



SUPPLEMENTARY TABLE S1. Effect of different concentrations of essential oils on color, juiciness, tenderness, and overall acceptability of minced meat from sample I (July 2019) and sample II (January 2020)

Day	Property	Sample I (July 2019)												Sample II (January 2020)																																					
		Marjoram oil				Thyme oil				Cinnamon oil				Lemongrass oil				Marjoram oil				Thyme oil				Cinnamon oil				Lemongrass oil																					
		Control		M1		M2		M3		T1		T2		T3		C1		C2		C3		L1		L2		L3		M1		M2		M3		T1		T2		T3		C1		C2		C3		L1		L2		L3	
		1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%	1%	1.5%	2%					
Day zero	Color	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Juiciness	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Tenderness	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Overall	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Day 2	Color	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Juiciness	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Tenderness	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Overall	3	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Day 4	Color	5	5	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Juiciness	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Tenderness	4	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Overall	2	2	3	3	3	4	4	4	2	2	2	3	2	3	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Day 5	Color	5	5	5	3	5	4	3	5	5	4	5	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5		
	Juiciness	5	4	4	3	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
	Tenderness	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
	Overall	2	2	2	3	2	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
Day 7	Color	5	5	5	4	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
	Juiciness	5	5	4	4	4	4	4	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
	Tenderness	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
	Overall	1	2	2	2	2	2	2	3	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
Day 8	Color	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5								

Minced meat samples were treated with oils and, along with the control samples, were kept at 2°C throughout the experiment. Letters M, T, C, and L refer to marjoram oil, thyme oil, cinnamon oil, and lemongrass oil, respectively. Numbers 3, 4, and 5 in color property indicate acceptable, dark, and very dark, respectively. Numbers 3, 4, and 5 in juiciness property indicate middle, juicy, and very juicy, respectively. Numbers 3, 4, and 5 in tenderness property indicate middle, soft, and very soft, respectively. Numbers 1, 2, 3, 4, and 5 in overall acceptability property indicate rejected, unacceptable, middle, acceptable, and very acceptable, respectively.

SUPPLEMENTARY TABLE S2. Effect of different concentrations of essential oils on anaerobic plate count and aerobic plate count (APC) in the examined minced meat from sample 1 (July 2019) maintained at 2°C

Sample I (July 2019)													
Count type		Anaerobic plate count						Aerobic plate count (APC)					
Experiment days		Day zero	Day 2	Day 4	Day 5	Day 7	Day 8	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8
Oil treatments	Control	1.40±0.02	1.46±0.03g	1.63±0.01de	2.35±0.02a	3.56±0.02a	4.74±0.02a	5.19±0.03	5.92±0.03a	6.63±0.03b	7.96±0.03a	8.76±0.03a	10.43±0.03a
	M1(1%)	1.40±0.02	1.61±0.02cd	1.77±0.02a	1.85±0.03d	2.13±0.03c	3.36±0.03c	5.19±0.03	5.75±0.03c	6.24±0.03d	6.68±0.03d	7.55±0.03g	8.91±0.03g
	M2(1.5%)	1.40±0.02	1.40±0.03h	1.57±0.03f	1.77±0.02e	1.90±0.02ef	2.40±0.02ef	5.19±0.03	5.66±0.03d	5.95±0.03f	6.16±0.03h	6.76±0.03j	7.39±0.03m
	M3 (2%)	1.40±0.02	1.52±0.01f	1.60±0.02ef	1.66±0.03f	1.70±0.03i	1.86±0.02i	5.19±0.03	5.30±0.03g	5.21±0.03	5.60±0.03j	6.91±0.03i	7.79±0.03k
	T1 (1%)	1.40±0.02	1.59±0.02d	1.65±0.02cd	1.90±0.02c	2.28±0.02b	3.56±0.03b	5.19±0.03	5.80±0.03b	6.10±0.03e	6.69±0.03d	7.30±0.03h	8.36±0.03i
	T2 (1.5%)	1.40±0.02	1.46±0.01g	1.52±0.03g	1.60±0.02g	1.85±0.02g	2.39±0.02f	5.19±0.03	5.22±0.03h	5.62±0.03h	6.14±0.03hi	7.25±0.03	8.11±0.03j
	T3 (2%)	1.40±0.02	1.37±0.02h	1.49±0.02g	1.66±0.03f	1.73±0.01i	1.88±0.02i	5.19±0.03	5.11±0.03i	5.01±0.03j	5.51±0.03k	6.67±0.03k	7.53±0.03l
	C1 (1%)	1.40±0.02	1.69±0.02a	1.74±0.02a	1.85±0.02d	1.93±0.02de	2.60±0.02d	5.19±0.03	5.77±0.03bc	6.79±0.03a	7.21±0.03b	8.31±0.03c	9.91±0.03c
	C2 (1.5%)	1.40±0.02	1.64±0.03bc	1.70±0.02b	1.76±0.02e	1.88±0.03fg	2.43±0.03e	5.19±0.03	5.51±0.03e	6.43±0.03c	7.00±0.03c	8.11±0.03e	9.19±0.03e
	C3 (2%)	1.40±0.02	1.54±0.02e	1.67±0.01bc	1.74±0.03e	1.80±0.02h	2.13±0.02h	5.19±0.03	5.31±0.03g	5.93±0.03f	6.45±0.03e	7.81±0.03f	8.68±0.03h
	L1 (1%)	1.40±0.02	1.65±0.03b	1.70±0.02b	1.94±0.02b	2.25±0.03b	3.59±0.03b	5.19±0.03	5.40±0.03f	5.77±0.03g	6.22±0.03g	8.56±0.03b	10.1±0.03b
	L2 (1.5%)	1.40±0.02	1.54±0.02e	1.57±0.02f	1.69±0.02f	1.95±0.02d	2.30±0.02g	5.19±0.03	5.30±0.03g	5.60±0.03h	6.40±0.03f	8.25±0.03d	9.35±0.03d
	L3 (2%)	1.40±0.02	1.40±0.01h	1.50±0.01g	1.58±0.02g	1.77±0.03h	1.87±0.01i	5.19±0.03	5.20±0.03h	5.40±0.03i	6.11±0.03h	8.11±0.03e	9.01±0.03f

Results are shown as mean ± standard error (SE). Means with different letters in the same column are significantly different ($P < 0.05$) by Duncan's post-hoc test. P-Values were calculated by ANOVA (unit: log CFU/g).

SUPPLEMENTARY TABLE S3. Effect of different concentrations of essential oils on anaerobic plate count and aerobic plate count (APC) in the examined minced meat from sample II (January 2020) maintained at 2°C.

Sample II (January 2020)													
Count type	Anaerobic plate count							Aerobic plate count (APC)					
	Experiment days	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8
Oil treatments	Control	1.20±0.03	1.42±0.02a	1.66±0.02a	1.71±0.02ab	1.90±0.01a	2.25±0.03a	3.98±0.03	4.62±0.02a	5.88±0.02a	6.81±0.03b	7.96±0.01a	8.56±0.02a
	M1 (1%)	1.20±0.03	1.35±0.03bc	1.61±0.03b	1.57±0.03d	1.68±0.02ef	1.90±0.02c	3.98±0.02	4.35±0.03ab	5.41±0.01d	6.34±0.02e	7.31±0.03e	8.12±0.03c
	M2(1.5%)	1.20±0.03	1.29±0.01de	1.55±0.01c	1.50±0.01e	1.66±0.03fg	1.75±0.03e	3.98±0.03	4.19±0.03ab	5.21±0.02g	5.88±0.02i	6.55±0.02j	7.16±0.04j
	M3 (2%)	1.20±0.03	1.25±0.03f	1.42±0.03f	1.66±0.03c	1.76±0.01c	1.60±0.02h	3.98±0.02	3.51±0.01ef	3.11±0.03k	3.84±0.01k	4.74±0.03l	5.84±0.03k
	T1 (1%)	1.20±0.03	1.30±0.02d	1.50±0.04d	1.57±0.02d	1.70±0.02de	1.75±0.01e	3.98±0.01	4.23±0.03ab	5.62±0.02c	6.21±0.03f	7.12±0.02h	7.91±0.02d
	T2 (1.5%)	1.20±0.03	1.35±0.03bc	1.46±0.03e	1.50±0.02e	1.60±0.03h	1.65±0.03g	3.98±0.03	3.81±0.02e	4.22±0.04	5.62±0.02j	6.46±0.04k	7.53±0.01f
	T3 (2%)	1.20±0.03	1.27±0.02de	1.39±0.02f	1.51±0.01e	1.81±0.01b	1.80±0.02d	3.98±0.03	3.21±0.01f	3.22±0.02j	3.81±0.03k	4.61±0.04m	5.67±0.03l
	C1 (1%)	1.20±0.03	1.34±0.01c	1.60±0.02b	1.73±0.03a	1.83±0.02b	1.94±0.02b	3.98±0.04	4.62±0.04a	5.79±0.01b	6.69±0.01d	7.44±0.02d	8.11±0.04c
	C2 (1.5%)	1.20±0.03	1.30±0.03d	1.56±0.01e	1.69±0.02bc	1.72±0.03d	1.75±0.03c	3.98±0.03	4.12±0.02b	5.29±0.02f	6.23±0.04f	7.19±0.04g	7.77±0.02e
	C3 (2%)	1.20±0.03	1.26±0.04ef	1.50±0.02d	1.60±0.01d	1.64±0.02g	1.55±0.02i	3.98±0.02	3.86±0.01d	4.90±0.03h	6.15±0.02g	6.90±0.04i	7.53±0.02f
	L1 (1%)	1.20±0.03	1.35±0.02bc	1.63±0.02ab	1.69±0.02bc	1.72±0.01d	1.83±0.02d	3.98±0.03	4.53±0.03a	5.88±0.02a	6.74±0.03c	7.68±0.03c	8.28±0.01b
	L2 (1.5%)	1.20±0.03	1.38±0.01b	1.51±0.03d	1.60±0.02d	1.67±0.03ef	1.69±0.01f	3.98±0.01	4.00±0.02c	5.34±0.03e	6.92±0.03a	7.87±0.04b	8.27±0.04b
	L3 (2%)	1.20±0.03	1.30±0.03d	1.42±0.01f	1.50±0.01e	1.59±0.01h	1.63±0.03gh	3.98±0.03	3.91±0.01c	4.69±0.02i	6.11±0.02h	7.24±0.02f	7.80±0.03e

Results are shown as mean ± SE. Means with different letters in the same column are significantly different ($P < 0.05$) by Duncan's post-hoc test. P- Values were calculated by ANOVA (unit: log CFU/g).

SUPPLEMENTARY TABLE S4. Effect of different concentrations of essential oils on the count of coliform bacteria, *E. coli*, and *S. aureus* in the examined minced meat from sample 1 (July 2019) maintained at 2°C

Sample I (July 2019)																			
Count type	Coliform bacteria							E. coli							S. aureus				
	Experiment days	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8
Oil treatments	Control	3.25±0.04	3.71±0.02a	3.32±0.02a	3.56±0.03a	3.73±0.03b	4.33±0.03a	2.63±0.02	3.31±0.03a	2.92±0.03a	3.16±0.01a	3.49±0.02a	3.93±0.01a	1.83±0.02	1.67±0.01b	2.65±0.03a	3.33±0.03b	4.96±0.04a	5.73±0.02a
	M1 (1%)	3.25±0.04	2.86±0.04g	2.62±0.02f	2.68±0.04i	2.89±0.02h	3.79±0.02d	2.63±0.02	2.86±0.02e	2.12±0.02g	2.54±0.02e	2.76±0.03g	3.19±0.02e	1.83±0.02	1.33±0.02g	1.93±0.02e	2.67±0.02f	3.49±0.02h	5.65±0.03a
	M2 (1.5%)	3.25±0.04	2.75±0.02h	2.53±0.03g	2.56±0.03j	2.77±0.04i	3.53±0.02f	2.63±0.02	2.75±0.03g	1.83±0.02j	2.26±0.02g	2.37±0.02i	2.93±0.02h	1.83±0.02	1.25±0.02h	1.88±0.02f	2.66±0.03f	3.37±0.04i	5.43±0.02b
	M3 (2%)	3.25±0.04	2.21±0.02ii	2.36±0.02h	2.12±0.04m	2.62±0.03j	3.42±0.02g	2.63±0.02	2.42±0.02h	1.56±0.03k	2.00±0.03h	2.22±0.02j	2.63±0.03i	1.83±0.02	1.23±0.03h	1.66±0.02i	1.82±0.02j	2.92±0.02j	4.73±0.04d
	T1 (1%)	3.25±0.04	2.68±0.02i	2.87±0.02e	2.94±0.03g	2.87±0.02h	4.13±0.03b	2.63±0.02	2.78±0.02f	2.00±0.02h	2.44±0.02f	2.57±0.03h	3.13±0.02f	1.83±0.02	1.58±0.02d	2.47±0.03b	2.98±0.03e	3.57±0.03g	5.63±0.02ab
	T2 (1.5%)	3.25±0.04	2.55±0.02k	2.26±0.03i	2.48±0.02k	2.65±0.02j	3.41±0.02g	2.63±0.02	2.41±0.01h	1.88±0.02i	2.28±0.02g	2.35±0.02j	3.00±0.02g	1.83±0.02	1.49±0.02f	1.86±0.02f	2.49±0.02g	3.35±0.02i	5.33±0.04b
	T3 (2%)	3.25±0.04	2.19±0.02l	2.16±0.02c	2.29±0.01l	2.51±0.03k	3.22±0.01h	2.63±0.02	2.20±0.02i	1.43±0.01l	2.00±0.03h	2.10±0.02k	2.43±0.03j	1.83±0.02	1.19±0.02i	1.36±0.02j	1.69±0.02k	1.91±0.02i	3.02±0.02e
	C1 (1%)	3.25±0.04	3.46±0.04c	3.13±0.01c	3.23±0.02e	3.29±0.02d	4.13±0.04b	2.63±0.02	3.16±0.02b	2.63±0.03c	3.00±0.02b	3.19±0.01c	3.24±0.02d	1.83±0.02	1.46±0.03f	1.73±0.04g	2.35±0.01h	4.69±0.04b	5.89±0.03a
	C2 (1.5%)	3.25±0.04	3.35±0.02e	2.91±0.02d	3.00±0.03f	3.15±0.01f	3.86±0.03c	2.63±0.02	3.00±0.03d	2.20±0.02f	2.80±0.02c	3.00±0.02e	3.15±0.02f	1.83±0.02	1.65±0.02be	1.69±0.02hi	2.69±0.02f	4.36±0.02d	5.68±0.02a
	C3 (2%)	3.25±0.04	2.88±0.02g	2.61±0.02f	2.76±0.04h	2.93±0.04g	3.55±0.04f	2.63±0.02	2.75±0.02g	2.11±0.02g	2.77±0.03cd	2.95±0.02f	3.00±0.03g	1.83±0.02	1.56±0.01de	1.70±0.04gh	1.88±0.03i	2.30±0.04k	5.36±0.01b
Liquor treatments	L1 (1%)	3.25±0.04	3.62±0.02b	3.25±0.03b	3.36±0.03c	3.61±0.02e	4.12±0.02b	2.63±0.02	3.12±0.02c	2.85±0.03b	3.16±0.02a	3.22±0.03b	3.82±0.02b	1.83±0.02	1.62±0.02c	2.20±0.01d	3.19±0.02d	4.55±0.02c	5.90±0.02a
	L2 (1.5%)	3.25±0.04	3.41±0.03d	3.16±0.02j	3.28±0.02d	4.30±0.04a	3.69±0.04e	2.63±0.02	3.00±0.01d	2.50±0.02d	3.00±0.02b	3.10±0.02d	3.32±0.03c	1.83±0.02	1.53±0.04e	2.30±0.02c	3.28±0.04c	4.30±0.03e	5.69±0.03a
	L3 (2%)	3.25±0.04	3.11±0.02f	2.87±0.03e	3.44±0.02b	3.24±0.03e	3.18±0.02i	2.63±0.02	2.80±0.03f	2.30±0.03e	2.75±0.03d	2.93±0.03f	3.00±0.02g	1.83±0.02	1.92±0.03a	2.33±0.04c	3.76±0.03a	3.93±0.01f	5.28±0.02c

Results are shown as mean ± SE. Means with different letters in the same column are significantly different ($P < 0.05$) by Duncan's post-hoc test. P-Values were calculated by ANOVA (unit: log CFU/g).

SUPPLEMENTARY TABLE S5. Effect of different concentrations of essential oils on the count of coliform bacteria, *E. coli*, and *S. aureus* in the examined minced meat from sample II (January 2020) maintained at 2°C

Sample II (January 2020)																				
Count type		Coliform bacteria								E. coli								S. aureus		
		Experiment days	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8
Oil treatments		Control	2.11±0.02	2.46±0.03a	2.98±0.03a	3.61±0.03a	3.69±0.03a	4.11±0.02ab	1.30±0.02	1.86±0.03b	2.53±0.02a	2.83±0.03a	3.29±0.02b	3.81±0.02a	1.19±0.02	1.36±0.01c	1.56±0.03e	1.83±0.02cd	2.42±0.03a	3.65±0.02a
		M1 (1%)	2.11±0.02	2.23±0.02c	1.83±0.04g	2.11±0.02h	2.86±0.02g	3.56±0.04ab	1.30±0.02	1.33±0.02h	1.35±0.01f	1.82±0.02i	2.38±0.02g	3.20±0.03e	1.19±0.02	1.28±0.02d	1.46±0.02g	1.73±0.01e	1.86±0.02ef	2.40±0.03f
		M2 (1.5%)	2.11±0.02	2.00±0.03e	1.65±0.02i	2.09±0.04h	2.66±0.04i	3.47±0.02c	1.30±0.02	1.10±0.02j	1.25±0.02g	1.86±0.02h	2.26±0.01h	3.17±0.02e	1.19±0.02	1.23±0.03e	1.39±0.03h	1.48±0.02i	1.60±0.02i	1.87±0.02i
		M3 (2%)	2.11±0.02	1.93±0.02f	1.26±0.03j	1.77±0.02j	2.32±0.02k	3.11±0.02d	1.30±0.02	1.23±0.02i	1.00±0.01h	1.20±0.04i	1.89±0.02k	2.91±0.02h	1.19±0.02	1.20±0.02e	1.36±0.02h	1.59±0.04h	1.66±0.02h	1.71±0.02k
		T1 (1%)	2.11±0.02	2.00±0.01e	1.79±0.03h	2.16±0.03g	2.79±0.03h	3.47±0.04c	1.30±0.02	1.30±0.01h	1.36±0.02f	1.86±0.02h	2.23±0.02h	3.17±0.02e	1.19±0.02	1.38±0.02c	1.60±0.03bc	1.70±0.02ef	1.83±0.03f	2.26±0.03g
		T2 (1.5%)	2.11±0.02	1.81±0.03g	1.62±0.03i	1.89±0.02i	2.52±0.03j	3.21±0.02cd	1.30±0.02	1.51±0.02e	1.22±0.0g	1.60±0.02j	2.10±0.03i	3.00±0.01g	1.19±0.02	1.29±0.04d	1.52±0.02f	1.69±0.03f	1.72±0.02g	1.91±0.02h
		T3 (2%)	2.11±0.02	1.65±0.02h	1.12±0.02k	1.59±0.04k	2.15±0.02l	2.89±0.02d	1.30±0.02	1.45±0.02f	1.00±0.02h	1.30±0.02k	2.00±0.02j	2.30±0.02i	1.19±0.02	1.21±0.02e	1.36±0.04h	1.49±0.02i	1.69±0.03g	1.75±0.02j
		C1 (1%)	2.11±0.02	2.30±0.03b	2.46±0.02b	2.93±0.02d	3.61±0.04b	3.98±0.03ab	1.30±0.02	2.00±0.03a	2.20±0.02bc	2.40±0.01c	3.20±0.04c	3.60±0.02b	1.19±0.02	1.43±0.04b	1.61±0.02b	1.91±0.01a	2.31±0.02d	3.30±0.01b
		C2 (1.5%)	2.11±0.02	2.20±0.03c	2.29±0.03c	2.65±0.03e	3.43±0.04c	3.79±0.02ab	1.30±0.02	1.80±0.02c	2.00±0.02c	2.35±0.02d	3.40±0.02a	3.50±0.03c	1.19±0.02	1.22±0.02e	1.66±0.03a	1.80±0.02d	2.28±0.01de	2.60±0.03e
		C3 (2%)	2.11±0.02	2.11±0.04d	2.00±0.02f	2.40±0.02f	2.92±0.02f	3.49±0.02c	1.30±0.02	1.65±0.03d	1.80±0.03d	2.10±0.02g	2.52±0.02f	3.00±0.02g	1.19±0.02	1.23±0.04e	1.50±0.02f	1.55±0.02u	1.69±0.02h	1.89±0.02hi
		L1 (1%)	2.11±0.02	2.23±0.03c	2.43±0.04b	3.15±0.03b	3.45±0.03c	3.91±0.03ab	1.30±0.02	1.67±0.01d	1.92±0.02c	2.60±0.04b	3.23±0.03c	3.38±0.04d	1.19±0.02	1.39±0.02c	1.57±0.024d	1.88±0.02ab	2.48±0.03a	3.29±0.03b
		L2 (1.5%)	2.11±0.02	2.00±0.03e	2.23±0.02d	2.98±0.02c	3.29±0.02d	3.88±0.02ab	1.30±0.02	1.41±0.02g	1.62±0.04e	2.30±0.02e	3.00±0.02d	3.10±0.02f	1.19±0.02	1.47±0.04a	1.65±0.03a	1.91±0.03a	2.40±0.02ab	3.20±0.02c
		L3 (2%)	2.11±0.02	1.90±0.03f	2.11±0.03e	2.67±0.04e	3.20±0.03e	3.73±0.03ab	1.30±0.02	1.20±0.03i	1.37±0.02f	2.20±0.02f	2.67±0.02e	3.00±0.03g	1.19±0.02	1.39±0.02c	1.57±0.02cd	1.85±0.02bc	2.30±0.01c	3.10±0.01d

Results are shown as mean ± SE. Means with different letters in the same column are significantly different ($P < 0.05$) by Duncan's post-hoc test. P-Values were calculated by ANOVA (unit: log CFU/g).

Egypt. J. Bot. **63**, No. 1 (2023)

Results are shown as mean $\pm$ SE. Means with different letters in the same column are significantly different ($P < 0.05$) by Duncan's post hoc test. P-Values were calculated by ANOVA.

SUPPLEMENTARY TABLE S7. Effect of different concentrations of essential oils on pH, total volatile nitrogen (TVN) and thiobarbituric acid (TBA) in the examined minced meat from sample II (January 2020) maintained at 2°C

Sample II (January 2020)																			
Chemical property	pH values						TVN values*						TBA values**						
	Experiment days	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8	Day zero	Day 2	Day 4	Day 5	Day 7	Day 8						
Oil treatments	Control	5.12±0.02	5.83±0.03a	6.32±0.04a	6.48±0.03a	6.63±0.03b	6.75±0.03a	5.30±0.02	10.45±0.03a	15.23±0.03b	24.83±0.04a	28.33±0.03a	34.75±0.02a	0.74±0.02a	1.20±0.04a	1.53±0.03a	1.71±0.03a		
	M1 (1%)	5.12±0.02	5.69±0.02c	5.88±0.02c	6.20±0.02d	6.44±0.02e	6.55±0.02de	5.30±0.02	9.39±0.02	15.43±0.02a	17.40±0.02c	18.44±0.02c	22.25±0.04d	0.13±0.02	0.39±0.02c	0.67±0.01bc	0.80±0.02abc	1.04±0.02e	1.35±0.02ef
	M2(1.5%)	5.12±0.02	5.43±0.02hi	5.67±0.02f	5.89±0.02g	6.34±0.02g	6.44±0.01g	5.30±0.02	8.43±0.04bc	12.53±0.04d	14.47±0.02e	16.14±0.04f	17.44±0.02h	0.13±0.02	0.28±0.02ef	0.57±0.02f	0.77±0.03bc	0.81±0.02f	1.28±0.03h
	M3 (2%)	5.12±0.02	5.39±0.02j	5.63±0.02g	5.73±0.04j	5.98±0.02k	6.39±0.02h	5.30±0.02	7.30±0.02cd	10.43±0.02g	13.43±0.03f	15.23±0.02g	16.82±0.02j	0.13±0.02	0.27±0.03efg	0.43±0.04h	0.64±0.02bc	0.76±0.02h	1.11±0.02i
	T1 (1%)	5.12±0.02	5.73±0.01b	5.93±0.04b	6.35±0.02b	6.69±0.03a	6.74±0.03a	5.30±0.02	8.47±0.04b	11.53±0.02e	13.45±0.03f	15.19±0.02h	18.14±0.04f	0.13±0.02	0.35±0.02	0.63±0.02e	0.85±0.03abc	1.12±0.03d	1.40±0.02cd
	T2 (1.5%)	5.12±0.02	5.60±0.02e	5.85±0.02c	6.19±0.03d	6.62±0.02b	6.70±0.02b	5.30±0.02	6.30±0.02d	10.35±0.04h	12.49±0.02h	14.62±0.04i	16.93±0.02i	0.13±0.02	0.24±0.02hi	0.55±0.03f	0.79±0.02abc	0.86±0.02gh	1.32±0.03fg
	T3 (2%)	5.12±0.02	5.35±0.03k	5.60±0.02g	5.83±0.02h	6.21±0.02i	6.57±0.02d	5.30±0.02	5.94±0.04d	9.30±0.02j	11.43±0.02k	13.21±0.02k	15.77±0.02i	0.13±0.02	0.22±0.04i	0.40±0.02h	0.73±0.02bc	0.82±0.02fg	0.90±0.02j
	C1 (1%)	5.12±0.02	5.65±0.02d	5.95±0.03b	6.36±0.02b	6.53±0.01c	6.73±0.03ab	5.30±0.02	8.55±0.04bc	14.75±0.04c	18.46±0.02b	21.71±0.02b	26.53±0.03b	0.13±0.02	0.37±0.02cd	0.70±0.02b	0.98±0.03ab	1.33±0.04b	1.65±0.04b
	C2 (1.5%)	5.12±0.02	5.40±0.01i	5.81±0.02d	6.25±0.01c	6.49±0.02d	6.62±0.02c	5.30±0.02	6.80±0.02c	8.65±0.02k	12.55±0.04g	14.29±0.04j	18.22±0.02c	0.13±0.02	0.30±0.03e	0.65±0.04cde	0.75±0.02bc	1.09±0.02d	1.43±0.02c
	C3 (2%)	5.12±0.02	5.46±0.02g	5.75±0.03e	6.12±0.02e	6.21±0.02i	6.49±0.02f	5.30±0.02	6.16±0.02d	7.95±0.03m	11.52±0.02j	16.21±0.02e	17.89±0.03g	0.13±0.02	0.26±0.02gi	0.47±0.02g	0.88±0.02abc	1.04±0.02e	1.38±0.03de
Lipids	L1 (1%)	5.12±0.02	5.53±0.04f	5.67±0.02f	5.97±0.02f	6.38±0.02f	6.53±0.03e	5.30±0.02	7.53±0.04cd	10.67±0.02f	15.77±0.02d	17.08±0.03d	23.63±0.03c	0.13±0.02	0.43±0.04b	0.74±0.03a	0.99±0.04ab	1.25±0.02c	1.42±0.02c
	L2 (1.5%)	5.12±0.02	5.38±0.02jk	5.60±0.02g	5.77±0.03i	6.25±0.02h	6.45±0.04g	5.30±0.02	6.98±0.02cd	9.60±0.02i	11.67±0.03j	16.15±0.02f	18.15±0.02f	0.13±0.02	0.39±0.02c	0.68±0.02bc	0.97±0.02ab	1.23±0.04c	1.36±0.01e
	L3 (2%)	5.12±0.02	5.26±0.03i	5.44±0.04h	5.69±0.02k	6.08±0.03j	6.20±0.02i	5.30±0.02	6.17±0.03d	8.14±0.03i	10.33±0.02i	15.18±0.02h	16.10±0.02k	0.13±0.02	0.37±0.02cd	0.64±0.01de	0.83±0.01abc	1.02±0.02e	1.30±0.02gh
*Unit of TVN: mg/100g **Unit of TBA: mg Malonaldehyde/Kg																			

Results are shown as mean ±SE. Means with different letters in the same column are significantly different ($P<0.05$) by Duncan's post hoc test. P-Values were calculated by ANOVA. *Unit of TVN: mg/100g **Unit of TBA: mg Malonaldehyde/Kg