PARTIAL REPLACEMENT OF THE MEAT IN BEEFBURGERS BY CHAMOMILE WASTES POWDER AFTER HARVESTING AS A RICH SOURCE OF DIETARY FIBER AND ANTIOXIDANTS

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(Manuscript received 12 January 2014)

Abstract

In global direction to "zero-waste", herbal wastes such as chamomile which is a source of dietary fiber and antioxidants may be used in food products as in meat processing sector. Chemical composition and antioxidant contents in chamomile stems powder were determined, then sensorial evaluation of different formula of beefburgers with replacement 2.5, 5.0, 7.5 and 10% meat with chamomile stems powder. Results showed chamomile stems powder was high in crude oil and dietary fiber (6.39 and 24.50 %, respectively). Antioxidant activity in chamomile was higher than vitamin C (88.18 and 38.24%, respectively). These results are attribute to the synergism of antioxidant contents in chamomile as total phenols, flavonoids and carotenoids (3.50, 1.50 and 0.57 mg/g, respectively) and also for the present volatile oil chamomile (0.10%). Water holding capacity as a one of the quality parameters was increased gradually by increasing the percentage of chamomile in beefburger formulas. But, oil absorption and cooking loss were decreased parallel to the increase of the chamomile wastes contents in different formulas. Formulas which contained 5.0 and 7.5% chamomile stems powder were the best of sensorial evaluation parameters. The tested hamburger was subjected to the total bacterial count (TBC), *Salmonella* sp. and Coliform group counts of before and after cooking at three months frozen storage (-18°C), results showed the decrement of TBC content gradually by increasing of chamomile percentage of different beefburger formulas before and after frying, also salmonella sp. and Coliform group were not detected in the same condition. These results are due to the content of antioxidants in formulas which may prevent growth of microorganisms during frozen storage 3 months. Conclusively, herbs and spices wastes can be recycled and used as thickening and antimicrobial agents in food processing and raising the level of the added value of the product.

INTRODUCTION

Chamomile (*Chamomilla recutita* [L.] Rauschert) belongs to the *Compositae* family and grows in Europe, North East Asia, North and South America. Some countries that produce chamomile for the international market are: Argentina, Egypt, Bulgaria, Hungary, Spain, Czech Republic, Germany, Brazil, Chile and Peru (Povh *et al.*, 2001). Its flowers are popularly used to prepare tea due to its sedative effects. In addition, chamomile extracts are widely used in the cosmetology industry to impart flavor to a number of personal care products (Rahimi *et al.*, 2011).

The flowering tops of the chamomile plant are used to make teas, liquid extracts, capsules, or tablets. The herb can also be applied to the skin as a cream or an ointment, or used as a mouth rinse (Lippincott and Wilkins, 2000) . Also, Chamomile (*Matricaria chamomilla*) flower heads and extracts are used in the pharmaceutical and especially in the cosmetic industry for their antispasmodic, anti-inflammatory and antimicrobial properties (Scalia *et al.,* 1999).

Havkin-Frenkel *et al.,* (2011) reviewed to highlight the specific fraction that contributes to the antioxidant activity in herbs and to describe appropriate techniques for preserving the active and beneficial compounds in herbal wastes.

New food products are prepared to satisfy costumer's demands concerning taste, appearance, value and comfort. Beefburgers are reasonably priced, highly consumed food products, which have great acceptability in many regions around the world. Despite being considered as a high caloric value food, beef burgers can be produced with good quality raw materials and can be enriched with some ingredients that could offer some functional properties (Livia *et al.*, 2011). Water holding capacity is one of the most important qualitative characteristics of meat, it can affect the appearance of the product, its behavior on cooking and its juicy sensation on chewing (Woelfel *et al.*, 2002). On the other hand, Jama *et al.*, (2008) reported that the decrease in cooking loss as ageing increased was as expected since enzymatic reactions by endogenous enzymes, such as collagenase which are produced by bacteria within beef or by ionic solubilisation, progresses at faster rates as ageing increases. The collagenase enzymes disintegrate the myofibrillar proteins and connective tissue thereby improving water holding capacity by proteins.

Therefore, the main purpose of this work was to prepare beefburgers with partial substitution of the meat with chamomile stem remains, left over after harvesting. Sensory analyses were performed and the determination of some quality characteristics of this product was evaluated. Also, studying bacterial count, *Salmonella sp.* and Coliform group before and after frying was in the scope of this work.

MATERIALS AND METHODS

Materials:

Ground beef muscle meat (16% fat) was obtained from local market. Also, chamomile wastes were obtained from herbs and Spices Company in obour City, Egypt. Chamomile wastes was crushed then pass through sieve (100 mesh size) and was used particles under this sieve.

Chemical analyses:

The chemical analyses of chamomile wastes powder such as, moisture, ash, crude oil, crude fiber and crude protein were determined according the procedures

described in AOAC, (1995). While, hydrolyzable carbohydrates were calculated by Difference.

Total phenols were determined colorimetrically as described by Daniel and George (1957). The content of flavonoids was determined by a Pharmacopeia method (1989). Total chlorophyll and carotenoids were extracted from dehydrated chamomile stems according to the methods of Fedtke (1973), the optical density of the diluted supernatant was determined by using spectrophotometer (Jenway 6050) at 662nm, 644nm and 440nm. The concentration of total chlorophyll and carotenoids were calculated by means of Wettstian's formula (Wettstian, 1957). Also, β-Carotene was determined according to the method of Nagata and Yamashita (1992). While, essential oil was determined according to ISO Method 6571 (2009).

The DPPH free radical scavenging activity was determined by the method of Yang *et al.*, (2008) with some modifications. Each sample, at a different concentration in ethanol (2 ml) was mixed with 2 ml of ethanolic solution containing 1 mM DPPH. The mixture was shaken vigorously, then left to stand for 30 min in the dark. The absorbance was measured at 517 nm. The absorbance of the control was obtained by replacing the sample with ethanol. DPPH radical scavenging activity of the sample was calculated as follows:

DPPH radical scavenging activity (%): [1 - absorbance of sample/absorbance of control] X 100. TBHQ and vitamin C were used for positive controls.

Preparation of beefburger formulas

In order to prepare the beefburgers, ground beef muscle meat, powder from chamomile wastes, and a commercial mix composed of refined salt, onion, garlic and seasons were used. Five types of formulations were prepared in which the meat replacement percentage varied from 2.5, 5.0, 7.5, 10.0% and 0.0% (control) with equal level of chamomile waste powder.

Table 1. Beefburgers Formulas contained different chamomile waste percentages (2.5, 5.0, 7.5 and 10% of original beef level, respectively)

Mixture	Control	Chamomile residue percentages			
		2.5%	5%	7.5%	10%
Beef meat	250	243.75	237.50	231.25	225.0
Chamomile powder	0.0	6.25	12.50	18.75	25.0
Minced onion	25.0	25.0	25.0	25.0	25.0
Minced Garlic	2.5	2.5	2.5	2.5	2.5
Corn Starch	20.0	20.0	20.0	20.0	20.0
Seasons*	2.5	2.5	2.5	2.5	2.5
Salt	5.0	5.0	5.0	5.0	5.0

*Seasons (nutmeg 4g : cardamom 12g: carnation 12g : 72g black pepper)

The raw materials and ingredients were mixed for 10 minutes. The beef burgers weighing at least 60 g were shaped in comprised beefburger, a burger shaping hand device, packed in plastic bags and stored in a freezer at –18°C.

Physical parameters of beefburgers

Cooking loss: Water holding capacity was calculated as the percent weight reduction of the cooked sample compared with the raw sample. The method reported by Jama *et al.* (2008).

Cooking loss=

[(weight of raw sample – weight of cooked sample) / weight of raw sample] × 100.

Water-holding Capacity (WHC): Water holding capacity (WHC) was measured using the method of El-Seesy (2000) as follows: Minced meat burger sample 0.3 g was placed on an ashless filter paper Whatman, No. 41 and placed between two glass plates, and pressed for 10 minutes by one kg weight, two zones were found on the filter paper, their surface areas were measured by a planimeter. The outer zone resulted from the water separated from the pressed tissues thus indicating the water holding capacity.

Oil absorption: Oil absorption was measured according to Nurul *et al.,* (2009) as suggested by Mohamed *et al.,* (1989). Beefburgers were weighed before and after frying in hot oil. Then, the beef burgers were ground and dried overnight in an oven at 105°C. The percentage of oil absorption was calculated as follows:

$$\text{Oil absorption \%} = \frac{\text{Dried sample weight after frying} - \text{Dried sample weight before frying}}{\text{Dried sample weight before frying}} \times 100$$

Longitudinal and accidental shrinkage ratios were determined according to Kong *et al.*, (2008) as the percent reduction in the cooked sample length along and across the muscle fiber, respectively, compared with the raw sample. Maximum lengths of the raw and cooked samples radial and the shrinkage ratios calculated as follows:

$$\text{Accidental shrinkage ratio} = \frac{X1 - X2}{X2} \times 100$$

$$\text{Longitudinal shrinkage ratio} = \frac{Y1 - Y2}{Y2} \times 100$$

Where X1 and X2 were the diameters (cm) of the raw and cooked sample disks across the muscle fibers, respectively, and Y1 and Y2 were the diameters (cm) of the raw and cooked sample disks along the muscle fibers, respectively.

Sensorial evaluation of beefburger formulas:

Burgers were assessed (before and after frying) for a number of sensory characteristics by ten members of the Department's staff, selected on the basis of interest and experience in sensory for evaluation and availability. Panelists were instructed to evaluate colour, texture, taste, flavour and overall acceptability using 10 point scale for grading the quality of samples (Crehan *et al.,* 2000).

Statistical analysis:

Data of sensorial evaluation was subjected to analysis of variance (ANOVA) followed by Duncan's multiple range tests carried out using SPSS computer program (SPSS, 1999).

Microbiological evaluation of beef burger formulas:

Total bacterial count (T.B.C.) and detection of Coliform groups were carried out according to APHA (1971). Whereas, detection of *Salmonella* spp. was according to ISO 6579 (2002).

RESULTS AND DISCUSSION

Table 2. Percentage of chemical analysis in chamomile stems wastes on dry weight basis

Items	%
Moisture	3.21
Crude protein	1.43
Ash	12.40
Crude oil	6.39
Total Dietary fiber	24.50
Mucilage	1.15
Total hydrolysable Carbohydrate	76.57

Results in table (2) indicated that the chamomile stems after harvesting was rich in dietary fiber (24.50%) and minerals (12.40%) followed by crude oil content (6.39%). Mucilage in chamomile stems residue (1.15%) as a soluble dietary fiber has several health benefits as hypolipidiemia and antidiabetic agents (Krishnaiah *et al.,* 2007), also have industrial functions in food products as a binding agent (Sanchez-Alonso *et al.*, 2007).

Table 3. Antioxidant contents of chamomile stems wastes powder (mg/g on dry weight)

Components	mg/g
Total phenols	3.50
Total flavonoids	1.50
Total chlorophyll	0.21
Carotenoids	0.57
β-carotene	0.066
Volatile oil (%)	0.10
DPPH activity*	88.18

*DPPH activity vitamin C 38.24% TBHQ 93.50%

Antioxidant activity in chamomile (Table 3) was higher than vitamin C (88.18 and 38.24%, respectively), while was lower than the synthetic antioxidant (TBHQ, 93.50%). These results attribute to the synergism of antioxidant contents in chamomile as phenol, flavonoids and carotenoids (3.50, 1.50 and 0.57 mg/g, respectively) also the content of volatile oil (0.1%).

Table 4. Water holding capacity (WHC), oil absorption (OA) and cooking loss in different beefburger formulas

Formulas	WHC before frying	OA after frying	Cooking loss
Control	1.82	15.18	22.40
Formula 1 (2.5%)	2.37	12.90	18.17
Formula 2 (5.0%)	2.50	10.89	15.10
Formula 3 (7.5%)	2.90	8.02	13.23
Formula 4 (10%)	4.36	7.4	12.03

Water holding capacity was increased gradually by the percentage increase of chamomile in beefburger formulas. But, oil absorption and cooking loss showed parallel decrements by the increase of chamomile left over contents in different formulas (Table 4), these results are agreement with that of Drummond and Sun (2005), they reported that the cooking loss refers to the reduction in weight of beefburger during the cooking process.

Fiber has been used in cooked meat products to increase water and fat-binding properties and to improve texture. Sanchez-Alonso *et al.,* (2007) indicated that the addition of fiber either 3 or 6% to minced hake and horse mackerel muscle increased water holding capacity and water binding capacity.

Table 5. Diameter and thickness before and after frying beefburgers formulas contained to chamomile stems wastes powder

Formula	Longitudinal (cm)			Accidental (cm)			Thickness (cm)		
	Before	After	shrinkage ratio	Before	After	Shrinkage ratio	Before	after	Increase %
Control	7.44	6.80	8.60	8.20	7.40	9.76	0.78	0.88	12.82
Formula 1 (2.5%)	7.98	6.98	12.53	7.54	7.50	0.53	0.75	0.88	17.33
Formula 2 (5.0%)	8.30	7.00	15.66	7.98	7.55	5.39	0.75	0.88	17.33
Formula 3 (7.5%)	8.88	7.38	16.89	7.98	6.88	13.78	0.68	0.87	27.94
Formula 4 (10%)	9.54	7.10	25.58	9.40	7.65	18.61	0.66	0.87	31.82

Data in table (5) showed that before and after frying the diameter was increased by increment of chamomile percentage before frying, but thickness was decrease gradually in different formulas. Due to frying, however, diameter decreased, while thickness increased. On the other hand, Kong *et al.* (2008) reported that the change in macromere length resulted in longitudinal shrinkage, whereas that in fiber diameter was more related to transverse shrinkage. The simultaneous occurrence of the increase in fiber diameter and transverse shrinkage for both chicken and salmon indicates that the shrinkage of collagen, particularly perimysium, might be the main reason for the transverse shrinkage.

Results in table (6) show the sensory evaluation scores of the beef burgers samples by panel test. The tested chamomile stems wastes powder was submitted to a series of qualitative measures (including elements such as overall acceptability, texture, odor, color and taste). It appears, there for that the taste in formula 1, 2 and 3 were the best compared with control and formula 4. While, the color decreased due to frying. On the other view, odor and texture in formula 3 and 4 before and after frying were the best. Generally, overall acceptability in formula 2 and 3 before and after frying were better than formula 1, 4 and control. From the results in table (6), it could be noticed that fried beefburgers samples with 5% and 7.5% showed the appreciably highest significantly scores in texture. The texture of meat and meat products is one of the most important characteristics that affect consumer acceptability, also taste followed the increase of overall-acceptability scores.

Microbiological assay of the manufactured beefburger

The inhibition of microbial growth and prevention of pathogenic microorganisms present are important factors in meat preservation. Total bacterial count (TBC) has been used to assess sanitary quality, safety and organoleptic ability (Fliss *et al.*, 1991). The tested beefburger was subjected to the total bacterial (TBC), *Salmonella sp.* and Coliform group counts of before and after cooking at zero time storage, and the obtained results are shown in table (7). The data revealed that the total bacterial count (TBC) in beef burgers prepared with 10% chamomile wastes powder, followed by formula (7.5%), formula (5%) then formula (2.5%) were significantly lower than that found in control. These findings are concurrent and confirmed with that found by Szoke *et al.*, (2004) who reported that, chamomile has been used for preserving food as antimicrobial. Chemical constituents' agent of chamomile wastes powder included to total phenols, flavoniods and carotenoids groups, which are known as therapeutically and food preservative active compounds.

Table 6. Sensorial evaluation for beefburger formulas contained chamomile wastes powder before and after frying

Formulas	Taste		Color		Odor		Texture		Overall acceptability	
	Before	After	Before	After	Before	After	Before	After	Before	After
Control		8.00±0.82	7.25± 1.12	8.00±0.71	6.75±0.43	7.38±0.42	7.75±1.02	7.50±0.87	7.75±1.09	7.50±0.87
Formula 1 (2.5%)		8.33±0.47	7.00±0.71	7.63±0.42	7.63±0.41	7.50±0.87	8.25±1.02	8.02±1.00	7.75±0.42	7.50±0.87
Formula 2 (5.0%)		8.33±0.94	8.00±0.00	7.75±0.83	7.75±0.43	7.65±1.09	8.25±0.43	8.00±0.71	8.00±0.71	8.25±1.09
Formula 3 (7.5%)		8.50±0.41	8.50±0.50	7.75±0.42	7.87±0.55	7.67±0.59	8.38±0.40	8.25±0.43	8.38±0.42	8.98±0.71
Formula 4 (10%)		7.33±0.94	7.68 ±0.74	7.38±0.42	8.00±0.71	7.86±0.71	8.50±1.12	8.50±0.50	7.13±0.74	7.62±0.40

Table 7. Microbiological evaluation for beefburger formulas contained chamomile stems wastes powder at zero time

Formulas	Before frying			After frying		
	Total bacterial counts (cfu/g)	Salmonella (cfu/25g)	Coliform group (cfu/g)	Total bacterial counts (cfu/g)	Salmonella (cfu/25g)	Coliform group (cfu/g)
Control	$69x\ 10^3$	ND	ND	$2x10^3$	ND	ND
Formula (2.5%)	$4x10^3$	ND	ND	$9x10^2$	ND	ND
Formula (5.0%)	$6x10^2$	ND	ND	$4x10^2$	ND	ND
Formula (7.5%)	$5x10^2$	ND	ND	$3x10^2$	ND	ND
Formula (10%)	$4x10^2$	ND	ND	$2x10^2$	ND	ND

ND=not detected Cfu=colony form unit

Results in the same table indicated that frying decreased TBC from $4x10^2$ to $2x10^2$ in formula (10%). On the other hand, *Salmonella* and Coliform group before and after frying were not detected in all samples at zero time.

Table 8. Microbiological evaluation for beefburger formulas contained chamomile stems residue powder at one month after frozen storage (-18°C)

Formulas	Before frying			After frying		
	Total bacterial counts (cfu/g)	Salmonella (cfu/25g)	Coliform group (cfu/g)	Total bacterial counts (cells/g)	Salmonella (cfu/25)	Coliform group (cfu/g)
Control	$11x10^3$	ND	ND	$9x10^2$	ND	ND
Formula (2.5%)	$9x10^3$	ND	ND	$7x10^2$	ND	ND
Formula (5.0%)	$5x10^2$	ND	ND	$5x10^2$	ND	ND
Formula (7.5%)	$4x10^2$	ND	ND	$3x10^2$	ND	ND
Formula (10%)	$3x10^2$	ND	ND	$2x10^2$	$1x10^2$	ND

ND=not detected Cfu=colony form unit

Table 9. Microbiological evaluation for beefburger formulas contained chamomile stems wastes powder at two months after frozen storage (-18°C)

Formulas	Before frying			After frying		
	Total bacterial counts (cfu/g)	Salmonella (cfu/25g)	Coliform group (cfu/g)	Total bacterial counts (cells/g)	Salmonella (cfu/25g)	Coliform group (cfu/g)
Control	$9x10^3$	ND	ND	$8x10^2$	ND	ND
Formula (2.5%)	$8.2x10^2$	ND	ND	$5x10^2$	ND	ND
Formula (5.0%)	$4x10^2$	ND	ND	$4 x10^2$	ND	ND
Formula (7.5%)	$3x10^2$	ND	ND	$3x10^2$	ND	ND
Formula (10%)	$2x10^2$	ND	ND	$1x10^2$	ND	ND

ND=not detected Cfu=colony form unit

At the same trends, data in tables (8) and (9) indicated that TBC in uncooked samples were higher than those of the fried samples at one and two month's storage. From the same tables it can notice that TBC of prepared samples (either uncooked or cooked samples) that contained chamomile at 10% level was somewhat lower than that of the other investigated formula at one and two month storage time.

On the other hand, results in the table (10) illustrated that frying eliminated TBC of beef burger samples from $1x10^2$ in control sample to 3x10 in sample contained 10% chamomile wastes powder. Conclusively, these data are adapted to Egyptian standard (ES 1688: 2005) of frozen beefburger, which include maximum limit of TBC of 10^5, while salmonella not detected.

From these results it could be concluded that efficiency of frying in elimination of bacterial load of prepared samples was remarkable when compared with uncooked for all formula and storage time. Also, chamomile waste powder contained antioxidant constituents may prevent the microbial growth during storage for three months along increasing of the replacement percentage.

Table 10. Microbiological evaluation for beefburger formulas contained chamomile stems wastes powder at three months after frozen storage (-18°C)

Formulas	Before frying			After frying		
	Total bacterial counts (cfu/g)	Salmonella (cfu/25g)	Coliform group (cfu/g)	Total bacterial counts (cfu/g)	Salmonella (cfu/25g)	Coliform group (cfu/g)
Control	$7x10^2$	ND	ND	$2x10^2$	ND	ND
Formula (2.5%)	$6x10^2$	ND	ND	9x10	ND	ND
Formula (5.0%)	$4x10^2$	ND	ND	7x10	ND	ND
Formula (7.5%)	$2x10^2$	ND	ND	5x10	ND	ND
Formula (10%)	$1x10^2$	ND	ND	3x10	ND	ND

ND=not detected Cfu=colony form unit

Finally, the results presented in this study demonstrate that herbs and spices wastes have generally high polyphenolic contents, making their utilization worthwhile and thus supporting sustainable agricultural production. In particular, the by-products vilipended are suitable as dietary supplements or as ingredients in functional foods. Moreover, the composite from herbs and spices wastes confers adequate characteristics for its use as a soil conditioner. Furthermore, herbs and spices wastes can be recycled and used as a substrate for the production of a high-added value product.

REFERENCES

1. A.O.A.C., 1995. Official Methods of Analysis of the Association of Official Analytical Chemists. 16th Ed., Published by the Association of Official Analytical Chemists. Arlington, Virginia , 2220 USA.
2. A.P.H.A., 1971. Recommended Methods for the Micro Examination of Food. American Public Health Association Pub. Inc., New York.
3. Crehan, C.M., E. Hughes, D.J. Troy and D.J. Buckley. 2000. Effect of fat level and maltodextrin on the functional properties of frankfurters formulated with 5, 12 and 30% fat. Meat Sci., 55: 403-409.
4. Daniel, H.D. and C.M. George. 1957. Peach seed dormancy in relation to endogenous inhibitors and applied growth substances. J. Am. Soc. Horti. Sci., 97 : 651-654.
5. Drummond, L. S. and D. W. Sun. 2005. Feasibility of water immersion cooking of beef joints: Effect on product quality and yield. J. Food Eng., 77: 289-294.
6. Egyptian Standard ES: 1688, 2005. Frozen beef burger.
7. El-Seesy, T. A., 2000. Quality and Safety of Meal Burger Patties Using " HACCP" System: Shrinkage-Cooking loss-Drip loss. 3rd Conference of " The Food Industry at the Service of Tourism", April 12-14th.
8. Fedtke, C., 1973. Effect of the herbicide methanbenzthiazoron on the physiology of wheat plants. Pesticide Sci., 4 : 653-664.
9. Havkin-Frenkel, D., N. Dudai and van der Mheen, Hans, 2011. Effective postharvest processing turns herbal waste into beneficial product – the case of oregano. An inter. J. For Reviews in Postharvest Boil. and Technol., 1: 2.
10. International Standards Organization ISO: 6571, 2009. Spices, condiments and herbs: Determination of volatile oil content (hydrodistillation method).
11. International Standards Organization ISO :6579, 2002. Microbiology food and animal feeding stuffs: Horizontal method for detection of *Salmonella* spp.

12. Jama, N., V. Muchenje, M. Chimonyo, P. E. Strydom, K. Dzama and J. G. Raats. 2008. Cooking loss components of beef from Nguni, Bonsmara and Angus steers. African J. Agric. Res., 3 (6): 416-420.
13. Kong, F., J. Tang, M. Lin and C.B. Rasco. 2008. Thermal effects on chicken and salmon muscles: Tenderness, cook loss, area shrinkage, collagen solubility and microstructure.LWT, 41: 1210–1222.
14. Krishnaiah, D., R. Sarbatly and A. Bono. 2007. Phytochemical antioxidants for health and medicine – A move towards nature. Biotechnology and Molecular Biology Review, 1 (4):097-104.
15. Lívia, X.P., R.A.A. Marcos, O.B.C. José, C.C. Jos-Maria and M.R. Afonso, 2011. The use of cashew apple residue as source of fiber in low fat hamburgers Tecnol: Aliment. Campinas, 31(4): 941-945.
16. Nagata, M. and I. Yamashita. 1992. Simple method for simultaneous determination of chlorophyll and carotenoids in tomato fruit. Nippon Shokuhin Kogyo Gakkaish, 39(10): 925–928.
17. Nurul, H., L. Boni, and I. Noryati. 2009. The effect of different ratios of dory fish to tapioca flour on the linear expansion, oil absorption, colour and hardness of fish crackers. Inter. Food Res. J., 16: 159-165.
18. Pharmacopeia, 1989. The state Pharmacopeia of USSR, Moscow, 2: 324-334. (C.F., Food Chem., 85: 231-237, 2004).
19. Rahimi, E., J.M. Prado, G. Zahedi and M.A.A. Meireles. 2011. Chamomile extraction with supercritical carbon dioxide: Mathematical modeling and optimization. J. Supercritical Fluids, 56: 80–88.
20. Sanchez-Alonso, I., Hajj-Maleki, R. and A.J. Borderias. 2007. Wheat fiber as a functional ingredient in restructured fish products. Food Chem., 100: 1037-1043.
21. SPSS, 1999. SPSS for Windows. Release 10 (October 1999) Standard Version.
22. Szoke, E., E. Maday, E. Tyihak, I.N. Kuzovkina and E. Lemberkovics. 2004. New terpenoids in cultivated and wild chamomile *(in vivo* and *in vitro*). J. Chromatography, B 800: 231–238.
23. Wettstian, D., 1957. Chlorophyll, letal und der subnikro supische formmech sallder-Plastiden. Exptl-Cell. Res., 12 : 427-433.
24. Yang, B., M. M. Zhao, J. Shi, N. Yang and Y. M. Jiang. 2008. Effect of ultrasonic treatment on the recovery and DPPH radical scavenging activity of polysaccharides from longan fruit pericarp. Food Chem., 106: 685–690.

إستبدال نسبة من اللحم في البيف برجر بمخلفات البابونج بعد الحصاد كمصدر غني بالألياف الغذائية و مانعات التأكسد

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في الإتجاه العالمي إلى "نفاية صفر" تعتبر مخلفات الأعشاب مثل البابونج مصدر للألياف الغذائية ومانعات التأكسد التي قد تستعمل في المنتجات الغذائية كقطاع إنتاج اللحوم. تم تقدير التحليلات الكيميائية والمحتوي من مانعات التأكسد في مسحوق سيقان البابونج ، ثمّ التقييم الحسي للخلطات المختلفة لهامبرجر اللحم البقري بإستبدال اللحم بالنسب ٢.٥، ٥.٠، ٧.٥ و١٠% مسحوق سيقان البابونج. النتائج أوضحت أن مسحوق سيقان البابونج ذو محتوى عال من الزيت الخام والألياف الغذائية (٦.٣٩ و٢٤.٥٠ % على التوالي). النشاط المانع للتأكسد في البابونج كان أعلى من فيتامين ج (٨٨.١٨ و٣٨.٢٤ %، على التوالي). هذه النتائج ترجع إلي خاصيّة التأزر (synergism) بين محتويات مانعات التأكسد في البابونج مثل الفينولات الكلية و الفلافونيدات الكلية و الكاروتينات ٣.٥ و ١.٥ و ٠.٥٧ ملليجرام/ جرام على التوالي)، أيضاً محتوى الزيت الطيار (٠.١٠ %) .

القدرة علي إمتصاص الماء أحد مؤشرات الجودة لوحظ زيادتها بشكل تدريجي بزيادة النسبة المئوية لمسحوق سيقان البابونج في خلطات البيف برجر. لكن إمتصاص الزيت والفقد عند الطهي لوحظ التناقص فيها موازياً للزيادة في المحتوي من بقايا البابونج في الخلطات المختلفة. إن الخلطات التي إحتوتْ علي ٥.٠ و ٧.٥ % كان لها أفضل مؤشرات التقييم الحسّية.

تم تقدير العدد الكلي للبكتريا و السالمونيلا ومجموعة القولون قبل وبعد القلي خلال التخزين بالتجميد (-١٨ ^{0}م) ثلاثة أشهر لخلطات البيف برجر ، أوضحت النتائج تناقص في محتوى العدد الكلي للبكتريا بشكل تدريجي بزيادة نسبة مئوية لمسحوق البابونج في خلطات البيف برجر المختلفة قبل وبَعد القلي، أيضاً سالمونيلا ومجموعات القولون لم تظهر في نفس الظروف. هذه النتائج بسبب المحتوى من مانعات التأكسد في الخلطات قد تمنع نمو الكائنات الحيّة الدقيقة أثناء التخزين بالتجميد ثلاثة أشهر. ومن النتائج يتضح أن مخلفات الأعشاب والتوابل يمكن تدويرها و إستخدامها كمواد تحافظ علي القوام و عوامل مضادة لنمو الميكروبات في مجال التصنيع الغذائي لرفع القيمة المضافة للمنتج.