extract (OLE) has both antimicrobial and antioxidant activities due to its polyphenols (Lee and Lee, 2010).

Turmeric (Curcuma longa) is extensively used as spice, food preservative and coloring material in India, China and South East Asia. curcuminoids has been isolated from the rhizome of C longa, attributing a wide array of biological activities (Tilak et al. 2004; Kumar et al. 2006) Curcumin is a phenolic component obtained from turmeric (Sharma et al., 2005) curcumin has antioxidant, antimicrobial, anti-cancer and anti-inflammatory effects (Aggarwal et al. 2007) .

Also, Ginger is one of the most used condiments for preparation of various dishes in India. (Fijelu Frank et al., 2014) suggested that ginger as a natural herb, could be used to extend the shelf life of meat products, providing the consumer with food containing natural additives, which might be seen more healthful than those of synthetic origin.

Therefore, this study was performed to investigate the antioxidant as well as the antimicrobial effectiveness of Olive leaves, ginger and curcuma extracts at various concentrations on the quality of fresh minced meat during chill storage (4±1°C).

2. MATERIALS AND METHODS

2.1. Collection of samples:

About 5 kg fresh minced beef samples were collected from different butchers shops at El Menofia governorate and transported in an ice box as rapidly as possible to the laboratory. Minced meat samples were divided into 4 groups, untreated (control 200 gm) and 3 treated groups each one 400 gm which were homogenized with olive leaves extract (5% Vol/W & 3% Vol/W) ,turmeric extract (1% Vol/W& 2% Vol/W) and ginger extract (0.4% Vol/W & 0.6% Vol/W). Both untreated and treated samples were packaged in a separate plastic bags, stored at (4±1°C) and then examined sensory, bacteriologically and chemically after (2 hrs) as zero time and at predetermined interval 24 hours. The experiment was conducted in triplicate and subjected to:

2.2. Sensory analyses:

The overall acceptability were determined for each sample of minced meat according to (Pearson and Tauber, 1984).

2.3. Bacteriological analyses:

Preparation of samples following ICMSF, 1978 was applied as 10 g portion of each sample was aseptically weighed into 90 ml of 0.1% peptone water in a sterile plastic bag, and then blended in a Stomacher 400 Lab Blender for 30 seconds. Ten-fold serial dilutions were used for bacteriological examination.

Determination of :-

Aerobic Plate Count (ICMSF., 1996).

Enterobacteriaceae count according to (Gork, (1976) .

Staphylococci count according to(ICMSF., (1996).

2.4. Chemical analyses:

Determination of pH (Pearson and Tauber, 1984), Total Volatile Nitrogen (TVN) following Food and Agriculture Organization (FAO, 1980). and Thiobarbituric acid number (TBA) following (Vyncke, 1970) were applied. All experiments were conducted in triplicate.

2.5. Statistical Analysis:

Was adapted according to Gomez and Gomez (1984).

2. RESULTS

The results achieved in table (1) showed that sensory analyses of control (untreated groups) remain accepted until 2 nd day while treated groups with olive leaf extract (5 % and 3 %) remain accepted until 6th day and 5th day. Also, ginger extract (0.6 % and 0.4 %) remain accepted until 5th day and 4th day respectively. Moreover, curcuma extract (0.2% and 0. 1%) remain accepted until 4th day and 3th day, respectively.

Table (2,3,4) indicated that the untreated samples showed the highest APC, Enterobacteriaceae counts and Staphylococcus count (log. cfu/g) comparing to the treated ones. The APC, Enterobacteriaceae counts and Staphylococcus count were gradually decrease during cold storage for all samples with different ratios depending on the type and concentration of the extracts. The treated samples with olive leaf extract (5 % and 3 %) showed the lowest counts followed by ginger extract (0.6 % and 0.4 %) at all days of cold storage.

Also, the results obtained in table (5) showed that the reduction percentage of APC, Enterobacteriaceae and Staphylococci counts. The highest reduction percentage were in olive leaf extract (5 %) which recorded 55.8%, 54.7% and 58.6% at 6th day of cold storage.

It is evident from the present investigation that the differences in pH mean values between different treated and untreated samples were significant (P<0.05) during storage at (4±1°C) as shown in table (6). The results showed an increase in pH mean values in untreated groups and decrease in treated ones. The highest rates were found in control samples (7.06±0.022) while, treated samples with olive leaf extract (5 % and 3 %) were the lowest (3.51 ±.044) and (3.55 ±.042) respectively followed by ginger extract (0.6 % and 0.4 %) were (3.55±.038) and (3.61±.038) respectively, while , curcuma extract (0.2% and 0. 1%) were (3.67±.022)and (3.71±.021) at 6th day of cold storage at (4±1°C) , respectively.

Table (7) showed an increase in TVN mean values (mg/100g) in untreated groups and decrease in treated ones. The highest rates were found in control samples (15.17±.088) while, treated samples with olive leaf extract (5 % and 3 %) were the lowest (11.45±.058) and (11.48±.088) respectively followed by ginger extract (0.6 % and 0.4 %) were (11.46±.058) and (11.51±.058) respectively, while , curcuma extract (0.2% and 0. 1%) were (11.59±.033) and (11.61±.033) at 6th day of cold storage at (4±1°C) , respectively.

On the other hand, TBA mean values in different treatments during storage by different rates shown in table (8) The untreated (control) sample showed the highest value (0.599±0.006) in 6th day of storage, while, treated samples with olive leaf extract

(5 % and 3 %) were the lowest (0.223 ±0.009) and (0.227±0.012) respectively followed by ginger extract (0.6 %and 0.4 %) were (0.226 ±0.009) and (.234±.006) respectively, while , curcuma extract (0.2% and 0. 1%) were (0.250±0.015) and (0.260±0.006) at 6th day of cold storage at (4±1°C) , respectively.

Table (1): Effect of various concentrations of natural extracts on overall acceptability of minced beef during cold storage at 4±1ºC.

Groups	conc.	Zero day	1st day	2nd day	3rd day	4th day	5th day	6 th day
Control	–	9	7	5	3	2	1	1
Olive leaf	5%	9	9	8	7	6	6	5
	3%	9	9	7	6	6	5	4
curcuma	2%	9	8	7	6	5	3	2
	1%	9	7	6	5	4	2	2
ginger	0.6%	9	9	7	7	6	5	4
	0.4%	9	8	7	6	5	4	3

Score System for Sensory Evaluation:

9: Excellent
8: Very very good
7: Very good
6: Good
5: Medium
4: Fair
3: Poor
2: Very poor
1: Very very poor

Table (2): The effects of various concentrations of natural extracts on APC (log. cfu/g) of the examined minced meat samples during cold storage at 4±1ºC.

Groups	control	Olive leaf		curcuma		Ginger	
		5%	3%	2%	1%	0.6%	0.4%
Zero day	5.72 ± 4.75	5.72 ± 4.75	5.72^{h} ± 4.75	5.72 ± 4.75	5.72h ± 4.75	5.72h ± 4.75	5.72 ± 4.75
1th day	5.84^{h} ± 4.96	5.55^{h} ± 4.73	5.67 ± 4.67	5.68 ± 4.72	5.69 ± 4.7	5.67 ± 4.72	5.68^{h} ± 4.69
2rd day	6.86 ± 5.53	5.41 ± 4.44	5.66^{h} ± 5.34	5.67 ± 5.08	^{gh}5.68 ± 4.76	5.66 ± 5.4	5.67 ± 5.47
3nd day	7.34 ± 6.5	5.01 ± 6.49	5.43 ± 6.51	5.44 ± 6.32	5.45^{fgh} ± 6.27	5.43^{fgh} ± 6.48	5.44 ± 6.45
4st day	7.92^{f} ± 6.63	4.71^{fgh} ± 6.49	4.74^{fgh} ± 6.52	4.78 ± 6.44	4.79 ± 6.44	4.74 ± 6.4	4.76 ± 6.44
5st day	8.14 ± 7.53	4.35 ± 7.7	4.72^{e} ± 7.7	4.76^{cd} ± 7.4	4.77 ± 7.65	4.72 ± 7.64	4.74 ± 7.7
6st day	8.52 ± 3.55	3.76 ± 3.67	3.79 ± 3.72	3.85 ± 3.49	3.88^{b} ± 3.58	3.77^{e} ± 3.58	3.78 ± 3.45

The values represent mean ± SD of three experiments.
Different letters within the same (column/row) indicate significant difference at $p < 0.05$

Table (3): The effects of various concentrations of natural extracts on *Enterobacteriace*(log. cfu/g) of the examined minced meat samples during cold storage at 4±1ºC.

Groups	control	Olive leaf		curcuma			Ginger
		5%	3%	2%	1%	0.6%	0.4%
zero	4.92	4.92	4.92^{e}	4.92	4.92	4.92^{e}	4.92
day	±	±	±	±	±	±	±
	4.14	4.14	4.14	4.14	4.14	4.14	4.14
1th day	4.98^{e}	4.55^{e}	4.58	4.63	4.64	4.56	4.58^{e}
	±	±	±	±	±	±	±
	4.64	4.22	4.34	4.42	4.54	4.23	4.33
2rd day	5.12	4.24^{e}	4.31	4.34	4.48^{e}	4.31	4.35
	±	±	±	±	±	±	±
	4.67	3.95	3.81	3.75	3.47	3.07	3.12
3nd day	5.24	4.05	4.1^{e}	4.19	4.25^{e}	4.06^{e}	4.17
	±	±	±	±	±	±	±
	4.61	3.6	3.68	3.75	3.77	3.61	3.62
4st day	5.54^{e}	3.59^{e}	3.63	3.78	3.78	3.45	3.59
	±	±	±	±	±	±	±
	5.38	3.14	3.13	3.28	3.42	3.13	3.17
5st day	5.81	3.21	3.25^{cd}	3.34	3.42	3.24	3.21
	±	±	±	±	±	±	±
	5.86	3.12	3.15	3.12	3.22	3.19	3.15
6st day	5.99	2.71	2.78	2.81	2.87^{c}	2.74^{cd}	2.71^{cd}
	±	±	±	±	±	±	±
	5.89	2.25	2.29	2.35	2.35	2.25	2.3

The values represent mean ± SD of three experiments.

Different letters within the same (column/row) indicate significant difference at $p < 0.05$

Table (4): The effects of various concentrations of natural extracts on *Staphylococci* (log. cfu/g) of the examined minced meat samples during cold storage at 4±1ºC.

Groups	control	Olive leaf		curcuma		Ginger	
		5%	3%	2%	1%	0.6%	0.4%
Zero day	4.53 ± 2.25	4.53 ± 2.25	4.53^{g} ± 2.25	4.53 ± 2.25	4.53 ± 2.25	4.53^{g} ± 2.25	4.53 ± 2.25
1th day	4.89^{g} ± 2.55	4.33^{g} ± 2.44	4.35 ± 2.44	4.39 ± 2.36	4.42 ± 2.36	4.34 ± 2.5	4.37^{g} ± 2.5
2rd day	5.14 ± 3.32	4.03 ± 3.4	4.09^{g} ± 3.38	4.11^{g} ± 3.18	4.21 ± 3.18	4.09 ± 3.42	4.12 ± 3.45
3nd day	5.73 ± 3.46	3.63 ± 3.74	3.71 ± 3.72	3.87^{g} ± 3.32	3.88 ± 3.25	3.71^{g} ± 3.69	3.74 ± 3.7
4st day	5.93 ± 4.16	3.25^{f} ± 4.57	3.31 ± 4.49	3.45 ± 3.95	3.49 ± 4.16	3.26 ± 4.61	3.32^{f} ± 4.53
5st day	6.12 ± 4.06	3.02^{f} ± 4.64	3.11^{ef} ± 4.57	3.23 ± 4.08	3.25^{ef} ± 3.76	3.12 ± 4.57	3.19 ± 4.59
6st day	6.48 ± 5.69	2.68 ± 5.84	2.71 ± 5.85	2.86^{b} ± 5.4	2.91 ± 5.45	2.67^{d} ± 5.88	2.73 ± 5.89

The values represent mean ± SD of three experiments.
Different letters within the same (column/row) indicate significant difference at $p < 0.05$

Table(5) Reduction percentage of microbial growth with different concentrations of natural extracts.

M.O	**Groups**	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**
APC	Olive leaf 5%	4.9 %	21.3%	31.7 %	40.5%	46.5%	**55.8%**
	Olive leaf 3%	3.6 %	17.4 %	26.0 %	40.1%	42.0%	**55.5%**
	Curcuma 2%	2.7 %	17.3%	25.8%	39.6%	41.5%	**54.8%**
	Curcuma 1%	2.5 %	17.2%	25.7 %	39.5%	41.4%	**54.4%**
	Ginger 0.6%	3.6 %	17.4 %	26.0 %	40.1%	42.0%	**55.7%**
	Ginger 0.4%	2.7 %	17.3%	25.8%	39.8%	41.7%	**55.6%**
Enterobacteriacea	Olive leaf 5%	8.6 %	17.1.3 %	22.7%	35.1%	44.7%	**54.7%**
	Olive leaf 3%	8.0 %	15.8 %	21.7%	34.4%	44.0%	**53.5%**
	Curcuma 2%	7.0 %	15.2%	20.0%	31.7%	42.5%	**53.0%**
	Curcuma 1%	6.8 %	12.5%	18.8%	31.7%	41.1%	**52.0%**
	Ginger 0.6%	8.4 %	15.8 %	22.5%	37.7%	44.2%	**54.2%**
	Ginger 0.4%	8.0 %	15.0%	20.4%	35.1%	44.7%	**54.7%**
Staphylococci	Olive leaf 5%	11.4 %	21.5%	36.6%	45.1%	50.6%	**58.6%**
	Olive leaf 3%	11.0 %	20.4 %	35.2%	44.1%	49.1%	**58.1%**
	Curcuma 2%	10.2 %	20.0%	32.4%	41.8%	47.2%	**55.8%**
	Curcuma 1%	9.6 %	18.0%	32.2%	41.1%	46.8%	**55.0%**
	Ginger 0.6%	11.2 %	20.4%	35.2%	45.0%	49.0%	**58.7%**
	Ginger 0.4%	10.6 %	19.8%	34.7%	44.0%	47.8%	**57.8%**

Table (6): The effects of various concentrations of natural extracts on pH of the examined minced meat samples stored at 4±1 ºC.

Days	***Control***	**Olive leaf (5%)**	**Olive leaf *(3%)***	***curcuma* *(2%)***	***curcuma* *(1%)***	**Ginger *(0.6%)***	**Ginger (0.4%)**
Zero	5.66^{n} ±.117	5.66± .117	5.66^{n} ±.117	5.66± .117	5.66^{n} ±.117	5.66± .117	5.66± .117
1st	5.89^{m} ±.038	5.61± .092	5.66± .086	5.81± .041	5.87± .033	5.63^{n} ±.085	5.64± .084
2nd	6.42± .118	5.21± .064	5.23^{l} ±.064	5.37± .090	5.38^{jk} ±.090	5.23± .061	5.26± .070
3th	6.77± .030	5.01± .026	5.09^{ij} ±.009	5.19^{h} ±.021	5.21± .021	5.03± .030	5.11± .024
4th	6.95^{bc} ±.023	4.61± .012	4.64± .021	4.83± .023	4.86± .021	4.63^{def} ±.015	4.65^{h} ±.015
5th	7.01± .003	4.15^{g} ±.023	4.22^{fg} ±.015	4.35± .035	4.37± .017	4.16± .023	4.24± .024
6th	7.06± .022	3.51^{efg} ±.044	3.55±.042	3.67± .022	3.71^{ab} ±.021	3.55± .038	3.61± .038

The values represent mean ± SD of three experiments.

Different letters within the same (column/row) indicate significant difference at $p < 0.05$

Table (7): The effects of various concentrations of natural extracts on TVN (mg/100g) of the examined minced meat samples during cold storage at 4±1 ºC.

Groups	control	Olive leaf		curcuma		Ginger	
		5%	3%	2%	1%	0.6%	0.4%
Zero day	13.37 ± 0.24	13.37st ± 0.24	13.37 ± 0.24	13.37 ± 0.24	13.37st ± 0.24	13.37 ± 0.24	13.37 ± 0.24
1th day	13.53 ± 0.176	13.01^{rst} ± 0.208	13.05 ± 0.203	13.15 ± 0.176	13.18^{opqrs} ± 0.176	13.04 ± 0.208	13.11^{pqrs} ± 0.208
2rd day	13.87^{jklmn} ± 0.088	12.87 ± 0.12	12.89^{lmnop} ± 0.12	12.93 ± 0.033	12.97^{ijkl} ± 0.088	12.9 ± 0.115	12.94 ± 0.153
3nd day	14.1 ± 0.058	12.43 ± 0.233	12.51 ± 0.233	12.6 ± 0.173	12.65^{defghi} ± 0.145	12.44 ± 0.26	12.49 ± 0.26
4st day	14.23^{cdefgh} ± 0.033	12.02 ± 0.12	12.09^{hijk} ± 0.058	12.21 ± 0.058	12.31 ± 0.067	12.08^{ghij} ± 0.133	12.17 ± 0.12
5st day	14.87 ± 0.033	11.87 ± 0.12	11.89^{defghi} ± 0.12	11.97 ± 0.033	11.99 ± 0.058	11.88 ± 0.115	11.91 ± 0.115
6st day	15.17 ± 0.088	11.45^{efghij} ± 0.058	11.48 ± 0.088	11.59^{cde} ± 0.033	11.61^{e} ± 0.033	11.46 ± 0.058	11.51 ± 0.058

The values represent mean ± SD of three experiments.

Different letters within the same (column/row) indicate significant difference at $p < 0.05$

Table (8): The effects of various concentrations of natural extracts on TBA (Melanoaldehyde /Kg) of the examined minced meat samples during cold storage at 4±1 ºC.

Days	***Control***	**Olive leaf (5%)**	**Olive leaf *(3%)***	***curcuma* *(2%)***	***curcuma* *(1%)***	**Ginger *(0.6%)***	**Ginger(0.4%)**
Zero	**.009 .433±**	**.009 .433±**	**.433 ^{w} ± .009**	**.009 .433±**	**.009 .433±**	**.433 ^{w} ± .009**	**.009 .433±**
1st	.006.480 ^{s} ±	.006 .401±	.407 ^{u} ± .006	.006 .414±	.006 .419±	.009.405 ^{v} ±	.009 .411±
2nd	.499 ^{hij} ± .012	.368 ^{pq} ± .006	.006 .370±	.381 ^{kl} ± .012	.006 .386±	.369 ^{nop} ± .006	.371 ^{mn} ± .006
3th	.520 ^{e} ± .009	.006 .336±	.009 .339±	.009 .349±	.009 .352±	.006 .338±	.006 .340±
4th	.006.570 ^{c} ±	.015 .313±	.009 .318±	.009 .321±	.326 ^{e} ± .006	.023 .314±	.019 .319±
5th	.006 .580±	.012 .276±	.015 .278±	.015 .281±	.020 .288±	.012 .277±	.017 .270±
6th	.006 .599±	.009 .223 ^{j} ±	.012 .227±	.015 .250±	.006 .260±	.009 .226 ^{j} ±	.006.234 ^{g} ±

The values represent mean ± SD of three experiments.

Different letters within the same (column/row) indicate significant difference at p <0.05

3. DISCUSSION

Sensory evaluation is an easy, quick and efficient method for getting idea about the quality of the product and its overall acceptance; sensory methods were used to assess the degree of freshness based on organoleptic characteristics such as color, odor, texture and overall acceptability of the product (Haq *et al.*, 2013). It is obvious from results obtained in table (1) that the sensory properties of different treated minced meat samples during cold storage (4±1°C) were enhanced and shelf-life were extended .The obtained results indicated that the best sensory quality was attained at the highest concentration of olive leaf and ginger, while slight improvement in sensory quality of curcuma-treated minced beef samples was noticed in samples as compared with untreated samples. These results were nearly similar to those results obtained by Mancini et al., (2017) , Omojola et al., (2015) showed that the ethanolic extract of ginger had salutary effects on the sensory profile. Therefore it is suggested that ginger , extract as a natural herb could be used to extended the shelf-life of chicken patties provide the consumer with food containing natural additives which might be more healthful .

Marangoni et al., (2017) cleared that the olive leaves delayed the formation of rancid flavors and odors and provided higher juiciness and lower acidity for chicken meat.

The results illustrated in table (2) agreed with those recorded by Soni et al.(2006), where they found that, the olive extracted from the leaf have a great antimicrobial activities on bacteria found in meat. These effects have been attributed, in part, to the presence in the Mediterranean diet of antioxidant vitamins, flavanoids and polyphenols that play an important role in disease prevention (Briante et al., 2002; Benavente-Garcia et al., 2000). In other words, flavonoids and phenolic compounds obtained from olive leaf are known to have diverse biological activities and may also be responsible for the pharmacological actions of olive leaf or, at least synergistically reinforcing those actions (Burt et al., 2004). Also, Du and Li, (2008) recorded that turmeric and ginger have antimicrobial activities as they reduce the number of total bacterial counts than the control group.

Also, *Enterobacteriaceae* count (log. cfu/g) decreased and this result agreed with those of Pattaratanawadee et al.(2006) who found that olive leaf extract, turmeric and ginger are highly effective against G +ve and G –ve bacteria.

For APC, all treated samples were accepted according to (EOS, 2005) as permissible limit (10^6/g). While, *Enterobacteriaceae* and *Staphylococci i*n both treated and untreated groups were unaccepted according to (EOS, 2005) permissible limit (10^2/g) for both.

As shown in table (4), the control samples had the highest counts of Staphylococcus count and this nearly similar to those obtained by (Calo et al., 2015) who found that, The G +ve bacteria are sensitive to polyphenols since the bacterial membranes interact with hydrophobic components of the polyphenols. On the other hand, G –ve bacteria are more resistant to polyphenols because they possess a hydrophilic cell wall. The reduction of G +ve bacteria with addition of olive oils than that of G –ve bacteria due to the gram +ve highly sensitive to polyphenyls found in olive and ginger.

pH plays an important role for microbiological growth affecting shelf-life of the meat products (Amal and Soher, 2010). Table (6) showed pH mean values and agree with those of Aytul (2010) who found that, pH values of all samples decreased up to the 6th day of storage. However, at the 9th day pH values increased except for the sample treated with 2% OLE. Control samples had the lowest pH values compared to the samples treated with OLE up to the 6th day, but at the 9th day control samples had the highest pH values. No particular trend was observed among the pH values of control and treated samples.

Zemenu (2017) found that pH values of minced meat samples were affected by ginger powder addition. The pH values decreased when the amount of ginger powder incorporation on minced meat samples increased from 1 to 5%. Moreover, when storage times increased from 0 to 6 days, the treated samples with ginger powder did not showed more changes in terms of pH values compared to control samples. The overall results of the current study showed that ginger powder addition on meat samples has an important impact on the shelf life and keeping quality of minced meat samples.

As shown in table (7), TBA is a good indicator for the assessment of quality of meat and degree of lipid oxidation. (Ndaw et al., 2008). This result agree with those of Olatidoye O. P.et al., (2015) who

investigated that ginger extract is considered as an important target to investigate in order to provide a new source of natural antioxidants and/or antimicrobial agents. The addition of ginger extracts was significantly effective in reducing thiobarbituric acid reactive substances (TBARS) levels, volatile basic nitrogen (VBN) and total acidity % relative to control sample during the storage period. The TBA value accepted till 0.9 mg Melanoaldehyde /Kg raw minced beef. All samples were accepted according to (EOS, 2005).

Moreover, TVN measurement is the traditional chemical mean most widely used for evaluation of degree of meat spoilage. The obtained results agree with Roundsa et al. (2013). they reported that due to antimicrobial effect of olive leaf, ginger and turmeric , reduction and inhibition of the bacteria growth on meat , so it reduces the TVN due to destruction of protein during meat spoilage. The TVN value accepted till 20 mg/100g in raw minced beef. All the examined samples of both treated and untreated groups were accepted according to (EOS, 2005).

4. CONCLUSION

In conclusion, olive leaves extract , curcuma extract and ginger extract have both of antimicrobial and antioxidant effects. olive leaves extract proved to be more efficient . So, the use of natural extracts as it is safe natural agent, is therefore recommended to improve safety and extend shelf life of meat product.

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