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Effect of Ethanolic Taro PeelsExtract on Oxidative Stability of Ghee

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Abstract: Fat oxidation remains one of the most important problems facing both the manufacturer and consumer because many of its negatively effects on the properties and flavor of the product.The objective of this study was todetermine the total phenolics, flavonoids and antioxidant activity of taro peels extract. Also, the ability of ethanolic extract of taro peels to retard the oxidation process of ghee was investigated. Taro peels extract was added to ghee at levels of 200, 400 and 600ppm. 200 ppm from tert-bytyl hydroquinone (TBHQ) was added to ghee for comparison.Samples of all treatments were incubated at 63 ºC for 21 days for accelerated oxidation. The results showed that taro peels contain high amounts of total phenolics (214.58±20.76 mg GAE/100g DW) and flavonoids (75.94±9.90mg QE/100g DW). The antioxidant activity of ethanolic taro peels extract was 91.04±1.55% compared to 94.96±0.67% for TBHQ.Ghee treated with ethanolic taro peels extract at level of 600 ppm showed the lowest peroxide, acid and TBA values compared with control ghee.Ghee treated with TBHQ had significantly higher ($P \leq 0.05$) oxidative stability index followed by ghee containing ethanolic extract compared with control ghee. In conclusion, taro peels extract can be used as safe natural antioxidant to retard of oxidation and extend the shelf life of fatty foods.

Keywords: Ghee, taro peels, antioxidants activity, phenolic content, oxidation stability, Rancimat.

Introduction

Ghee is considered to be one of the most important dairy products which is used for cooking in Egypt. It is manufactured from

either milk cream or butter. Chemically, ghee is mixed lipids from glycerides together with free fatty acids, phospholipids, sterols, carotenoid pigments, fat soluble vitamins, carbonyl compounds, hydrocarbons, traces of casein and trace elements. Ghee undergoes oxidative degradation during storage. Oxidation of lipid lead to formation of free radicals and undesirable oxidized compounds such as organic acids, aldehydes, ketones and malonaldehyde and therefore the off-flavour is formed in foods and nutritional quality, and shelf-life of stored products are decreased**(Nerin*et al*., 2008;Pawar*et al*., 2012 and Aditya and Divya, 2018)**.

Several synthetic antioxidants like butylated hydroxyl anisole (BHA), tert-bytyl hydroquinone (TBHQ), ethyl protocatechuate (EP) and butylated hydroxyl toluene (BHT) are added during food processing to inhibit the free radicals formation and retarding oxidation reactions in foods **(Win *et al*., 2011;El-Sayed *et al*. 2016aand Elsorady and Ali, 2018)**. In recent years, the legislations restricted use of artificialantioxidants in numerouscountries because of their toxic components may cause liver damage or cancer **(Prior, 2004 and Mehta, 2006)**.Scientific researchs were interested by using various plants (such as fruits, leaves, seeds, herbs, vegetables, cereals, nuts and other plants) to be safer as natural sources of antioxidants such as phenolics, flavonoids, tannins, coumarins, Vit C, Vit E, carotenoids, lycopene, lignans and terpenoids**(Jeong*et al*., 2004; Win *et al*., 2011 and Hazra*et al*., 2014)**.

A large amounts of wastes as peels and seeds result during use of fruits and vegetables in food processing. These wastes influence on environment and cause serious problems worldwide, so it should be managed and/or utilized. On the other hand, scientific investigations found that fruit and vegetable wastes are high nutritional value and very rich with bioactive components that can be use as food additives or supplements **(Vasso and Constantina, 2007)**. Some fruit and vegetable peels had higherconcentrationsof phenolic compoundsand antioxidant activity than the pulp. Therefore, these peels were used as an important source of natural antioxidants in food processing to decrease the lipid oxidation and extend its shelf-life **(Guo*et al*., 2003 and Abd-Allah *et al*., 2016)**.

Taro (*Colocassiaesculenta L*), also known as Colcasia, is an edible corms which are used as an important food in dietary meals for more than 400 million people worldwide **(Kumoro*et al*., 2014)**. In 2012, 8200 feddan of taro was harvested and 120000 tons were produced in Egypt. The top governorates producers in Egypt are Menoufiya, Al Sharkia, Qalyubia, Assiut and Al Minia**(El-Sayed *et al*., 2016b)**.

This study was carried out to assess the total phenolics, flavonoids and antioxidant activity of ethanolic taro peels extract and its effect as natural antioxidant on oxidative stability of ghee during thermal oxidation conditions.

Materials and methods

Materials

Fresh buffalo butter was obtained from Dairy Technology Unit, Food Science Department, Faculty of Agriculture, ZagazigUniversity, Sharkia Governorate, Egypt. Taro corms (*ColocasiaesculentaL*) were purchased from local market at Zagazige city, Sharkia Governorate, Egypt. The chemicals and reagents used were purchased from El-Gomhoriafor Chemicals and Medical InstrumentsCompany, Sharkia, Egypt. While,tert-bytyl hydroquinone (TBHQ) and 2, 2-diphenyl-1-picrylhydrazyl (DPPH), were purchased from Sigma Co. (St. Louis, MO,USA).

Preparation of taro peels

Taro were washed with tap clean water and peeled by stainless steel knife. The peel samples were rewashed again to remove starch and the mucilage. Approximately, two kilograms of fresh peels were dried at oven air (45±2°C) for 24h, milled to powder then sieved through a 60 mesh screen.Taro peels powder was packed in a tightly sealed plastic bags then stored in the refrigerator for further uses and analysis.

Preparation of ethanolic extract

Dried powder of taro peels was extracted in the laboratory using aqueous ethanol 70% at ratio (1:10 w/v), overnight at room temperature with shaking, followed byfiltration through Whatmanpaper (No.1). The residues werere-extracted under the same conditions then the combined filtratewas evaporated in a rotary evaporator (BÜCHI-water bath-B-480, Germany) at 45°C. The extract was freeze-dried (Thermo- Electron Corporation - Heto power dry LL300 Freeze Dryer, France). The dried

extract was weighed todetermine the yield and stored at -20 °C until further use,according to **Contini*et al*. (2008)**.

Determination of chemical composition

Moisture, crude protein, fat, ash and crude fiber were determined for dried taro peels powder according to **AOAC (2000)** standard methods. Total carbohydrate content was estimated by difference = 100-(%moisture+ %fat+ %crude protein + %ash + % crude fiber).

Determination of minerals

Calcium, magnesium, zinc and iron were determined and calculated on dry weight basis by the method of **Nation and Robinson (1971)**. The minerals were determined after solubilizing 0.8g sample in 5ml sulphoric acid, heated for 15 min, one ml of perchloric acid was added and the digestion process was continued till the end point (light green color) then the sample was transferred to a standard flask and the volume was adjusted to 25 ml by deionized water. The samples were analyzed by atomic absorption (Varian-Spectr AA 220) in the National Research Center, Dokki, Egypt. Results were expressed as mg/100g. While, phosphorus content was estimated colorimetrically(UV-visible spectrophotometer, JASCO V-530, MODEL TUDC 12 B4, Japan Servo CO. LTD Indonesia), using potassium dihydrogen phosphate as the standard **(AOAC, 2000).**

Determination of total phenolic content

The total phenolic were measured by using a Folin–Ciocalteu reagent as described by **Singleton and Rossi (1965)**, the phenols were measured at 765nm then the results were reported as mg of gallic acid equivalents (GAE) per 100 g of dried weight.

Determination of total flavonoids

Total flavonoid content was determined as**Ordon*et al*. (2006)**, the absorbance was measured at 420 nm, and flavonoids content expressed as quercetin equivalent (QE)per 100 g of dried weight.

Antioxidants activity assay

Free radical scavenging activity (DPPH assay)

The free radical scavenging of ethanolic extract was measured by the 2,2- diphenyl-1 hydrazil (DPPH) assay according to **(Burits and Bucar, 2000)** with some modification, Briefly 3ml of 0.1mM ethanolic solution of DPPH was added to 1 ml of ethanolic extract at concentration 100 µg/ml. The absorbance was measured against a blank at 517 nm at

0, 30, 60 and 120 min . Inhibition of free radical DPPH in percent was calculated by the following equation:

DPPH scavenging activity% = (Ac- As/ Ac) ×100;

Where Ac is the absorbance of control reaction (containing all reagents except the extract) and As is the absorbance in the presence of the tested extract.

Identification of phenolic compounds by HPLC

Separation and identification of phenolic compounds by using HPLC (Hewlett Packard Series 1050, USA), were carried according to **Goupy*et al*. (1999)**with the column (Hypersil BDS 5 um C18). Sampling injector by using quaternary HP pump (series 1100), solvent degasser, iso gradient separation was carried out with methanol and acetonitrile as a mobile phase at flow rate of 1 ml/min, temperature was maintained at 35°C. The ultraviolet UV detector set at wavelength 280 nm for phenolic compounds. Standards were obtained from Sigma Co., were melted in a mobile phase and injected in HPLC. Retention time and peak area were used for calculation of phenolic compounds concentration by the data analysis of hewlletpackared software.

Preparation of ghee

Ghee used in this study was made from fresh buffalo butter. The butter was turned into ghee by boiling off according to the method of **Fahmi (1961)**, resultant ghee was divided into five equal portions and treated as follow; the first portion was retained without additives and served as a control (C), the second portion was treated with TBHQ as a synthetic antioxidants at a level of 200ppm (C_1), The third portion was treated by crude extract of taro peel at concentration of 200ppm (T_1), the fourth portion treated by 400ppm of crude extract (T_2) and the fifth portion treated with 600ppm of crude extract (T_3). All treatments were incubated in the incubator at 63±2°C to accelerate the fat autoxidation for 21 days. The samples were analyzed at different storage periods at zero time, 7^{th}, 14^{th} and 21 days for detection of peroxide, acid and thiobarbituric values while all treatments were triplicated.

Determination of peroxide and acid values

Peroxide and acid values of ghee were determined according to **AOAC (2005)**.

Determination of thiobarbituric (TBA) value

TBA values of ghee sampleswheredetected according to methods described by **Keeny (1971)**.

Oxidation stability test of ghee using Rancimat equipment

Oxidative stability of ghee was determined according to **AOCS (1997)** by Rancimat(USA, model 617). It is based on volatile acids from oxidation reaction passed through deionized water and conductivity rates were determined. Heating block was detained constant at 130 ºC. Befor the test, frozen ghee samples were thawed at 40–50 ºC, and 3 g of ghee was taken for the analysis.

Statistical analysis method

All data were statistically analysedusingStatistix8.1 package program **(Statistix, 2009)**. The data were expressed as mean ± SD. Statistically differences between all treatments and storage periods were analyzed by least significant difference (LSD).

Results and discussion

Proximate chemical composition of taro peels powder

The chemical composition of taro peels powder is presented in Table(1).The moisture content of taro peels powder was 7.92±0.14%. Total protein, fat and carbohydrate content were 7.43±0.28%, 0.79±0.02% and 62.18±3.89%, respectively. Moreover, ash and crude fiber contentwere11.05±0.11% and10.63±0.79%, respectively. It is observed from the data that taro peels had high content of ash and fiber which suggest these use as functional ingredients in processed foods. **Elhassaneen*et al*. (2018)** found that taro flour content of moisture, fat, protein, ash, crude fiber and carbohydrate were 6.67 ± 0.08,0.93 ± 0.02,5.99±0.22, 5.02±0.05, 4.24±0.30 and 78.63±0.35%, respectively. So, taro peel powder had 2-fold quantity of ash and fiber compared to taro corms flour. On the other side, the quantity of carbohydrate in peel was less than taro corms flour.

Also, taro peel powder is rich in minerals such as calcium, phosphorus, magnesium, zinc and iron to be 556.98±15.06, 230±0.35, 121.64±0.96, 4.28±0.65 and 21.14±0.72mg/100g, respectively. The quantity of minerals in taro peel powder is more than found in taro corms flour according to **Elhassaneen, *et al*.(2018)**.

Table (1) : Chemical composition and minerals content of taro peels powder

Chemical composition %		Minerals (mg/100g)	
Moisture	7.92±0.14	Phosphorus	230.00±0.35
Total protein	7.43±0.28	Calcium	556.98±15.06
Fat	0.79±0.02	Magnesium	121.64±0.96
Carbohydrate	62.18±3.89	Zinc	4.28±0.65
Ash	11.05±0.11	Iron	21.14±0.72
Crude fiber	10.63±0.79		

Total Phenolics, flavonoids and identify of phenolic compounds

Table (2) shows the quantity of total phenolic for ethanolic taro peels extract.Folin–Ciocalteumethoddetermined the decrease of reagent by phenolic compounds throughthe formation of a blue complex that can be measured at 760 nm against gallic acid equivalent (GAE) as a standard.The total polyphenols content of taro peels powder was found to be 214.58±20.76mg GAE/100g DW. Also, flavonoids have a broad spectrum of chemical and biological activities as radical-scavenging characteristics, for this reason, the extract was analyzed for total flavonoid content by using $ALCL_3$ method. The total flavonoids content was being 75.94±9.90 mg QE/100g DW for taro peel.Generally, peels shell and hull which are the outer layers of plants contain large amount of phenolic compounds than pulp **(Lee *et al*., 2006)**. The obtained results are matched with**Eissa, *et al.* (2010)** revealed that taro peel extracts had higher total phenolics content.

Phenolic compounds are very important plant ingredientsbecause of their scavenging capability due to their hydroxyl groups **(Oktay *et al.*, 2003)**. Therefore, phenolic compounds of ethanolic taro peel extract were separated and identified by HPLC. Data are illustrated in Table (2).It can be noticed that Ferulicacid is the most abundant phenolic compound being 226.33±4.55 mg/100g DW. Furthermore, Coumarin,Quercetin,Kaempherol and Naphthaline were found in small amounts being 30.41±1.10,2.84±0.37, 0.73±0.08 and 0.15±0.01 mg/100g DW, respectively.

Table (2): Total Phenolics, flavonoidsand identify of phenolic compounds of ethanolic taro peels extract (mg/100g dry weight basis)

Item		Ethanolic taro peel extract
Total phenolic		214.58±20.76
Flavonoids		75.94±9.90
Phenolic compounds	Coumarin	30.41±1.10
	Ferulic acid	226.33±4.55
	Quercetin	2.84±0.37
	Kaempherol	0.73±0.08
	Naphthaline	0.15±0.01

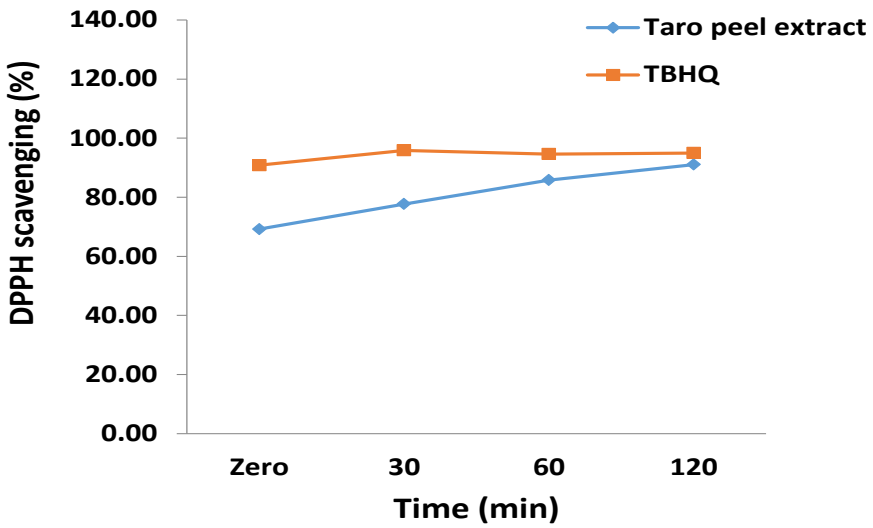

Fig. (1): DPPH scavenging activity of ethanolic taro peels extract and TBHQ

Antioxidant activity

The results of DPPH radical scavenging activity of ethanolic taro peels extract compared with TBHQ are represented in Fig. (1). The results indicated that the radical scavenging activity found to be 91.04±1.55% compared to 94.96±0.67% for TBHQ at 120 min. Taro

peels extract had higher antioxidant activity (91.04%) than that intaro corm extract (80.11%) **(Elhassaneen*et al*., 2018)**. The results suggest that taro peels extract is capable of scavenging free radicals by their phenolic structure which act as hydrogen or electron doner. Where,the phenoxy radical formed in the reaction of antioxidant with fatty acid peroxy radical is steadied by delocalization of the impaired electrons around the aromatic ring **(Ramadan *et al*., 2003 and Zaki*et al*., 2014).**

Acid value

Data showed in Table (3) illustrate the changes in the acid values expressed as mg NaOH/g fat of different treatments as affected by using ethanolic taro peels extract and TBHQ during incubation period at 63± 1°C for 21 days. It could be observed from the results that, there were no significant differences in acid values among all treatments and control within the first seven days of incubation period at 63± 2ºC. Acid values of ghee treated with TBHQ and ethanolic taro peels extract were significantly lower than that of control on 14 and 21 days of incubation period.

Moreover, a significant increases in the acid values of all treatments were observed with progressingincubation period. Ghee treated with TBHQ (200 ppm) followed by ghee treated with 600 ppm of ethanolic taro peels extract showed the lowest increase in acid values compared with other treatments. These results are in agreement with **El-Shourbagy and El-Zahar (2014), Atwa*et al*. (2015) and El-Sayed *et al*. (2016a)**.

Table (3): Effect of ethanolic taro peels extract on the acid values (mg NaOH/g fat) of ghee during incubation period at 63± 2°C for 21 days

Storage periods (days)	C	C_1	T_1	T_2	T_3	LSD
0	$0.092\pm0.013^{A,d}$	$0.084\pm0.008^{A,d}$	$0.097\pm0.013^{A,d}$	$0.089\pm0.009^{A,d}$	$0.086\pm0.007^{A,d}$	0.017
7	$0.221\pm0.051^{A,c}$	$0.175\pm0.012^{A,c}$	$0.207\pm0.011^{A,c}$	$0.210\pm0.018^{A,c}$	$0.194\pm0.017^{A,c}$	0.047
14	$0.460\pm0.030^{A,b}$	$0.237\pm0.018^{D,b}$	$0.384\pm0.033^{B,b}$	$0.380\pm0.027^{B,b}$	$0.309\pm0.041^{C,b}$	0.055
21	$0.983\pm0.055^{A,a}$	$0.314\pm0.016^{D,a}$	$0.568\pm0.014^{B,a}$	$0.453\pm0.045^{C,a}$	$0.398\pm0.056^{C,a}$	0.076
LSD	0.077	0.026	0.037	0.053	0.067	

C: Control without antioxidants

C_1: Ghee treated with 200 ppm TBHQ (positive control).

T_1, T_2, T_3: Ghee treated with 200, 400 and 600 ppm ethanolic taro peels extract. respectively.

Means followed by different capital letters in the same row are significantly different ($P \leq 0.05$).

Means followed by different small letters in the same column are significantly different ($P \leq 0.05$).

Peroxide value

Peroxide value is an indicator of the onset of oxidative changes in oil and fats resulting the oxidation of unsaturated fatty acids and formation of peroxides and/or hydrolysis of glycerides lead to increase content of free fatty acids **(Riuz*et al*., 2001)**. From the obtained results in Table (4), it could be observed that the ghee samples treated with TBHQ and taro peels extract had the lower peroxide values than that in the control sample during incubation period at 63 ± 2 ºC for 21 days. Also, the peroxide values significantly increased in all treatments by progressingstorage periods. The highest increases in peroxide values were observed in control samples.

Treating ghee with taro peels extract significantly decreased the rate of peroxide development during incubation. This may be due to their capability of radical scavenging and metal chelating **(Yemis*et al*., 2008)**. The trend of the obtained results is in agreement with **El-Abbassy (2001), Pankaj *et al*. (2013) and El-Sayed *et al*. (2016a)**.

Table (4): Effect of ethanolic taro peels extract on the peroxide value (meq.O2/kg fat) of ghee during incubation period at 63± 2°C for 21 days

Storage periods (days)	C	C_1	T_1	T_2	T_3	LSD
0	$0.588\pm0.012^{A,d}$	$0.575\pm0.112^{A,d}$	$0.586\pm0.016^{A,d}$	$0.583\pm0.139^{A,d}$	$0.578\pm0.021^{A,d}$	0.147
7	$3.156\pm1.025^{A,c}$	$1.146\pm0.045^{B,c}$	$1.746\pm0.245^{B,c}$	$1.543\pm0.325^{B,c}$	$1.343\pm0.137^{B,c}$	0.905
14	$5.932\pm0.149^{A,b}$	$1.985\pm0.186^{C,b}$	$3.623\pm0.723^{B,b}$	$2.351\pm0.353^{C,b}$	$2.141\pm0.129^{C,b}$	0.691
21	$11.033\pm0.174^{A,a}$	$4.674\pm0.315^{C,a}$	$7.422\pm0.558^{B,a}$	$5.118\pm0.553^{C,a}$	$4.453\pm0.437^{C,a}$	0.787
LSD	0.988	0.362	0.890	0.701	0.448	

C: Control without antioxidants. C_1: Ghee treated with 200 ppm TBHQ (positive control).

T_1, T_2, T_3: Ghee treated with 200, 400 and 600 ppm ethanolic taro peel extract. respectively.

Means followed by different capital letters in the same row are significantly different ($P \leq 0.05$).

Means followed by different small letters in the same column are significantly different ($P \leq 0.05$).

Thiobarbituric acid (TBA) value

TBA value is as an index to assess the development of oxidation changes appearedin fatty foods. It is measure the levels of secondary oxidation products like aldehydes, malonaldehyde and ketones **(Farag*et al*., 1990)**. The changes in the TBA expressed as mg malonaldehyde/kg

fat of different treatments as affected by using ethanolic taro peels extract and TBHQ during incubation period at 63± 2°C for 21 days are presented in Table (5). It is evident that the ghee samples treated with TBHQ and taro peels extract had the lower TBA values than the control sample during the accelerated incubation period. Moreover, no significant differences in TBA values were observed between ghee samples treated with TBHQ and samples treated with 600 ppm of taro peels extract at different incubation periods. Also, the highest concentration of taro peels extract (600 ppm) was more effective in retarding the development of TBA values. This due to phenolic compounds found in extracts, where it act as hydrogen or electron donors to proxy radicals in the reaction and thus decreasing the formation of the hydro peroxides and secondary products or delaying the autoxidation of linoleic acid through chain radical termination **(Banerjee and Bonde, 2011 and Morales *et al*., 2012)**.**Eissa*et al.* (2010)** found that the pre-treatment of dried and frozen apple pulp rings with taro peels extract led to inhibit the oxidative enzymes activity and maintain its colour during storage period for 4 months. These results agree with **El-Abbassy (2001), Atwa*et al*. (2015)and El-Sayed *et al*. (2016a)**.

Table (5): Effect of ethanolic taro peels extract on the TBA values (mg malonaldehyde/kg fat) of ghee during incubation period at 63± 2°C for 21 days

Storage periods (days)	C	C_1	T_1	T_2	T_3	LSD
0	$0.006\pm0.001^{A,c}$	$0.005\pm0.002^{A,c}$	$0.005\pm0.001^{A,c}$	$0.005\pm0.001^{A,c}$	$0.005\pm0.001^{A,c}$	0.002
7	$0.013\pm0.001^{A,c}$	$0.009\pm0.002^{BC,c}$	$0.010\pm0.002^{B,c}$	$0.010\pm0.001^{B,c}$	$0.008\pm0.001^{C,c}$	0.002
14	$0.065\pm0.011^{A,b}$	$0.039\pm0.010^{B,b}$	$0.054\pm0.011^{AB,b}$	$0.051\pm0.004^{AB,b}$	$0.044\pm0.007^{B,b}$	0.016
21	$0.113\pm0.016^{A,a}$	$0.068\pm0.011^{B,a}$	$0.082\pm0.008^{B,a}$	$0.075\pm0.005^{B,a}$	$0.067\pm0.008^{B,a}$	0.018
LSD	0.018	0.014	0.013	0.006	0.010	

C: Control without antioxidants. C_1: Ghee treated with 200 ppm TBHQ (positive control).

T_1, T_2, T_3: Ghee treated with 200, 400 and 600 ppm ethanolic taro peel extract. respectively.

Means followed by different capital letters in the same row are significantly different ($P \leq 0.05$).

Means followed by different small letters in the same column are significantly different ($P \leq 0.05$).

Oxidative stability index (Rancimat)

The effect of ethanolic taro peels extract and TBHQ integrationon oxidative stability of ghee was evaluated by Rancimat apparatus and results are presented in Fig (2). The induction time was used as index of antioxidativepossibilityof antioxidants used. The induction period is also known as oxidative stability index determined as the time required reaching an end point of oxidation conform to either a level of rancidity or a fast variation in the rate of oxidation **(Presa-Owens *et al.*, 1995)**. Ghee containing ethanolic extract had significantly higher ($P \leq 0.05$) induction periods than that of control sample. Ghee containing TBHQ had significantly higher ($P \leq 0.05$) oxidative stability index followed by ghee containing ethanolic extract compared with control ghee. **Pawar*et al.* (2012)**stated that phenolic compounds are considered to be the most important antioxidative components in plants, and a significant correlation was extant between the concentrations of plant phenolic and the total antioxidant capacities. These results agree with **Pawar*et al.* (2012), El-Shourbagy and El-Zahar (2014) and Atwa*et al.* (2015)**.

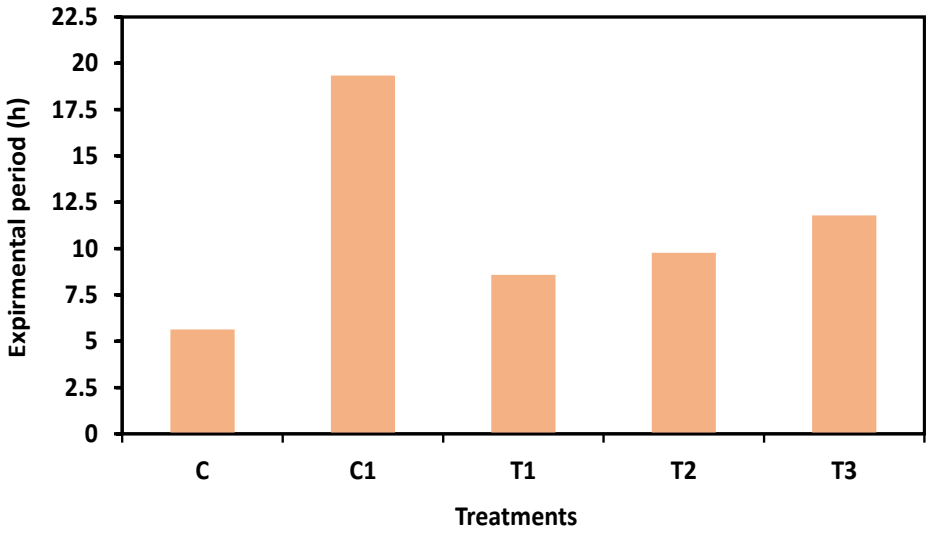

Fig. (2): Rancimat of ghee treated with TBHQ and ethanolic taro peels extract at 130 °C

C: Control without antioxidants. C_1: Ghee treated with 200 ppm TBHQ (positive control). T_1, T_2, T_3: Ghee treated with 200, 400 and 600 ppm ethanolic taro peel extract. respectively.

Conclusion

From the obtained results, it could be concluded that ethanolic taro peels extract had high phenolic content and showed high antioxidant activity. Addition of taro peels extract at level of 600 ppm during processing of ghee improved its oxidative stability. Thus taro peels extract can be used to retard of oxidation and extend the shelf life of ghee.

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تأثير إضافة المستخلص الإيثانولى لقشر القلقاس على ثبات السمن ضد الأكسدة

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الملخص العربى

تعتبر عملية أكسدة الدهن من أهم المشاكل التى تواجه كلا من المنتج والمستهلك للسمن نظرا لما ينتج عنها بعض التغيرات التى تؤثر سلبيا على خواص المنتج ونكهته. لذلك أجريت هذه الدراسة لتقدير المحتوى الكلى للمركبات الفينولية والنشاط المضاد للأكسدة للمستخلص الإيثانولى لقشر القلقاس، وكذلك لتقييم مدى تأثير إضافة هذا المستخلص على درجة ثبات السمن ضد الأكسدة، وقد تم اضافةمستخلص قشر القلقاس عند صناعة السمن بنسب مختلفة (٢٠٠، ٤٠٠، ٦٠٠ جزء فى المليون)بالإضافة الى عينة سمن مضاف اليها ٢٠٠ جزء فى المليون من مركب TBHQ كمضاد أكسدة صناعي وعينة سمن بدون أي اضافات (كنترول)، وتم تحضين كل المعاملات على درجة حرارة ٦٣ ± ٢°م لمدة ٢١ يوم، وتم تقدير درجة الثبات ضد الأكسدة من خلال تقدير رقم كلا من البيروكسيد والحامض وقيم TBA و Oxidative stability indexوقد أظهرت النتائج احتواء مستخلص قشر القلقاس على نسبة عالية من المركبات الفينولية، وقد أعطى هذا المستخلص نشاطاً عالياً كمضاد للأكسدة (٩١.٠٤%)، وكانت عينات السمن المحتوية على المستخلص الايثانولى لقشر القلقاس اقل المعاملات انخفاضا فى قيم البيروكسيد والحامض و TBA مقارنة بالعينة الكنترول (بدون اضافات)، وكان مؤشر الثبات ضد الأكسدة(Oxidative stabilityindex) لعينات السمن المحتوية على TBHQ أعلى معنويا من باقىالمعاملات يليه عينات السمن المحتوية على المستخلص بمعدل ٦٠٠ جزء فى المليون، ومن خلال هذه النتائج توصى الدراسة بإضافة المستخلص الإيثانولى لقشر القلقاس بمعدل ٦٠٠ جزء فى المليون إلى السمن كمضاد أكسدة طبيعى آمن عنالمركبات الصناعية وذلك لتحسين ثبات السمن ضد الأكسدة خلال التخزين.

الكلمات المفتاحية:السمن، قشور القلقاس، مضادات الأكسدة، المركبات الفينولية،مؤشر الثبات ضد الأكسدة.