



Utilization of Pomegranate Peels to Increase the Shelf Life of Chicken Burger During Cold Storage

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THIS study was conducted to utilize the pomegranate peels to reduce the microbial load and extend shelf life of chicken burgers during cold storage (2-10 days) at (4±1°C). Some chemical properties, *e.g.* acid value, peroxide value and thiobarbituric acid (TBA) of lipid extracted from chicken burger samples, which were prepared with percentages 0, 10, 20 and 30 % (w/w) of additive pomegranate peels were studied. Sensory attributes (appearance, odor, texture and taste) of chicken burgers during cold storage were evaluated. Flavonoids and phenolic compounds were determined by high performance liquid chromatographic method (HPLC) using ultraviolet detector set at 330 and 280 nm, respectively. Total bacterial count, psychrophilic bacteria, spore-forming bacteria, total molds and yeasts count of chicken burger samples were determined during cold storage. The results showed that additive pomegranate peels to chicken burgers samples during its preparation decreased the acid, peroxide and TBA values of their lipids and retarded the growth of total molds and yeasts, total bacterial, psychrophilic bacteria and spore-forming bacteria of chicken burgers samples during cold storage for concentration 10, 20 and 30 % (w/w) of additive pomegranate peels. The applied additive also improved the appearance, odor, texture and taste of the chicken burgers samples of interest. It was concluded that the activity of pomegranate peels, as natural antioxidant and antimicrobial assay to control microbial load of chicken burgers samples, could be conducted as a food additive to enhance the safety of consumable chicken products.

Keywords: Pomegranate peels, Antioxidant, Antimicrobial, Chemical properties, Sensory attributes, Chicken burger.

Introduction

Pomegranate (*Punica granatum* L.) is cultivated in Middle East, South Africa, America, China, and India. There are three parts of pomegranate fruit: juice, seeds, and peels (Lansky and Newman, 2007, Endo et al., 2010 and Kharchoufi et al., 2018). Weight of pomegranate peels reaches 40–50% of the total weight of pomegranate fruit and is produced as a by-product by the food industry (Li et al., 2006, Çamand Hisil, 2010, Hasnaoui et al., 2014 and Gullon et al., 2016). Pomegranate peels contain quercetin, gallic acid, p-coumaric acid, ellagic acid, caffeic acid, vanillic acid,

hydrolysable tannins, hexahydroxydiphenic acid, punicalagin and punicalin which represent bioactive compounds (Khanbabaee and Van Tee, 2001, Li et al., 2006, Çam & Hisil, 2010, Fischer et al., 2011, Hasnaoui et al., 2014, Romeo et al., 2015 and Gullon et al., 2016). Pomegranate peels contain bioactive phenolics compounds including ellagic acid, ellagic acid – O–hexoside, ellagic acid –O– pentoside, 1-6 pedunculagin derivative (Kharchoufi et al., 2018), and these compounds are effective as antimicrobial efficacy and antioxidant activity. Moreover, Zhuand Liu, 2013 and Alexandre et al., 2018 mentioned that pomegranate peel has a high source of

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antioxidants compounds which are recognized as antimicrobial, antiobesity, anti-cancer, anti-hypertensive, anti-mutagenic, anti-ulcerogenic and diabetic.

Fruit peels are used in various applications such as pharmaceutical and food preservation (Singh et al., 2002 and Al-Zoreky, 2009). Many chicken and meat products are unhealthy due to their cholesterol, high animal fat, antimicrobials additive, and synthetic antioxidants contents which cause some degenerative diseases. Therefore, many researches have been making great efforts to produce new chicken and meat products with natural antioxidants, antimicrobials, low fat and enriched with dietary fiber contents. Besides, there are two ways for the production of healthy food products; the first one is lowering the undesired matters, and the second is enhancing the levels of desired healthier substances (Serrano et al. 2007 and Decker & Park, 2010). Plants and derivatives are important sources for many bioactive substances such as minerals, vitamins, and natural antioxidants (flavonoids, polyphenols, tocopherols, terpenoids, tannins,... etc). And the use of these derivatives as a natural antimicrobials, antioxidants and animal fat replacers in some meat products may improve quality of these products and can enhance healthier meat products. (Hygreeva et al., 2014).

Lipid oxidation and oxidative reactions of protein responsible for low texture and flavors off-odors in products of meat lead to breakdown of these products (Lund et al. 2011 and Utrera et al., 2012). On the other hand, fresh products of meat are also oversensitive to microbial spoilage due to their high nutrients and moisture (Casaburi et al. 2015 and Van Haute et al., 2016).

In recent years, consumer interests to the utilization of natural antimicrobials and antioxidants in processing foods to preserve it as additive compounds from natural sources have been increased. In this study pomegranate peels can be seen as a raw material and natural antioxidants. This study was conducted to investigate pomegranate peels additive as antimicrobial effectiveness against bacteria, yeasts and molds and natural antioxidant to extend shelf life of chicken burger.

Materials and Methods

Materials

Chemicals were purchased from Sigma-

Aldrich Company. Pomegranate peels and chicken burger ingredients (Chicken, pepper, onion, rusk, carrot and salt) were obtained from local markets in Egypt.

Preparation of chicken burger

Fresh chicken burger was prepared according to formula described by Mohamed et al. (2014) with replacement of the chicken meat by 10, 20 and 30 % (w/w) pomegranate peels then chicken burger samples were stored in cold refrigerator at $4 \pm 1^\circ\text{C}$. Sensory, chemical and microbial evaluation of chicken burger samples under investigation were examined every two days during storage at refrigerator temperature ($4 \pm 1^\circ\text{C}$).

Sensory evaluation

Sensory attributes, e.g. appearance, odor, texture and taste for chicken burger samples under investigation, was examined every two days during storage at refrigerator temperature ($4 \pm 1^\circ\text{C}$) as the method described by Mohamed et al. (2014).

Methods

Gross chemical composition

Moisture, lipid, protein, crude fiber and ash contents were examined according to official method (AOAC 2000). Total carbohydrates were calculated according to the work published by Egan et al. (1981) as follows :

Total carbohydrates % = $100 - (\text{moisture \%} + \text{crude protein \%} + \text{total lipids \%} + \text{ash \%} + \text{crude fibers \%})$.

Determination of flavonoids and phenolic Compounds

Flavonoids and phenolic compounds were determined by HPLC according to the method of Mattila et al. (2000) and Goupy et al. (1999), respectively.

Measurement of lipid peroxidation of chicken burger samples

Acid, peroxide values of chicken burger samples were determined according to the methods described by the AOAC (2000), while thiobarbituric acid (T.B.A.) value examined according to Zhang et al., (2019).

Microbial determination

Total bacterial count was counted according to the methods published by APHA (1992). Psychrophilic and spore-forming and bacteria counts were determined according to FDA (2002). Total molds and yeasts were counted according to Oxoid (1998).

Statistical analysis

Statistical analysis was calculated as described by Bezerra et al. (2008).

Results and Discussion*Flavonoids content of pomegranate peels extract*

Table 1 shows the flavonoids content of pomegranate peels extract. It could be noticed that quercetrin was the predominant flavonoid compound (876.59 ppm) in pomegranate peel extract, followed by hisperidin (282.47 ppm) while apegnin was the latest (11.04ppm). These data confirmed with those published by Romeo et al. (2015) and Gullon et al. (2016).

TABLE 1. Flavonoids content of pomegranate peels extract.

Flavonoids	Pomegranate peels extract (ppm)
Luteolin	42.41
Narengin	76.70
Rutin	181.03
Hisperidin	282.47
Rosmarinic	39.37
Quercetrin	876.59
Quercetin	56.35
Hispertin	238.07
Kampferol	99.55
Apegnin	11.04

TABLE 2. Phenolic content of pomegranate peels extract.

Phenolic compounds	Pomegranate peels extract (ppm)
Gallic	164.09
Pyrogallol	738.87
4-Amino-benzoic	105.37
3-OH-Tyrosol	946.98
Protocatchuic	546.83
Chlorogenic	130.65
Catechein	885.73
Catechol	187.70
Caffeine	198.14
P-OH-benzoic	274.55
Caffeic	423.53
Vanillic	287.08
p-coumaric	98.27
Ferulic	205.51
Iso-ferulic	36.83
Reversetrol	21.01
Ellagic	55.10
Alpha-coumaric	220.65
3,4,5-methoxy-cinnamic	97.49
Coumarin	56.58
Salycillic	498.16
Cinnamic	46.99

Phenolic compounds of pomegranate peel extract

Table 2 illustrates the phenolic compounds of pomegranate peels extract. It can be noticed that 3-OH-Tyrosol is the highest value of phenolic compounds (946.98 ppm) in pomegranate peel extract followed by catechein (885.73ppm). These data are compatible with the results showed by Alexandre et al. (2018) and Kharchoufi et al., (2018).

Proximate composition of chicken burger samples

Table 3 represents the proximate composition of chicken burger prepared from control and formulas with pomegranate peels additives. The moisture, lipids, protein, ash, fiber and total carbohydrates contents of control chicken burger sample were 64.22, 15.30, 34.24, 9.82, 1.90 and 38.74 % on dry basis, respectively. The results agree with the work published by Mikhail et al. (2014). Table 3 revealed that the changes took place in the proximate composition of chicken burger samples prepared with pomegranate peel additive, and the highest moisture, total lipids, crude protein and ash content were found in the control sample. However, the lowest one was found in chicken burger sample prepared with pomegranate peel additive (30%) which contained the highest crude fiber (3.90%) and carbohydrates (55.67%), respectively. These changes may be due to the proximate composition of pomegranate peels powder.

TABLE 3. Proximate composition of chicken burger samples.

Chemical composition (%)	Chicken burger samples			
	Control	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels
Moisture	64.22±0.42	63.20±0.20	61.23±1.20	59.50±0.50
Total lipids*	15.30±0.84	13.82±0.94	11.81±0.03	9.50±0.45
Crud protein*	34.24±0.25	32.04±1.00	29.58±0.63	22.57±0.83
Ash*	9.82±0.32	8.84±0.60	8.67±0.37	8.36±0.19
Crude fiber*	1.90±0.10	2.60±0.10	3.03±0.15	3.90±0.10
Total carbohydrates*	38.74	42.70	46.91	55.67

*% on dry weight basis.

Sensory evaluation of chicken burger during cold storage

Table 4 (a-d) showed the sensory properties of chicken burger as affected by pomegranate peel additives during cold storage (4±1°C). At the beginning of cold storage (*i.e.* zero time), no significant ($P>0.05$) difference was found between the chicken burger samples under investigation. A significant ($P>0.05$) difference was noticed in all treatments after two days. It could be noticed the sensory attributes (appearance, odor, texture and taste) of chicken burger samples prepared with 10, 20 and 30% pomegranate peels were rejected after 8, 10 and 10 days of cold storage, respectively, compared to the control samples which were rejected on the 6th day of cold storage. Hence, chicken burger samples prepared with 20 and 30% pomegranate peel scored the best treatment, compared to the other samples. This may be due to the effects of flavonoids and phenolic compounds as natural antioxidants of pomegranate peel, which may improve the appearance, odor, texture and taste via retardation the growth of microbial load (Kharchoufi et al., 2018).

Lipid peroxidation of chicken burger samples

Oxidation of chicken meat lipids responsible for the deterioration of texture, flavor and color of chicken meat products leads to the formation of potentially toxic compounds and retard their nutritional value.

Acid value

Table 5 shows the initial acid values of lipids extracted from chicken burger samples as affected with pomegranate peels during cold storage (4 ± 1°C). It can be observed that acid values of chicken burger samples increased with increasing the cold storage period, this increase may be due to the autoxidation of lipids and liberation of free fatty acids. In addition, it can be noticed that addition of pomegranate peels to formula of chicken burger

during its preparation reduced the acid values of their lipids during cold storage (4±1°C). These results are probably attributed to the presence of natural antioxidants in the pomegranate peel included chicken burger formulas, which in turn prevents lipid oxidation process.

Peroxide value

The effects of pomegranate peels on peroxide values of lipids extracted from chicken burger samples during cold storage (4±1°C) are presented in Table 6. The results indicated that the peroxide value of control chicken burger samples increased from 5.651 in the initial storage to 8.902 in the fourth day of storage. Moreover, peroxide values of all chicken burger samples under investigation gradually increased during cold storage period. These data confirmed with the results showed by Estévez and Lorenzo (2019), reported that natural antioxidants inhibit oxidative reactions in the meat products. Table 6 also exhibited that addition of pomegranate peels to formulas of chicken burger brought about reduction in peroxide values of chicken burger samples compared with the control sample and the highest reduction was observed in the samples of chicken burger with additive 30 % of pomegranate peels followed by 20%. This reduction in peroxide values may be attributed to the effects of flavonoids and phenolic compounds in pomegranate peels as well as natural antioxidant ingredient. These results agree with those published by Estévez and Lorenzo (2019), reported that natural antioxidant contains a high percentage of polyphenols, which are potent and antioxidant agents to prolong the shelf life of food products via a) retard the formation of toxic oxidation-related compounds, b) maintain nutritional quality, and c) prevent or minimize oxidation.

TABLE (4-a). Changes in the appearance of chicken burger as affected by pomegranate peels during cold storage (4±1°C).

Changes in the appearance of chicken burger samples					
Storage (Days)	Control chicken burger	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels	L.S.D* _{0.05}
Zero time	9.39 ^a ± 0.32	8.92 ^b ± 0.34	8.32 ^c ± 0.44	7.75 ^d ± 0.53	0.38
2	9.35 ^a ± 0.28	8.87 ^b ± 0.33	8.17 ^c ± 0.50	7.53 ^d ± 0.40	0.35
4	8.56 ^a ± 0.73	8.47 ^a ± 0.48	7.73 ^b ± 0.67	7.28 ^b ± 0.38	0.53
6	®	7.61 ^a ± 0.53	7.05 ^b ± 0.13	6.80 ^c ± 0.42	0.36
8		®	6.5 ^a ± 0.53	5.76 ^b ± 0.36	0.43
10			®	®	

Means ± SD

®: At these points samples were rejected.

*: Least significant differences.

TABLE (4-b). Changes in the odor of chicken burger as affected by pomegranate peels during cold storage (4±1°C).

Changes in the odor of chicken burger samples					
Storage (Days)	Control chicken burger	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels	L.S.D* _{0.05}
Zero time	9.38 ^a ± 0.33	8.89 ^b ± 0.25	8.36 ^c ± 0.49	7.63 ^d ± 0.37	0.33
2	9.35 ^a ± 0.28	8.87 ^b ± 0.33	8.17 ^c ± 0.50	7.53 ^d ± 0.40	0.35
4	8.45 ^a ± 0.60	8.27 ^a ± 0.41	7.61 ^b ± 0.59	7.11 ^d ± 0.41	0.45
6	®	7.30 ^a ± 0.45	6.86 ^b ± 0.34	6.50 ^b ± 0.53	0.41
8		®	6.30 ^a ± 0.45	5.56 ^b ± 0.45	0.44
10			®	®	

Means ± SD

®: At these points samples were rejected.

*: Least significant differences.

TABLE (4-c). Changes in the texture of chicken burger as affected by pomegranate peels during cold storage (4±1°C).

Changes in the texture of chicken burger samples					
Storage (Days)	Control chicken burger	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels	L.S.D* _{0.05}
Zero time	9.52 ^a ± 0.22	9.03 ^b ± 0.09	8.47 ^c ± 0.52	7.63 ^d ± 0.37	0.31
2	9.39 ^a ± 0.27	8.97 ^b ± 0.40	8.30 ^c ± 0.61	7.53 ^d ± 0.40	0.42
4	8.65 ^a ± 0.58	8.47 ^a ± 0.48	7.86 ^b ± 0.55	7.11 ^d ± 0.41	0.53
6	®	7.50 ^a ± 0.49	7.16 ^a ± 0.47	6.50 ^b ± 0.53	0.46
8		®	6.30 ^a ± 0.48	5.56 ^b ± 0.45	0.44
10			®	®	

Means ± SD

®: At these points samples were rejected.

*: Least significant differences.

TABLE (4-d). Changes in the taste of chicken burger as affected by pomegranate peels during cold storage (4±1°C).

Changes in the taste of chicken burger samples					
Storage (Days)	Control chicken burger	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels	L.S.D* _{0.05}
Zero time	9.20 ^a ± 0.32	9.03 ^b ± 0.09	7.98 ^c ± 0.66	7.46 ^d ± 0.43	0.44
2	9.20 ^a ± 0.30	8.97 ^a ± 0.40	7.91 ^b ± 0.66	7.36 ^c ± 0.46	0.45
4	8.25 ^a ± 0.54	8.47 ^a ± 0.48	7.41 ^b ± 0.59	6.91 ^c ± 0.32	0.45
6	®	7.50 ^a ± 0.49	6.66 ^b ± 0.48	6.30 ^c ± 0.48	0.39
8		®	6.10 ^a ± 0.32	5.40 ^b ± 0.46	0.37
10			®	®	

Means ± SD

®: At these points samples were rejected.

*: Least significant differences.

TABLE 5. Acid value of lipids extracted from chicken burger samples as affected by pomegranate peels during cold storage (4±1°C).

Storage (Days)	Acid values of chicken burger samples			
	Control	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels
Zero time	0.451	0.442	0.446	0.437
2	0.599	0.465	0.451	0.449
4	0.701	0.578	0.599	0.545
6	®	0.679	0.654	0.600
8		®	0.689	0.660
10			®	®

®: At these points samples were rejected.

TABLE 6. Peroxide value of lipids extracted from chicken burger samples as affected by pomegranate peels during cold storage (4±1°C).

Storage (Days)	Peroxide value of chicken burger samples			
	Control	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels
Zero time	5.651	5.492	5.489	5.477
2	6.989	6.405	6.431	6.049
4	8.902	7.471	7.990	7.345
6	®	8.989	8.654	8.100
8		®	9.766	9.261
10			®	®

®: At these points samples were rejected.

Thiobarbituric acid

The effects of pomegranate peels on TBA values of lipids extracted from chicken burger samples with an optical density at 532 nm during cold storage at 4±1°C are showed in Table 7. The data presented that TBA value of control chicken burger samples increased from 0.018 in the initial storage to 0.081 in the fourth day of storage. Moreover, TBA values of all chicken burger samples under investigation increased gradually during cold storage period. Additionally, addition of pomegranate peel to formulas of chicken burger resulted in a reduction in TBA values of chicken burger samples compared with control sample, and the highest reduction was observed in the samples of chicken burger with 30 % pomegranate peel additive. The reduction in TBA values may be attributed to the effects of flavonoids and phenolic substances in pomegranate peels as well as natural antioxidant ingredient. These results are compatible with several authors: Devatkal et al. (2010) and Andrés et al. 2017. They reported that pomegranate juice, seed and peel extracts

reduced the TBARS values and lipid oxidation in goat patties and chicken breast meat as compared to control samples as a result of the antioxidant agents.

Microbial evaluation

Bacterial aspects of chicken burger and the effects of pomegranate peels during storage at 4±1°C were enumerated and presented in Table 8. The initial counts of total bacterial, psychrophilic bacteria, spore forming bacteria, total molds and yeasts of control chicken burger were high counts (9.7×10^3 , 2.5×10^2 , 6.5×10^2 and 8.1×10^2 cfu/g, respectively) while addition of pomegranate peel (10, 20 and 30 %) to chicken burger formulas lowered the counts of microbial load. In addition, the best treatments to retardation the microbial load were noticed in chicken burger samples which were prepared using 20 and 30 % pomegranate peel additive followed by that prepared by using 10% pomegranate peel additive. Furthermore, the addition of pomegranate peel extended shelf-life of chicken burger to 8 and 10 days, respectively

compare with 6 days for the control sample. These data confirmed by those reported with Endo et al., 2010, Hayrapetyan et al., 2012, Quattrucci et al., 2013, Finegold et al., 2014, Molva and Baysal, 2015, Juneja et al., 2016, who reported that pomegranate peel proved its effectiveness against many fungi and bacteria such as *Candida albicans*, *Listeria monocytogenes*, *Pseudomonas syringaepv. Tomato*, *Clostridium difficile* and

Alicyclobacillusacidoterrestris, respectively. It could be concluded that the activities of antioxidant and antimicrobial substances for pomegranate peels which extended shelf-life of chicken burger might be due to the presence of flavonoids such as quercetrin, hispertin, hisperidin and rutin (Romeo et al. 2015 and Gullon et al., 2016) and phenols compounds such as punicalagin, ellagic acid and pedunculagin (Gil et al., 2000 and Kharchoufi et al., 2018).

TABLE 7. Thiobarbituric acid value of lipids extracted from chicken burger samples as affected by pomegranate peels during cold storage (4±1° C).

Storage (Days)	Thiobarbituric acid value of chicken burger samples			
	Control	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels
Zero time	0.018	0.019	0.015	0.017
2	0.066	0.039	0.027	0.022
4	0.081	0.070	0.056	0.041
6	®	0.089	0.075	0.050
8		®	0.079	0.067
10			®	®

®: At these point samples were rejected.

TABLE 8. Microbial load of chicken burger samples as affected by pomegranate peels during cold storage (4±1°C).

Microbiological parameters	Storage (Days)	Microbial counts of chicken burger samples (Cfu/g)			
		Control	Chicken burger with 10% pomegranate peels	Chicken burger with 20% pomegranate peels	Chicken burger with 30% pomegranate peels
Total bacterial count	Zero time	5.7×10 ³	4.8×10 ³	3.2×10 ³	2.4×10 ³
	2	6.5×10 ³	3.9×10 ³	3.1×10 ³	2.9×10 ³
	4	9.2×10 ³	8.8×10 ³	7.9×10 ³	6.4×10 ³
	6	®	9.8×10 ³	8.7×10 ³	7.3×10 ³
	8		®	9.7×10 ³	9.1×10 ³
	10			®	®
Psychrophilic bacteria	Zero time	2.5×10 ²	2.0×10 ²	1.5×10 ²	0.4×10 ²
	2	4.6×10 ²	3.7×10 ²	2.8×10 ²	1.5×10 ²
	4	6.8×10 ²	5.0×10 ²	4.5×10 ²	2.9×10 ²
	6	®	7.1×10 ²	6.0×10 ²	5.0×10 ²
	8		®	8.0×10 ²	8.3×10 ²
	10			®	®
Spore-forming bacteria	Zero time	6.5×10 ²	5.0×10 ²	4.2×10 ²	2.3×10 ²
	2	9.0×10 ²	7.2×10 ²	5.3×10 ²	3.1×10 ²
	4	9.9×10 ²	8.8×10 ²	7.8×10 ²	5.2×10 ²
	6	®	9.7×10 ²	8.6×10 ²	5.9×10 ²
	8		®	9.3×10 ²	8.3×10 ²
	10			®	®
Total molds & yeasts	Zero time	8.1×10 ²	7.0×10 ²	6.5×10 ²	4.9×10 ²
	2	8.9×10 ²	7.7×10 ²	6.9×10 ²	6.0×10 ²
	4	9.7×10 ²	9.0×10 ²	8.8×10 ²	7.9×10 ²
	6	®	9.9×10 ²	9.6×10 ²	9.0×10 ²
	8		®	9.8×10 ²	9.9×10 ²
	10			®	®

®: At these point samples were rejected.

Conclusions

Pomegranate peels additives have a high source of various substances such as flavonoids and phenolic compounds, which are represented by their high antimicrobial and antioxidant activities. The results revealed that quercetin compound is the predominant flavonoid compound followed by hesperidin and epigallocatechin gallate in pomegranate peel extract, while 3-OH-Tyrosol has the highest concentration of phenolic compounds of pomegranate peel extract followed by catechin. Chicken burger samples prepared from 0, 10, 20 and 30 % of pomegranate peel additive. The results also indicated that a significant ($P > 0.05$) difference was observed in all treatments after two days and sensory attributes (appearance, odor, texture and taste) of chicken burger samples prepared with 10, 20 and 30% pomegranate peels rejected on days 8, 10 and 10 of cold storage, respectively, compared to control samples which rejected on the 6th day of cold storage. Hence, chicken burger samples prepared with 20 and 30% pomegranate peel were scored as the best samples, comparing to the others. The results also suggested that pomegranate peels have bioactive compounds which caused extending the shelf-life of chicken burger, hence improving its quality.

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استخدام قشور الرمان لزيادة فترة الصلاحية لبرجر الدجاج أثناء التخزين بالتبريد

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اجريت هذه الدراسة لاستخدام قشور الرمان لتقليل الحمولة الميكروبية وزيادة فترة الصلاحية لبرجر الدجاج أثناء التخزين بالتبريد (٢-١٠ أيام) على درجة حرارة (4 ± 1 م). وتم دراسة بعض الخواص الكيميائية للدهون المستخلصة من عينات برجر الدجاج المجهز بإضافة قشور الرمان بنسبة ١٠ % ، ٢٠ % ، ٣٠ % (وزن/وزن). وتم تقييم بعض الاختبارات الحسية (المظهر والرائحة والقوام والطعم) لبرجر الفراه أثناء فترة التخزين بالتبريد. وتم تقدير المركبات الفينولية والفلافونويدات بجهاز التحليل الكروماتوجرافى على الكفاءة وعلى طول موجى ٣٣٠ ، ٢٨٠ نانومتر على الترتيب، وتم تقدير العد الكلى للبكتريا وأعداد البكتريا المحبة للبرودة والمتجرثمة والفطريات والخمائر لعينات برجر الدجاج أثناء التخزين بالتبريد. وقد أظهرت النتائج ان إضافة قشور الرمان إلى عينات برجر الدجاج أثناء تجهيزها أدى إلى تقليل رقم الحموضة ورقم البيروكسيد و رقم حمض الثيوباربيوتريك و كذلك خفض نمو أعداد البكتريا المحبة للبرودة والمتجرثمة والفطريات والخمائر لعينات برجر الدجاج أثناء التخزين بالتبريد وبالتالي تحسين اللون والقوام والطعم والمظهر لها لمدة ٨ أيام. من ذلك يمكن أن نستنتج أن قشور الرمان والتي تعتبر بدورها مضادات أكسدة ومضادات ميكروبية طبيعية يمكن استخدامها كإضافات غذائية لزيادة الأمان الصحى لمنتجات الدجاج.