Arabian Journal of Chemistry (2021) **14**, 103411

King Saud University

Arabian Journal of Chemistry

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ORIGINAL ARTICLE

Effect of Thyme Addition on some Chemical and Biological Properties of Sunflower Oil

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Received 5 July 2021; accepted 24 August 2021
Available online 30 August 2021

KEYWORDS

Sunflower oil;
Thyme;
Antioxidant activity;
Fatty acid;
Biological function

Abstract Antioxidants are used to prevent oxidative changes and flavor development in oils and fats. The aim of this study is to evaluate the antioxidant effect of adding thyme powder added on sunflower oil during frying at different temperature intervals (250 ± 1 °C). Thyme powders were added to sunflower oil at ratio of 0.5%, 1% and 1.5%, and the frying period were estimated for 2 h at 250 ± 1 °C. The oil samples collected intervals were at 0.5, 1, 1.5, and 2 h and the potatoes were fried in each time. The antioxidant activity of thyme powders was 93.05 %, estimated using DPPH root scanning methods. The values of acid, peroxide and, the saponification, and the fatty acid content were considered criteria for evaluating the effectiveness of thyme powder in improving the quality of sunflower oil during frying. Our results confirmed that the adding thyme powder to sunflower oil improved their chemical properties, leading to decrease the acid, peroxide, and saponification values, and unsaturated fatty acids increased. Examination of serum function of rats fed with fried potatoes in sunflower oil-added thyme powder decreased total cholesterol, low-density lipoprotein, and triglycerides, while high-density lipoprotein increased. Moreover the results confirmed that thyme powder reduces liver and kidney functions compared to the control sample. Therefore,

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Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

https://doi.org/10.1016/j.arabjc.2021.103411
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adding thyme to sunflower oil retards oxidative decomposition and improves its quality as a natural antioxidant to prolong oil stability.

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1. Introduction

Vegetable oils are a complex mixture of various saturated and unsaturated fatty acids, phosphatides, pigments, sterols, and tocopherols. The rate of saturated to unsaturated fatty acids is imperative for human nutrition (Ganesan et al., 2018). Fats and oils are part of normal daily consumption. They are a major source of energy and are important nutrients in the human diets. Edible oils are used in cooking and traditional medicine to treat bronchitis, edema, colds, coughs, and burns, and they also play an important role in the body as a carrier of essential fatty acids that are not synthesized in the body but are necessary through the diet to maintain the integrity of cell membranes. They are also necessary for the synthesis, which has many vital functions for the functioning of the body (Agra et al., 2007). Sunflower oil are among the five most important oil crops grown worldwide. The ratio of omega-3 and omega-6 fatty acids are prominent for providing cardiovascular and heart health benefits, so the amount of saturated and non-saturated fatty acids varies saturated with different oil crops (-González-Fernández et al., 2017). Sunflower oil is generally made of linoleic acid (C-18: 2) and oleic acid (C-18: 1); these two acids account for about 90% of the total fatty acid content of sunflower oil. The remaining 8–10% comprises fatty acids and palmitic acids (C-18: 0 and C-16: 0, respectively). (Friedt et al., 1994). Oxidation of fats results in unpleasant odors, unpleasant flavors and discoloration, so sunflower oil is susceptible to oxidation because it contains large amounts of polyunsaturated fatty acids, such as linoleic acid (18:2–6). It also reduces nutritional quality and food safety, which induce harm to human health (Dutta, et al., 2002). Fat oxidation causes changes in many characteristics, such as texture and taste, nutritional value, shelf life, and appearance, and it can be observed in both animal and vegetable fats and oils (McClements and Decker, 2000), so synthetic antioxidants food additives were used. However, these additives have been implicated in some health risks, especially cancer. So there is growing interest, due to safety concerns about replacing synthetic antioxidants with natural ones, which may be safer. (Botterweck et al., 2000). The antioxidant properties of herbs and spices are effective in delaying the development of rancidity in oils and fats (Szabo et al., 2010). Various herbs, spices, and natural extracts from selected herbs are stable for oxidation due to the presence of natural phenolic compounds (Hinneburg et al., 2006). Natural antioxidant extracts have been found to have similar activity as chemically synthesized antioxidants against the oxidation of edible oils. One of these popular plants is licorice root (Glycyrrhiza uralensis), which is an important Chinese materia medica frequently used in clinical practice (Wang et al., 2020). Thyme (*Thymus vulgaris* L.) is a plant predominantly cultivated in the Mediterranean region. It is an aromatic plant of the Lamiaceae family (Nguyen et al., 2000; Dapkevicius et al., 2002). *Thymus vulgaris L.*, is distributed worldwide, is native to southern Europe and is an economically important plant (Hosseinzadeh et al., 2015). The thyme plant has a warm, pungent taste, and aromatic scent. The aroma of this plant is due to the essential oil that gives value and flavor for culinary purposes and has a great medical benefits (Boskabady et al; 2006). Thyme extracts have antioxidant activity, which makes them suitable for use in the food industry as alternatives to synthetic antioxidants (Bergo et al., 2008). The aim of this study is to use thyme powder as natural antioxidants in preserving sunflower oil from rancidity during frying and to know its effect on the acid value, the peroxide value, and the saponification value of the sunflower oil when frying, and to study its effect on cholesterol, triglycerides, high density lipoprotein (HDL), low density lipoprotein (LDL), kidney and liver function, for experimental rats that were fed on fried potatoes in sunflower oil containing thyme powdered during frying.

2. Materials and methods

2.1. Materials

Fresh sunflower oil and thyme powder were obtained from the local market in Menoufia Governorate. Chemicals were purchased from Alpha Chemicals Company, Egypt. Normal male albino rats (25) of Sprague-drawly strain strain weighing 220 ± 5 g were used.

2.2. Methods

2.2.1. Preparing fried potatoes

The fresh potatoes were thoroughly cleaned of impurities, then peeled and washed well with water, then cut into equal slices (1 × 5) cm, then soaked in water to preserve them during the frying period. The potatoes were fried in sunflower oil with thyme powder as natural additives at 250 ± 1 °C (3 kg of oil for each treatment) in Sonifer sf-1003 Deep Fryer 3L. The ratios of thyme powder were 0.5%, 1.0%, and 1.5%. The period of oil frying was estimated for 2 h (The potatoes-fried samples collected intervals were at 0.5, 1, 1.5, and 2 h in each times). The frying time of the potato sample was 10 min, and the 1 kg of fresh potatoes was used in frying for each treatment (4 cycles).

2.2.2. Sunflower oils samples

Sunflower oil samples were collected while frying potatoes in sunflower oil with thyme powder as natural additives at 250 ± 1 °C. The ratios of thyme powder were 0.5%, 1.0%, and 1.5% for 0.5, 1, 1.5, and 2 h (the oil samples collected intervals were at 0.5, 1, and 1.5 in each time). Oil samples were kept at −20 °C until further analysis.

2.2.3. Saponification number, peroxide, and acid value of sunflower oils

AOAC (2000) was used to determine the saponification number, peroxide, and acid values of sunflower oils.

2.2.4. Fatty acids profiles of sunflower oils

Fatty acid profiles of sunflower oils were determined using the gas chromatography (GC) technique, as mentioned in AOAC (2000).

2.2.5. Antioxidant activity of thyme

The antioxidant activity of thyme powder as DPPH· (2,2′-dip henyl-1-picrylhydrazyl radical) was determined using the method described by Aly et al. (2021b).

2.2.6. Organoleptic tests:

The color, appearance, texture, odor, and taste of fried potatoes in sunflower oil with thyme powder were characterized by the panelists of the staff members of Benha University, Egypt, as the method mentioned by Ismail et al. (2020).

2.2.7. Experimental animals

Five groups from rats (each group contain 5 rats) were used in experimental animals as flow (G1,G2,G3,G4 and G5): G1 represents control group rats, G2 and G3 represent rats fed with potatoes fried in sunflower oil without any additives for 0.5 h and 2 h, respectively. G4 and G5 represented group of rats feed fried potatoes in sunflower oil with thyme powder by 1.5% for 0.5 h and 2 h, respectively. Thyme powder was added to natural additives in the ratio (1: 9%), meaning that the rats were taking 10 g of potato product and 90 g of their own feed **(**AOAC, 2000**),** and the experimental rats were housed in the animal's house of the Agricultural Research Center, Egypt.

2.2.8. Standard diet and experimental diets

Table 1.

2.2.9. Organs collection

Spleen, liver, kidney, and heart separated and weighted to evaluate the relative tissue weights of experimental rats at the end of the experimental period after fasting it for six-hour fasting.

2.2.10. Collection of serum and blood samples

The blood samples were collected from the retro orbital plexus vein in dry clean centrifuge tubes (15 ml.) using a fine capillary glass tubing following the procedure described by Aly et al. (2021a). The tubes were kept for about half an hour. at room temperature to allow blood to clot, then the tubes were centrifuged at 3000 rpm for 10 min, and the clear serum was separated and stored in the a deep freezer at stored at −10 °C for subsequent biochemical analysis

2.2.11. Biochemical analysis

Biochemical properties including LDL, HDL, total cholesterol, triglycerides, serum aspartate transaminase (AST), alanine aminotransferase (ALT), creatinine, and urea were evaluated following the method by Aly et al. (2021a)**.**

2.2.12. Statistical analysis

A one-way analysis of variance of mean data was used following the methods estimated by Aly et al. (2020)**.**

3. Results and discussion

3.1. Antioxidant activity of thyme powder

Antioxidants are components of plant foods and play an important role in the treatment of diseases. The antioxidant activity of thyme powder was found to be 93.05%. These results are in agreement with Kaur et al. (2017) results that thyme contains phenolic compounds, flavonoids that have high antioxidant activity and potential benefits in food, pharmaceutical, and human health applications. Thyme plants have been used to treat many diseases. Caprioli et al. (2018) revealed that thyme extracts contain natural antioxidants at a high rate because they contain flavonoids (e.g., asluteolin and apigenin derivatives) and phenolic acids (e.g., rosmarinic, cinnamic, and carnosic). Li et al. (2006) revealed that synthetic antioxidants are toxic and carcinogenic in animal experiments, so they should be replaced with natural antioxidants because consumers are quite skeptical about the production of any synthetic antioxidant products, and there has been general acceptance regarding natural antioxidants.

3.2. Effect of adding thyme powder to the acid, peroxide, and saponification values of sunflower oil during heating at 250 ± 1 °C

The fats and oils were subjected to clear oxidative changes at high temperature during frying. Table 2 shows the acid value, peroxide, and saponification values of sunflower oil with natural additives' thyme powder at 250 ± 1 °C. Thyme powder was added in ratios of 0.5%, 1%, and 1.5% for 0.5, 1, 1.5, and 2 h. The highest acid value was found in the sunflower oil sample without any additives, while the lowest values were found in the sunflower oil sample with thyme powders of 0.5%, 1%, and 1.5%. These results are in agreement with Andreasen

Table 1 The standard diet was prepared according to NRC [1995]. It comprises of the following: (g/kg diet).

Ingredients g/kg diet		Group1(Control)	Group2	Group3	Group4	Group5
Casein		200	200	200	200	200
Corn starch		497	447	447	447	447
Sucrose		100	100	100	100	100
Vitamin mixture		20	20	20	20	20
Mineral mixture		100	100	100	100	100
Corn oil		50	50	50	50	50
Dl methionine		3	3	3	3	3
Cellulose		30	30	30	30	30
Fried potatoes in sunflower oil without additives for	**0.5 h**	.....	50		.....	.....
	2 h			50		
Fried potatoes in sunflower oil added to thyme powder by 1.5% for	**0.5 h**	.....	.....	.....	50	.....
	2 h					50

Nrc (1995).

Table 2 Effect of adding thyme powder on the acid value, peroxide value and saponification value of sunflower oil during heating at 250 ± 1 °C.

Chemical properties	Time of heating (Hour)	Sunflower oil treatments			
		without any additives	with thyme powder with 0.5%	with thyme powder with 1%	with thyme powder with 1.5%
Acid value (Milligrams/kg)	0.5 h	0.50	0.27	0.25	0.20
	1.0 h	0.57	0.34	0.32	0.30
	1.5 h	0.61	0.39	0.34	0.32
	2.0 h	0.63	0.40	0.38	0.34
Peroxide value (Mill equivalents / k g)	0.5 h	13.8	5	3.3	1.6
	1.0 h	14.5	6	4	3
	1.5 h	16.2	8	7	4.5
	2.0 h	17.6	10	8	5
Saponification value (Milligrams/kg)	0.5 h	151	86.8	79	71.1
	1.0 h	156	90	79.5	75
	1.5 h	157.3	95	84.2	80
	2.0 h	175.5	98	87	84

et al. (2001) reports that the decreased acid value occurred because of polyphenols that have antioxidant activity. Karoui et al. (2016) revealed that extracts of thyme have antioxidant activity due to their containing phenolic acids, such as rosmarinic, carnosic, and cinnamic. They also contain flavonoids, such as luteolin and apigenin. Also, from the same Table 2, the peroxide and saponification values of treatments were parallel, and the highest peroxide value was in the sunflower oil sample without any additives, while it was found the lowest values in the sunflower oil sample with thyme powder of 0.5%, 1%, and 1.5%, and the reduction for the peroxide value of sunflower oil was more in the sunflower oil sample with thyme powder of 1.5%. These results are in agreement Sébédioo et al. (1991) findings that the oxidative changes reduce the nutritional quality of fats and oils. This reduction in saponification values resulting from added thyme may be due to the retardation of the oxidation of sunflower oil. These findings are in agreement with Wanasundara and Shahidi's (1998) findings that oxidative spoilage of fats and oils in foods induces sporadic odors and flavors, which result in decreased nutritional quality and safety; this also results from the formation of by-products and potentially toxic compounds, so adding antioxidants is necessary to preserve flavor and color, avoiding the destruction of vitamins. In addition, thyme powder is a good source of antioxidants and can be used as a natural antioxidant in foods and oils in place of synthetic antioxidants.

3.3. Effect of adding thyme powder on the fatty acid composition of sunflower oil during frying by heating at 250 ± 1 °C

The results obtained in Table 3 and Figs. 1–4 showed that fatty acids of sunflower oil in sample T1 contained 11.5% total saturated fatty acids (SFA), which contained meristic acid (0.29%), palmitic acid (7.96%), stearic acid (3.26%), and arachitic acid (0.19%). It also contained 84.66% total polyunsaturated fatty acid (USFA), and linoleic acid was the most important unsaturated fatty acid (57.3%), followed by oleic acid (24.45%), decadinoic acid (2.42%), gadoleic acid (0.18%), and palmitioleic acid (0.38%). The total saturated fatty acids of sunflower oil in sample T2 increased to 12.6%, and the total unsaturated fatty acids decreased to 82.67%; these results are roughly consistent with those obtained by Normand et al. (2006), which stated that sunflower oil contains about 30% monounsaturated fatty acid (oleic acid) and 59% polyunsaturated fatty acid (linoleic acid). Gordon (1991) mentioned that sunflower oils contain 6% saturated fatty acids, 20% monounsaturated fatty acids, and 68–72% polyunsaturated fatty acids. Adding thyme powder to sunflower oil in samples T3 and T4 caused a significant reduction in total saturated fatty acids; these values reached 9.18 and 10.07%, respectively. Also, these addition caused a significant increase

Table 3 Effect of adding thyme powder on the fatty acid composition of sunflower oil during frying heating at (250 ± 1 °C).

Fatty acid (%)	Treatments			
	T1	T2	T3	T4
Myristic acid (C14:0)	0.29	ND	0.13	ND
Pentadecanoic acid (C15:0)	ND	ND	0.18	0.42
Palmitic acid (C16:0)	7.96	7.99	5.59	6.07
Palmitioleic acid (C16:1 ω7)	0.38	ND	0.15	0.12
Stearic acid (C18:0)	3.26	3.28	3.09	3.37
Oleic acid (C18:1 ω9)	24.45	25.20	25.13	26.68
Linoleic acid (C18:2 ω6)	57.3	56.68	60.03	57.30
Decadinoic acid (C18:2 ω4)	2.42	ND	2.69	2.75
Arachitic acid (C20:0)	0.19	0.20	0.19	0.21
Gadoleic acid (C20:1 ω9)	0.18	0.16	0.14	0.20
Non identified fatty acids	ND	0.03	0.11	0.25
Vaccinic acid	0.58	0.99	1.08	1.11
Behenic acid	0.43	0.43	0.49	0.52
Total saturated fatty acids	11.5	12.6	9.18	10.07
Total unsaturated fatty acids	84.66	82.67	88.14	87.05
Total fatty acids	96.93	96.93	98.89	98.75

ND: Not detected.
T1: Sunflower oil exposed to heat without additives for 0.5 h.
T2: Sunflower oil exposed to heat without additives for 2 h.
T3: Sunflower oil exposed to heat added with thyme powder with 1.5 %when frying for 0.5 h.
T4: Sunflower oil exposed to heat added with thyme powder with 1.5% when frying for 2 h.

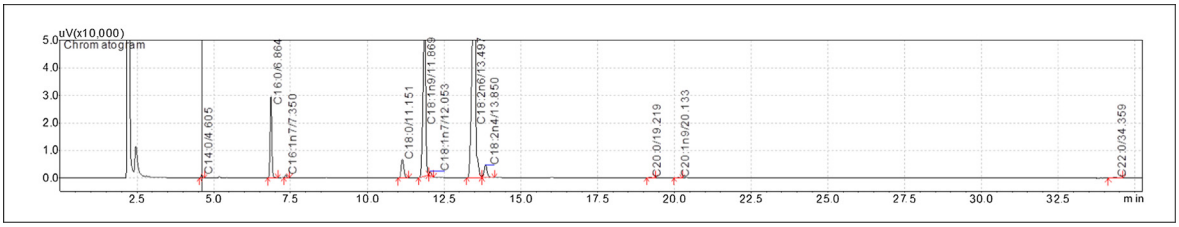

Fig. 1 Chromatogram Fatty acid of sunflower oil exposed to heat without any additives for 0.05 h.

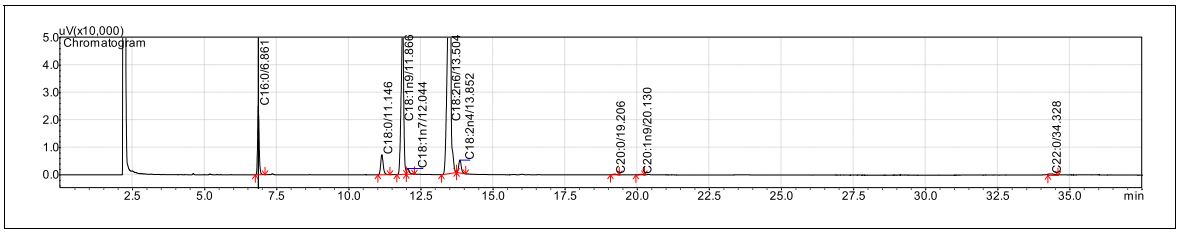

Fig. 2 Chromatogram Fatty acid of sunflower oil exposed to heat without any additives for 2 h.

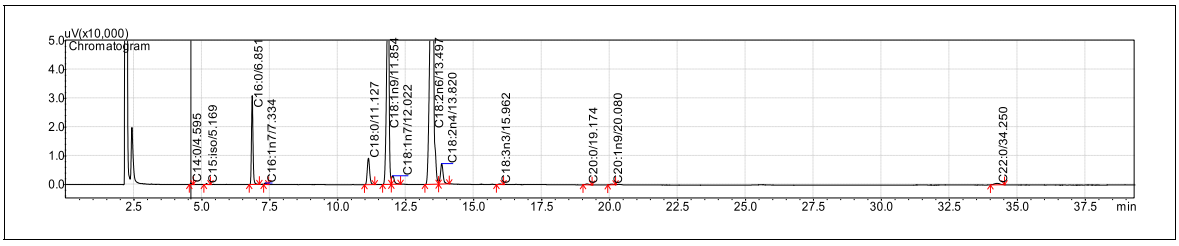

Fig. 3 Chromatogram Fatty acid of Sunflower oil with thyme powder ratio added with 1.5% when frying for 0.5 h.

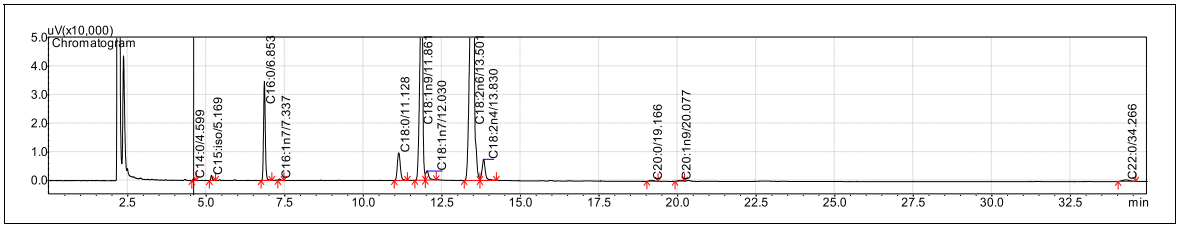

Fig. 4 Chromatogram Fatty acid of Sunflower oil with thyme powder ratio added with 1.5% when frying for 2 h.

in total unsaturated fatty acids. These results parallel those of Abdel-Hamied et al. (2009) and Jaswir et al. (2000), which stated that plant extracts are natural sources of antioxidants containing carotenoids, polyphenols, tocopherols, citric, and ascorbic acid and are widely used to decrease the oxidative property of plant oils. Upadhyay and Mishra (2016) showed that frying demands the use of thermally effective antioxidants that can retard triglyceride thermolysis.

3.4. Sensory evaluation of fried potatoes in sunflower oil with added thyme powder at 250 ± 1 °C

Table 4 shows the sensory evaluation (Appearance, Color, Texture, taste, and odor) of fried potatoes in sunflower oil with the addition of thyme powder (0.5%, 1%, and 1.5%) for 0.5, 1, and 1.5, and 2 h at a temperature of 250 ± 1 °C. From the result, it is clear from the result that the degree of appearance of fried potatoes in sunflower oil without additives ranged between 9.5 and 7.8, and the degree of appearance of fried potatoes in sunflower oil with thyme powder (0.5%, 1%, and 1.5%) ranged in 9.25 – 7.55; 8.95 – 7.25 and 8.85 – 6.80, respectively. The results also indicated that the color scores ranged from 9.6 to 7.6 for fried potatoes in sunflower oil without additives. The results also indicated that the texture results ranged from 9.4 to 7.7, the taste scores ranged between 9.50 and 7.70, and the degree of odor ranged from 8.7 to 7.6. Also, all samples of fried potatoes in sunflower oil were acceptable to all members of the committee for all sensory characteristics. However, all samples of fried potatoes in sunflower oil supplemented with thyme scored high on organoleptic properties

Table 4 Sensory evaluation of fried potatoes in sunflower oil added to powdered thyme in different proportions at 250 ± 1 °C.

Sensory properties	Time of heating (Hour)	Treatments of fried potatoes in sunflower oil				
		without any additives	with thyme powder with 0.5%	with thyme powder with 1%	with thyme powder with 1.5%	L.S. $D^*_{0.05}$
Appearance	0.5	9.5 ± 0.17	9.25 ± 0.26	8.95 ± 0.16	8.85 ± 0.24	2.2
	1	8.6 ± 0.21	8.20 ± 0.26	8.10 ± 0.21	7.95 ± 0.16	1.96
	1.5	8.2 ± 0.24	7.45 ± 0.37	7.25 ± 0.26	6.80 ± 0.26	1.87
	2	7.8 ± 0.25	7.55 ± 0.21	7.25 ± 0.26	6.80 ± 0.26	1.82
Color	0.5	9.6 ± 0.16	8.95 ± 0.16	8.85 ± 0.26	8.35 ± 0.24	2.2
	1	8.8 ± 0.21	8.25 ± 0.26	8.10 ± 0.21	7.80 ± 0.26	1.95
	1.5	8.2 ± 0.24	7.40 ± 0.21	7.10 ± 0.32	6.85 ± 0.24	1.88
	2	7.6 ± 0.24	7.65 ± 0.24	7.35 ± 0.24	6.55 ± 0.24	1.85
Texture	0.5	9.4 ± 0.16	8.95 ± 0.16	8.85 ± 0.24	8.75 ± 0.26	2.3
	1	8.2 ± 0.24	8.20 ± 0.26	7.90 ± 0.21	7.40 ± 0.21	2.07
	1.5	7.9 ± 0.26	7.25 ± 0.26	6.95 ± 0.37	6.75 ± 0.26	1.86
	2	7.7 ± 0.26	7.2 ± 0.26	7.55 ± 0.16	6.85 ± 0.24	1.84
Taste	0.5	9.50 ± 0.16	8.95 ± 0.16	8.90 ± 0.21	8.40 ± 0.21	2.3
	1	8.70 ± 0.26	7.90 ± 0.21	7.70 ± 0.26	7.35 ± 0.24	2.06
	1.5	7.80 ± 0.24	7.60 ± 0.24	6.95 ± 0.24	6.80 ± 0.26	1.87
	2	7.70 ± 0.26	7.55 ± 0.21	7.30 ± 0.26	6.75 ± 0.26	1.83
Odor	1	9.6 ± 0.16	8.90 ± 0.21	8.75 ± 0.21	8.60 ± 0.26	2.3
	1	8.7 ± 0.24	7.95 ± 0.16	7.80 ± 0.26	7.60 ± 0.39	2.09
	1.5	7.9 ± 0.21	7.75 ± 0.24	7.40 ± 0.21	6.80 ± 0.26	1.88
	2	7.6 ± 0.26	7.15 ± 0.26	7.10 ± 0.21	7.05 ± 0.16	1.86

Values are means ± SD with the same latter in the same row are not significantly different ($P \leq 0.05$). *: Least significant differences.

and were also acceptable for human consumption, but samples of fried potatoes in sunflower oil supplemented with thyme of (0.5%) were the highest of these properties.

3.5. Effect of meals prepared from fried potatoes in sunflower oil with thyme powder for 4 weeks on body weight and relative organ weights in male albino rats

Table 5 shows the relative organ and body weights of the rats, and no clear trend in nutritional therapy was observed. Rats' relative organ weights of the liver, kidneys, spleen, heart, and body weights were unaffected, and there were no significant differences between the control group and all other groups. The body weight values for the control group were 226.50, 235.30, 250.20, and 260.20 g for one to four weeks, respectively; these results parallel those of Aly et al. (2021c). The relative organ weight values of the liver, kidneys, spleen, and heart for the control group were 2.59%, 0.67%, 0.34%, and 0.24%, respectively.

3.6. Effect of feeding fried potatoes in sunflower oil with thyme powder for 4 weeks on some biological parameters

The same biological parameters (triglycerides, cholesterol, HDL, LDL, urea, creatinine, GOT, and GPT) of rats fed with fried potatoes in sunflower oil with thyme powder for four weeks were examined, and the obtained data are illustrated in Table 6. The results showed that thyme significantly

Table 5 Effect of meals prepared from fried potatoes in sunflower oil with thyme powder for 4 weeks on body weight (g) and relative organs in male white rats.

Biological parameters		Groups					L.S.D$^*_{0.05}$
		G1	G2	G3	G4	G5	
Body weight (g)	1st week	226.50 ± 27.77	233.70 ± 19.60	234.50 ± 25.37	233.20 ± 24.96	233.40 ± 22.07	7.10
	2nd week	235.30 ± 12.74	241.02 ± 19.66	241.90 ± 17.71	240.00 ± 21.96	240.20 ± 25.20	7.87
	3rd week	250.20 ± 12.15	256.30 ± 20.61	257.20 ± 12.95	256.40 ± 26.15	257.00 ± 30.93	8.53
	4th week	260.20 ± 12.27	267.90 ± 23.86	268.30 ± 13.81	265.60 ± 29.28	265.80 ± 37.76	9.22
Relative organs	Liver %	2.59 ± 0.58	2.97 ± 0.33	3.03 ± 0.37	2.74 ± 0.78	2.90 ± 0.48	0.30
	Kidney%	0.67 ± 0.11	0.86 ± 0.08	0.86 ± 0.15	0.75 ± 0.11	0.84 ± 0.27	0.16
	Spleen%	0.34 ± 0.08	0.37 ± 0.14	0.43 ± 0.24	0.35 ± 0.07	0.36 ± 0.26	0.13
	Heart %	0.24 ± 0.05	0.34 ± 0.06	0.36 ± 0.19	0.29 ± 0.04	0.30 ± 0.10	0.07

Values are means ± SD for 5 rats. Data were analyzed by one-way analysis of variance (ANOVA).
F test Means ($p < 0.05$).
G1**:** Control group in which normal rats were fed on basal diet and tap water.
G2**:** Potatoes fried in sunflower oil without additives for 0.5 h.
G3: Potatoes fried in sunflower oil without additives for 2 h.
G4: Potatoes fried in sunflower oil added with thyme powder by 1.5% for 0.5 h.
G5: Potatoes fried in sunflower oil added with thyme powder by 1.5% for 2 h.

Table 6 Effect of feeding fried potatoes with sunflower oil with thyme powder for 4 weeks on some biological parameters.

Biological parameters		Groups					L.S.D*$_{0.05}$
		G1	G2	G3	G4	G5	
Lipid profile	Cholesterol (mg/dl)	67.5 ± 5.29^{a}	78.6 ± 11.8^{d}	80.20 ± 13.2^{e}	68.9 ± 3.46^{b}	70.6 ± 12.6^{c}	1.10
	Triglyceride (mg/dl)	49.9 ± 11.8^{a}	58.5 ± 8.08^{d}	61.6 ± 17^{e}	51.2 ± 3.21^{b}	52.6 ± 4.04^{c}	1.20
	HDL (mg/dl)	58.2 ± 3.21^{e}	45.6 ± 1^{b}	44.3 ± 7.57^{a}	57.7 ± 14^{d}	54.7 ± 8.02^{c}	1.04
	LDL (mg/dl)	35.3 ± 4.16^{a}	41.5 ± 5.03^{d}	42.6 ± 7.57^{e}	35.7 ± 0.58^{b}	36.3 ± 11.7^{c}	1.02
Kidney function	Urea (mg/dl)	40.8 ± 10.00^{a}	45.9 ± 11.6^{d}	47.2 ± 14.6 ^{e}	41.5 ± 6.56^{b}	24.2 ± 9.5^{c}	0.9
	Creatinin (mg/dl)	0.56 ± 0.03^{a}	0.68 ± 0.03^{d}	0.73 ± 0.12^{e}	0.58 ± 0.08^{b}	0.59 ± 0.09^{c}	0.02
Liver function	GPT (U/ml)	11.5 ± 8.72^{a}	14.6 ± 7.57^{c}	15.1 ± 6.08^{d}	11.9 ± 4.16^{b}	12.2 ± 11.3^{c}	0.8
	GOT (U/ml)	15.2 ± 2.65^{a}	18.5 ± 8.5^{d}	19.4 ± 1.73^{e}	16.8 ± 5.29^{b}	16.3 ± 7^{c}	0. 7

Values are means ± SD for 5 rats. Data were analyzed by one-way analysis of variance (ANOVA). F test Means ($p < 0.05$).
G1**:** Control group in which normal rats were fed on basal diet and tap water.
G2**:** Potatoes fried in sunflower oil without additives for 0.5 h.
G3: Potatoes fried in sunflower oil without additives for 2 h.
G4: Potatoes fried in sunflower oil added with thyme powder by 1.5% for 0.5 h.
G5: Potatoes fried in sunflower oil added with thyme powder by 1.5% for 2 h.

decreased total cholesterol, LDL, triglycerides, liver, and kidney functions, while HDL increased compared to the control sample. Also, the highest level of thyme powder was better in preserving the sunflower oil, causing decreased oxidative degradation of oil samples during frying. These results parallel those of Rota et al. (2008) that triglyceride levels of serum of animals treated with carbon tetrachloride and carbon chloride decreased, and adding the thyme had no real effects on liver functions for animals treated with carbon tetrachloride. Abdel-Aziem et al. (2014) mentioned that thyme had lower hepatoprotective effects in many models, and extracts of thyme (metabolic and ethanoic) are used against aflatoxins that cause oxidative liver damage. Grespan et al. (2014) demonstrated that thyme extracts ameliorated and protected liver injury in rats.

4. Conclusion

Powdered thyme is generally desirable because it has an acceptable smell and a distinct flavor for food products. It also contains exciting compounds that make it high in natural antioxidants. Therefore, this study was conducted to shed light on the effects of adding powdered thyme to sunflower oil when frying to prevent rancidity and prolong shelf life. Also, when frying potatoes in sunflower oil added to the powdered thyme, the overall degree of acceptance when adding thyme was 0.5%, while adding thyme to oil is a tool to reduce total saturated fatty acids and increase total unsaturated fatty acids. Feeding rats on meals prepared from fried potatoes with sunflower oil added to powdered thyme is a way to reduce total cholesterol, triglycerides, protein, and LDL, increase HDL, and improve liver and kidney functions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors are thanks to Benha University, Egypt, Umm Al-Qura University, Taif University, Al-Baha University and Bisha University Saudi Arabia. Also thanks for Higher Institute for Agriculture Co-Operation, Shobra, Cairo,Egypt. The authors would like to acknowledge and to thank the Taif University Researchers Supporting Project number (TURSP-2020/71), Taif University, Taif, Saudi Arabia.

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