قشور الرمان المطبقة في المعجنات عالية الدسم
Pomegranate Peels Applied in High Fat Pastry

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قشور الرمان المطبقة في المعجنات عالية الدسم

إعداد

أ/ العنود عمر على محضر

أستاذ مساعد في تكنولوجيا الأغذية، كلية التربية، التربية الأسرية، جامعة أم القرى، وزارة التربية والتعليم، المملكة العربية السعودية

ملخص البحث

ويرتبط الدور الكيميائي للفاكهة مع محتواها من المغذيات النباتية التي تحمل خصائص مضادة للأكسدة. لذلك، تم دمج مسحوق قشور الرمان بنسبة ١، ٢ و ٥٪ من المعجنات عالية الدهون وقارنت كفاءتها في ثبات بعض الثوابت الدهنية مقارنة بعينة المعجنات (مسحوق قشور الرمان الحر) خلال فترة التخزين عند درجة حرارة الحاضنة (٥٠ ° ± ١ ° C) كشرط معجل للتدهور.

تم الكشف عن محتوى الفينول الكلي ، نشاط مضادات الأكسدة ، التي عبر عنها DPVH نشاط الكسح الجذري، إلى حد كبير في مسحوق قشور الرمان. كما وجد أنه مع زيادة كمية مسحوق قشور الرمان في المعجنات الدهنية المختبرة، تم زيادة الفينول الكلي (كما GAE mg / 100gm) وبالتالي نشاط الكسح الجذري (RSA٪). تم تخفيض الأحماض الدهنية الحرة (FFA ٪ كما حمض الأوليك).

نتيجة لزيادة كمية مسحوق قشور الرمان في المعجنات الدهنية المختبرة. كما كان أقل في نهاية فترة التخزين نتيجة لزيادة كمية مسحوق قشور الرمان في المعجنات الدهنية المختبرة.

كما تم اكتشاف نفس النمط في حالة قيمة البيروكسيد (POV as meq / Kg) والقيمة الحمضية (AV كمجرام / غرام) من المعجنات الدهنية خلال فترة التخزين. بشكل عام، يمكن الاستنتاج أن مسحوق قشور الرمان يمكن اعتباره أداة جيدة في مقاومة التأكسد وتأخير عملية تأكسد المنتجات الدهنية. Cosequently، يمكن استخدامه في التطبيقات العلاجية إما في ظروف جيدة أو أسوأ.

الكلمات المفتاحية: قشور الرمان، معجنات عالية الدسم، محتوى الفينول الكلي، نشاط مضاد للأكسدة، أحماض دهنية، قيمة بيروكسيد، قيمة حمضية.

Pomegranate Peels Applied in High Fat Pastry

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Abstract

The chemopreventive role of fruits is associated with their phytonutrient contents bearing antioxidative properties. Therefore, pomegranate peel powder was incorporated by 1, 2 and 5% of the high fat pastry and compared their efficiency in stability of some fat constants in relative to the control pastry sample (pomegranate peel powder free) within the storage period at incubator temperature (50°±1°C) as an accelerator condition for deterioration.

Total phenolics content, antioxidation activity, expressed by DPPH radical scavenging activity, were highly detected in the pomegranate peel powder. It was also found that as the pomegranate peel powder amount increased in the tested fatty pastry, the total phenols (as GAE mg/100gm) and consequently radical Scavenging Activity (RSA %) was increased. The free fatty acids (FFA% as oleic Acid) were lowered as a result of increasing the pomegranate peel powder amount in the tested fatty pastry. It was also lower at the end of the storage period as a result of increasing the pomegranate peel powder amount in the tested fatty pastry.

The same pattern was also detected in case of peroxide value (POV as meq/Kg) and acid value (AV as mg/g) of fatty pastry during the storage period. In general, it could be concluded that the pomegranate peel powder could be considered a good tool in antioxidizing and delay the peroxidation process of the fatty products. Cosequently, it could be used in therapeutic applications either in the good or worst conditions.

Key words: **pomegranate peel, high fat pastry, total phenolics content, antioxidation activity, free fatty acids, peroxide value, acid value.**

Introduction

Recent years have seen increased interest on the part of consumers, researchers and the food industry into how food products can help maintain health and the role that diet plays in the prevention and treatment of many illnesses has become widely accepted (Viuda-Martos *et al.*, 2010 a,b).

To overcome the disadvantages of using synthetic anti-oxidants in food products, an investigation was carried out to evaluate the anti-oxidant effect of extracts of fruit by-products viz., kinnow rind powder (KRP), pomegranate rind powder (PRP) and pomegranate seed powder (PSP). Results showed that these extracts are rich sources of phenolic compounds having free radical scavenging activity. Further, a significant ($P < 0.5$) reduction in TBARS values (lipid oxidation) during storage of goat meat patties was observed in PRP, PSP and KRP as compared to control patties. Average TBARS values (mg/kg meat) during refrigerated storage ($4° \pm 1°$ C) were significantly lower in PRP, followed by PSP and KRP as compared to control. The overall anti-oxidant effect was in the order of PRP > PSP > KRP. It was concluded that extracts of above fruits by-product powders have potential to be used as natural anti-oxidants in meat products (Devatkal *et al.*, 2010).

***Punica granatum* (Punicaceae) is a small tree originating from the Middle East and now extending throughout the Mediterranean, China, India, South Africa and America. It is employed in folk medicine for the treatment of various diseases such as ulcers, fever, diarrhea and microbial infections among others. The pharmacological properties of various parts of this tree have been extensively studied. The fruit, called pomegranate, is a rich source of polyphenolic compounds, which possess antioxidant properties that can play an important role against cancer cells (Adams et al., 2006 and Lansky and Newman, 2007).**

Antimicrobial activities against *Staphylococcus aureus, enterohemorrhagic Escherichia coli* and *Candida sp.* have also been reported (Voravuthikunchai *et al.*, 2005).

The crude methanol extract of the rind has been reported to contain 192 mg/g of total phenolics (Surveswaran *et al.*, 2007). The extract showed high antioxidant activity, with trolox equivalent antioxidant capacity (TEAC) values of 395 and 316 mmol/100 g dry weight, as evaluated by 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,20-azinobis (3-ethylbenzothiazoline-6- sulphonic acid) (ABTS) assays, respectively.

In a recent study we have shown that ellagic acid is the major antioxidative constituent in the methanol extract of pomegranate rind. We have used this compound as an indicative marker for standardization of pomegranate rind extract. Ellagitannins isolated from pomegranate have been reported to

exhibit antibacterial activity against both methicillin-resistant and methicillin-sensitive Staphylococcus aureus, with MICs of 62.5 µg/ml. Pomegranatejuice and peel have also been shown to possess anticancer activities. This may be associated with plant-based anti-inflammatory effects (Machado *et al.*, 2003).

Of the antioxidant compounds, phenolics drew significant attention in recent years for their ability to scavenge free radicals generated within cell (Yang *et al.*, 2001). Phenolic compounds protect human body by neutralising destructive effect of free radicals on plasma membrane, organelle membranes and DNA (Issa *et al.*, 2006; Villano *et al.*, 2007). Presence of hydroxylated aromatic ring(s) is a common feature of phenolic
compounds that are widely distributed in plants (Boudet, 2007). Hydroxyl groups linked to aromatic rings are associated with the formation of electron-rich environment that scavenges the reactive oxygen species (ROS) excluding them from reacting nucleophilic centres in plasma membrane, cellular proteins and DNA (Issa *et al.*, 2006).

Phenolic compounds produced by plants are divided into two major groups: phenolic acids and flavonoids. Cinnamic acids and benzoic acids are the two main groups of phenolic acids. Anthocyanidins, flavons, flavonols, flavonons, catechins and proanthocyanidins are the subgroups of flavonoids. The general phenylpropanoid pathway is responsible for biosynthesis of a substrate common to many of the phenylpropanoid compounds such as flavonoids, monolignols, hydroxycinnamic acids, sinapoyl esters, coumarins and stilbenes (Vermerris and Nicholson, 2006). Therefore, phenylpropanoid pathway serves as a rich source of natural compounds including flavonoids, coumarins and lignans (Fraser and Chapple, 2011).

Fruits, especially red ones, were determined as to be the dietary sources containing high amount of bioactive phenolic compounds. Thus, pomegranates have received a considerable interest in recent years because of their abundant bioactive natural compound contents such as vitamin C, flavonoids, gallotannins, cyanidin, pelargonidin, delphinidin glycosides (Mousavijenad *et al.*, 2009), and regular consumption of pomegranate is associated with cancer chemotherapeutic effect (Malik *et al.*, 2005) and prevention of chronic inflammation (Newman and Ephraim, 2007).

Pomegranate fruits are rich source of bioactive compounds and thus have higher antioxidant activity compared with red wine and green tea. The most influential factors that could affect the content and composition of bioactive molecules in pomegranate are genetic heterogeneities, varietal factors, climate conditions, soil structure, agricultural practices, water–heat stress, harvesting time and storage conditions.

Antioxidant and antibacterial properties of pomegranate peel in in-vitro model systems have been reported (Al- Zoreky, 2009). However, pomegranate peel has received less attention as natural preservatives in meat (Devatkal *et al.*, 2010). Pomegranate peel extract has both antioxidant and antimutagenic properties and may be exploited as biopreservative in food applications and neutraceuticals. However, so far, there has been no attempt to investigate the antioxidant properties of pomegranate in food products (Naveena *et al.*, 2008).

Due to the large amount of pomegranate peel and because of valuable harmaceutical and nutritional compounds previously reported, in another paper, the current research was carried out to investigate the total phenols and antioxidant properties of pomegranate peel as well as to throw the light on their role in stability of specified fat constants of a well known high fat pastry.

Materials And Methods

Collection of plant material:

Pomegranate (*Punica granatum* L.) fruits were collected from a well known fruit market at Mecca, Kinkdom of Saudi Arabia. Care was taken to select healthy pomegranate fruits. It was identified as reddish or yellowish red color rind belonging to Punicaceae family. The pomegranate fruits were handy peeled and the required fruit rind was cut and removed from the fruit. The fruit rind was dried in an oven at 40 °C for 24 h, then mechanically grounded to be powdered and the fine powder was sieved through 24-mesh according to Sangeetha and Vijayalakshmi (2011). The pomegranate rind fruit powder was stored at -18°C until use.

All the raw materials were obtained from the local market at Mecca, Kinkdom of Saudi Arabia. The control sample of the high fat pastry formulae was consisted of one kg wheat flour (72% extraction rate), 40 g instant yeast, 10g salt, 100 g butter, 60 g sugar and about 60 to 80 ml tap water. It was prepared as described by Leung *et al.*, (1984).

The other samples were prepared by the same method and exactly 1, 2 or 5% amount of the wheat flour (72% extraction rate) was substituted by the same amount of pomegranate fruit peels. The tested samples was stored up to 5 wk in an incubator (50°±1°C) as an accelerator condition for deterioration to verify the ability of pomegranate rind fruit powder in protecting or delaying the deterioration of fatty pastry.

Analytical Methods:

The amount of total polyphones was colorimetrically determined in pomegranate peels by using Folin- Ciocalteu reagent. The OD readings were calibrated and presented as Gallic Acid Equivalent (mg GAE/100 g) as described by Singleton *et al.*, (19 99). All tests were conducted in triplicate.

The antioxidation activity was determined by the DPPH Radical Scavenging (modified by Ohnishi *et al.*,1994) method. It was done by using 1,1-diphenyl-2-picrylhydrazyl radical (DPPH) indicator scavenging activity.

Free fatty acids (FFA as oleic acid %) was estimated according to AOAC (1995). Peroxide value (PV) and acid value (AV) were determined, in the extracted of the tested materials, according to the method recommended by the AOAC (2005).

Sensory evaluation attributes, general appearance, taste, order, crust color, crumb color, texture and after test, were estimated by the method of Moraes *et al.*, (2010). The sensorial evaluation was done by twenty well trained members of Umm Al-Qura University, Ministry of Education, Kingdom of Saudi Arabia.

Panellists were asked to indicate their preference in a maximum degree for the extremely like and a minimum degree for the extremely dislike as recommended by Jayasena *et al*., (2008) and Pacheco de Delahaye *et al*., (2005).

Statistical analysis:

All data were presented as mean values (±SE). Analysis of variance (ANOVA) were performed using SAS (1987) software, where there was statistical significance ($P < 0.05$), the means were further separated using Duncan's Multiple Range Test.

Results And Discussion

Numerous epidemiological studies suggest that diets rich in phytochemicals and antioxidants have protective roles in health and disease. These natural antioxidants might play an important role in combating oxidative stress associated with degenerative diseases such as cancer, cardiovascular diseases, diabetes, Alzheimer's disease and aging (Wong *et al.*, 2006 and Naczk and Shahidi 2006).

In this concern, Table (1) showed that the tested pomegranate peel powder had markedly higher in total phenols and antioxidant capacity, agreed with that found by Shaban *et al.*, (2013). Such results confirmed the observation of Li *et al.*, (2006) and

Rowayshed *et al.*, (2013) who advised to utilize the pomegranate fruit peels powders in fortification of foodstuffs due to their roles in scavenging against superoxide anion, hydroxyl and peroxyl radicals and it inhibited CuSO4-induced LDL oxidation.

Table (1): The total phenols and antioxidant activity levels of the utilized ingredients (on dry basis)

Item	Flour70%	Pomegranate peels
Total phenols (GAEmg/100gm)	4.2b ±0.03	140.33a ±0.05
Radical Scavenging Activity (RSA%)	63.oob ±0.02	91.00a ±0.01

Each value (mean of three replicates) is followed by ± SE.
Values, within the same raw, with different letters are significantly different (p ≤5.05).

Data presented In Table (2) showed that as the pomegranate peel powder amount increased in the tested fatty pastry, the total phenols (as GAE mg/100gm) and consequently radical Scavenging Activity (RSA%) was increased in relative to that found in the control sample (pomegranate peel free). It could be regarded to the low amount of phenols in wheat flour than that found in pomegranate peel (Table 1 and 2).

In monitoring antioxidant activity in a food, potential measurements include peroxide value (PV), free fatty acid (FFA) content and acid value were used to evaluate the ability to inhibit lipid or other sensitive component oxidation commonly involve deterioration tests in which oxidation is accelerated sometimes as a result of the action specified materials (Suhaj 2006).

Table (2): The total phenols and antioxidant activity levels of the tested Pastry (on dry basis)

Treatment	Fatty pastry (control)	Fatty pastry with1% pomegranate peels	Fatty pastry with2% pomegranate peels	Fatty pastry with5% pomegranate peels
Total phenols (GAE)mg/100gm	36.o4d ±0.02	42.86c ±0.04	46.42b ±0.05	56.42a ±0.04
Radical Scavenging Activity (RSA %)	14.92d ±0.03	30.66c ±0.04	39.14b ±0.05	58.16a ±0.02

Each value (mean of three replicates) is followed by ± SE.
Values, within the same raw, with different letters are significantly different (p ≤5.05)

PV is the measure of degree of initial oxidation of oils and fats. Data presented in Table (3) showed a continuous significant increase in PV with the increase in storage period was observed for all the samples.
This increase in PV attributed to the formation of hydroperoxides, i.e. primary oxidation products (Iqbal *et al.*, 2008).

On contrary, a continuous significant decrease in PV was detected with the increase in the pomegranate peel powder level in the high fat pastry formulae at each specified storage period.

Table (3): Changes in peroxide value (PV, meq/Kg) of fatty pastry during storage

Samples	0	1 week	2week	3 week	4 week	5 week
Fatty pastry (control)	2.45eA	3.06dA	5.23cA	6.11bA	6.24bA	6.26aA
Fatty pastry with1% pomegranate peels	1.68fB	1.84eB	2.04dB	2.36cB	3.12bB	4.21aB
Fatty pastry with2% pomegranate peels	1.58fC	1.68eB	1.82dC	2.02cC	2.28bC	2.82aC
Fatty pastry with5% pomegranate peels	1.02fD	1.20eC	1.28dD	1.33cD	1.38bD	1.48aD

Both values, within the same raw, with different letters (in lower case form) are significantly and that, within the same column, with different letter (in upper case form) is different ($p \leq 0.05$).

The same pattern was also found in both of FFA and AV (Table 4 and 5, respectively). Such results confirmed the protective role of pomegranate peel powder in maintaining the fat constant stability of the fatty pastry product during the storage period and increasing the peel level showed a gradient stability level.

Table (4): Changes in free fatty acid (FFA % as oleic acid) of the tested pastry during storage

Samples	0	1 week	2week	3 week	4 week	5 week
Fatty pastry control	0.318 eA	0.333 dA	0.346 cA	0.355 bcA	0.360 abA	0.368 aA
Fatty pastry with1% pomegranate peels	0.288 dB	0.292 cdB	0.300 bcdB	0.312 abcB	0.324 aAB	0.330 aB
Fatty pastry with2% pomegranate peels	0.248 dC	0.253 cdC	0.260 bcdC	0.268 abcC	0.275 abC	0.283 aC
Fatty pastry with5% pomegranate peels	0.208 cD	0.215 bcD	0.226 abcD	0.232 abD	0.239 aC	0.244 aD

Both values, within the same raw, with different letters (in lower case form) are significantly and that, within the same column, with different letter (in upper case form) is different ($p \leq 0.05$).

Table (5): Changes in acid value (AV as mg/g) of fatty Pastry during storage

Samples	0	1week	2week	3week	4 week	5week
Fatty pastry control	1.18fA	1.22eA	1.82dA	2.33cA	2.58bA	3.06aA
Fatty pastry with1% pomegranate peels	1.11eAB	1.14eABC	1.48dB	2.00cB	2.12bB	2.44aB
Fatty pastry with2% pomegranate peels	1.08eBC	1.11eBC	1.22dC	1.32cC	1.48bC	1.64aC
Fatty pastry with5% pomegranate peels	1.02fC	1.06eC	1.12dD	1.16cD	1.20bD	1.28aD

Both values, within the same raw, with different letters (in lower case form) are significantly and that, within the same column, with different letter (in upper case form) is different (p ≤0.05).

The sensory evaluation of the tested high fatty pastry showed that up to 2% pomegranate peel enhanced and scored a higher value with respect to most of the tested attributes (General appearance, Order, Crust Color, Crumb color and Texture (Table 6). While, the other attributes showed a more closed value to the control sample score. On contrary, the 5% pomegranate peel sample shoed the lowest score in all the tested attributes.

In general, it could confirmed that addition pomegranate peel (up to 2%) could increase the stability and delay the deterioration some of the fat constants of high fat pastry without reveal any adverse impact on the sensory attributes.

Table (6): Sensory evaluation of fatty pastry from wheat flour (70% ext) and pomegranate peels

samples	General appearance	Taste	Order	Crust Color	Crumb color	Texture	After Test
Fatty pastry control	9.08 a	9.5	9.6	9.4	9.6	19.52	9.8
Fatty pastry with1% pomegranate peels	±0.04	±0.02	±0.06	±0.08	±0.02	±0.01	±0.02
Fatty pastry with2% pomegranate peels	9.50	9.4	9.7	9.6 0	9.7 0	19.66	9.4
	±0.02	±0.03	±0.04	±0.06	±0.04	±0.05	±0.04
Fatty pastry control	9.40	92.4	9.04	9.00.	9.00	19.22	8.62
Fatty pastry with1% pomegranate peels	±0.05	±0.05	0.02±	±0.04	±0.04	±0.04	±0.06
Fatty pastry with2% pomegranate peels	8.5	8.5	8.0	85	7.0	17.50	7.00
	±0.01	±0.04	±0.06	±0.03	±0.04	±0.06	±0.08

Each value (mean of three replicates) is followed by ± SE.

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