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PHESICOCHEMICAL AND ORGANOLEPTIC PROPERTIES OF CHICKEN BURGER SUBSTITUTED WITH DIFFERENT LEVELS OF CHICKPEA DURING FROZEN STORAGE

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ABSTRACT

Fast foods are rich in fats that affecting human health. The main objective of this study was to investigate physicochemical and organoleptic properties of manufactured chicken burger substituted with different levels of chickpea during frozen storage. Physicochemical analyses of chicken meat were moisture content (73.58%), protein (23.17%), fat (2.21%), ash (1.04%), fiber and starch zero (%), pH 6.14 and finally thiobarbituric acid number (TBA) 0.112. The physicochemical analyses of chickpea were moisture content (4.5%), protein (23.3%), fat (4.17%), ash (3.11%), starch (62.76%), fiber by (2.09%), pH 6.6 and finally TBA 0.202. The substitution of chickpea (5%, 10% and 15%) decreased moisture content from 74.20 to 67.50%, pH value was increased from 6.27 to 6.73, protein increased from 23.00% to 25.70, increased effect on water holding capacity (WHC) from 53.30 to 58.74% and increased fat from 2.21 to 2.98 compared with the control sample. For the chickpea substitution at 15%, (TBA) value was higher by 1.3 mg malondialdehyde/kg when compared with the control. Moreover, the maximum acceptable levels of malondialdhyed were observed after 5 months. Concerning the organoleptic properties, a significant decrease ($P< 0.05$) in firmness score between the treated and the control samples during storage. Flavour, juiciness and overall acceptability did not show any significant difference in all investigated samples.

Key words: Chicken burger, physicochemical, organoleptic, chickpea, frozen storage .

INTRODUCTION

Presently, Egypt has a large population of consumers who eating chicken and has been sufficient with self-supplies. Chicken meat is among the most popular meat protein source consumed by Egyptian. Increased in chicken meat popularity has been noted by the fact that it can be processed into ready to eat meals (Barbut, 2002). In addition, processed chicken based products such as burgers have been distributed through wholesalers and restaurants, and also widely consumed by the people. Furthermore, local industries have grown up to accomplish the demands from these products (Chang, 2010; Guerrero and Hui, 2010). From the nutritional point of view, chicken meat and its products are known as good sources of animal protein of high biological value. It contains most of the essential amino acids required for growth. It considered as an excellent source of high polyunsaturated fatty acids, saturated fatty acids and low cholesterol value (Mothershaw *et al.,* 2009). Moreover, chicken meat is a good source of vitamins such as B12, niacin, riboflavin, thiamine and ascorbic acid as well minerals as sodium, calcium, iron, phosphorus, sulphur and iodine required for maintaining life and promoting growth (FAO /WHO, 2014). It plays an active role in the solution of the problem of shortage of red meat in developing countries as it makes many positive contributions to the diet of those on low incomes, as it is an economical meat, quickly and easily to prepare and serve (Mohammed, 2013).

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The term “burgers” was taken originally from the word “hamburger” which presumably is a product that originated from Hamburg. Most of European countries regulated that burgers should contain at least 80% meat and 20-30% of fat content (United States Patent and Trademark Office, 2010).

In recent years, there has been an increasing interest to other legumes such as chickpea (*Cicer arietinum* L.) as the best source of vegetable protein (Molina *et al.*, 2002). It is well known that plant proteins are an alternative to proteins from animal sources for human nutrition. The chickpea is one of the most important crops in the world because of their nutritional quality, it is rich source of complex carbohydrates, protein, vitamins and minerals (Wang *et al.*, 2010). Chickpea has shown numerous health benefits, *e.g.* lower glycemic index for people with diabetes (Goni and Valentin, 2003) increased satiation and cancer prevention as well as protection against cardiovascular diseases due to their dietary fiber content (Chillo *et al.*, 2008).

To control spoilage and prolong the shelf-life of some food products, freezing is considered as an excellent method of preserving the quality of chicken meat products for long periods (9-12 months), at temperatures below -18°C. Quality of chicken meat can be evaluated by sensory attributes besides chemical and microbiological analyses (Balamatsia *et al*., 2006).

Therefore, this work was carried out to study the physicochemical and organoleptic properties of manufactured chicken burger substituted with different levels of chickpea during freezing storage.

MATERIALS AND METHODS

Collection of Chicken Breast

Fresh chicken (white- leghorn) was purchased from supermarkets. All samples were collected 1 to 2 weeks for processing during 2014 - 2015. Directly transferred to the laboratory of Food Science Department, Faculty of Agriculture, Zagazig University, Egypt, under aseptic conditions and kept at -18ºC ± 2 till processing and analyses.

Seeds of Chickpea

Chickpea seeds were purchased from the local market in Zagazig city during 2014 - 2015.

Technological Treatments

Preparation of chickpea (*Cicer arietinum* L.)

Seeds were manually sorted to remove split, wrinkled and mouldy legumes and foreign materials. The cleaned chickpea seeds were soaked in distilled water (1:4 *W/V*) for 12 hours at room temperature, The soaked seeds were drained and dehulled and then cooked for 10 min in a pressure cooker using (seed to water 1:4) according to the method described by Thapliyal *et al*. (2014). The cooked seeds were drained through strainer ,ground to pass through 30 mesh screen sieve and dried at 50 ºC for 10 hrs., in an electric oven with a motor fan, and kept in polyethylene pouches until use.

Preparation of chicken burger

Chicken burger patties were prepared in the laboratory by mixing minced chicken breast meat with other ingredients which are presented in Table 1 in molenix mince.

Table 1. Chicken burger formula

Ingredient	Percentage	Weight(g)
Minced chicken meat	87.5	875
Salt	1.5	15
Onion juice	10	100
Black pepper	0.5	5
Spices	0.5	5

The mixture was divided into 4 equal portions for different treatments. First portion was left as control without chickpea, the 2nd, 3ed and 4th portions of chicken burger were achieved by substituting with chickpea at a ratio of 5%, 10%, and 15%, respectively. The chicken burger samples were transferred to a burger machine which formed burger with an average of 50 g weight, 10 cm diameters for the piece, and 0.5cm thickness (Ibrahim *et al.*, 2015). Chicken burger samples were packed in polyethylene bags in foam dish, and then stored at -18^0C for 6 months. The frozen samples were examined every month. Each sample was subjected to a sensory evaluation, chemical analyses, water holding capacity (WHC), thiobarbituric acid test (TBA), pH, and microbiological analyses (El-Arby and Toliba, 2013). The protocol repeated six times every month.

Chemical Analyses of Manufactured Chicken Burger

Moisture**,** crude protein and fat were measured according to the methods described in AOAC (2005). There assays were conducted in a Centeral Laboratory, Fac. Agric., Zagazig University, Egypt.

Amino acid analysis

Amino acid composition of manufactured chicken burger substituted with chickpea was carried out according to Millipore (1987) in the Central Laboratory, Fac. Vet. Med., Zagazig Univ., Egypt. The amino acid analyzer type was 1-Sykam Automatic Amino Acid Analyzer S 433

pH value

pH value was determined according to the method mentioned by (AOAC, 2005), using pye digital pH meter (Type 3320 Jenway LTD, felsted Dan mow Essex (M63 IB, UK).The pH was measured directly from the scale on the instrument to the nearest 0.05pH unit then a constant value has been recorded.

Water Holding Capacity (WHC)

WHC was estimated according to the method recommended by Dal Bosco *et al.* (2012), by a centrifugation, 1 g of fresh and stored prepared burger was placed on tissue paper in a test tube and centrifuged at 1500 x g for 4 min. Burger weights were measured after centrifugation. The remaining water after centrifugation was quantified by drying the samples at 70°C overnight. The WHC was calculated as follows : (weight after centrifugation-weight after drying)/ initial weight ×100.

Determination of Thiobarbituric Acid Test (TBA)

Thiobarbituric acid value was measured according to the method described by Fernandez-Lopez *et al.* (2005).

TBA value (/kg) = absorbance at 538 n.m × 7.8

Sensory Evaluation

Sensory evaluation was conducted every month (zero time-6) for prepared chicken burger samples according to the method described by (Mohammed, 2013). Cooked chicken burger samples were served warm to 15 panelists (Staff and graduate students of Food Science Department, Faculty of Agriculture, Zagazig University, Egypt) without care of age or sex. The panelists were subjected to evaluate the samples of each brand for tenderness, juiciness, flavour, colour and overall acceptability by using scores from 1 to 10, where (9-10) excellent, (6-8) very good, (4-5) fair and (2-3) not acceptable.

Statistical Analysis

All values in the organoleptic examination were presented as means ± standard error. Data were statistically analyzed according to Snedecor and Cohran (1980) to determine the differences in the organoleptic properties among the different treatments. Significant differences among the means were determined by Tukey Honestly Significant Difference (HSD) test (JMP ; USA) considering $P<0.05$.

RESULTS AND DISCUSSION

Physicochemical Properties of Chicken Meat and Chickpea

Table 2 shows physicochemical properties of chicken meat. The moisture content recorded (73.58%), protein (23.17%), fat (2.21%), ash

Table 2. Physicochemical properties of chicken meat and chickpea

Physicochemical property	Moisture (%)	Protien (%)	Fat (%)	Ash (%)	Starch (%)	Fiber (%)	pH	TBA ml/kg
Chicken meat	73.58	23.17	2.21	1.04	-	0.00	6.14	0.112
Chickpea	4.50	23.30	4.17	3.11	62.76	2.09	6.60	0.202

(1.04%), fiber and starch values were zero (%), pH 6.14 and finally TBA was 0.112 ml/kg . The results of chicken meat are similar to the results reported by Edris *et al.* (2012) who showed that the breast of chicken meat contained 20.8% → 23.8% protein, 1.19 → 2.4% fat, 72.2% → 75.4% moisture and 0.8% → 1.20% ash.

However, these results are in disagreement with those recorded by Afifi (2000) who reported that the moisture content of chicken breast ranged from (67.37% to 71.02%), protein (13.27% to 18.25%), fat (9.10% to 13.21%) and ash (1.250% to 1.475%). Concerning to pH and TBA, results agreed with Afifi (2000), Edris *et al*., (2012) and Kamel (2015) where pH value ranged from 5.9 to 6.44 and TBA value ranged from 0.04 to 0.223.Pearson and Gillette, (1996) reported that the ideal pH for meat is between 5.8 and 6.3, so the present result is ideal.

Physicochemical properties of chickpea used in burger manufacture were: moisture (4.50%), protein (23.30%), fat (4.17%), ash (3.11%), starch 62.76% and fiber 2.09%, pH 6.60 and finally TBA was 0.202.These results agree with Esmat *et al*. (2010) and Abd El-Fatah *et al*. (2013) who recorded that the chemical composition of chickpea was protein (24.5% to 24.63%), fat (5.55% to 5.62%), ash (3.30% to3.69%), carbohydrate (62.26% to 64.6%) and fiber (1.85% to 4%). The results of the current study are in disagreement with those reported by Muzquiz and Wood (2007) who found the chemical composition of chickpea was 22. 22% protein, 5.63% fat, 3.04% ash, 63.41% carbohydrate and 5.70-7% fiber. These results also are in disagreement with Jukanti *et al*. (2012). They found that the protein (%) was ranged from 17 to 22, meanwhile fat (%) was ranged from 2.7 to 8.83. And also are in disagreement with El-Adawy (2002) who recorded that the seeds of chickpea contain high levels of carbohydrate (47.42%-41.10%) and protein (21.70% – 23.40%).The disagreement results may be due to the variety of chickpea used.

Amino Acids Analysis of Chicken Meat and Chickpea

Amino acids (AA) analysis of chicken meat and chickpea are shown in Table 3. It is clear that chicken meat as a source of animal protein is rich in essential AA than non-essential AA, meanwhile the chickpea as a source of plant protein is higher in non-essential AA than essential AA Zedan (2007) reported that the (%) of essential AA in chicken meat is 60.6 and non-essential is 46.3. In the same time the results of chickpea agreed with (Esmat *et al*., 2010) and Abd El-Fatah *et al*. (2013). They reported that the chickpea is rich in non-essential amino acids (55.9-58.64) and low in total essential amino acids (33.9-39.8 g/100g protein).

Effect of Freezing Storage at -18°C on Some Physicochemical and Sensory Properties of Manufactured Chicken Burger Substituted with Chickpea

The increasing demand for better quality and healthy meat products has also stimulated the use of new non-meat components (Mbougueng, *et al*., 2015). The minimum requirement of meat content in manufacturing of any processed meats including burgers to be not less than 65% (Food Regulations, 1985). Presently, substitution of some ingredients with other non-meat ingredients has been practiced among processed meat industries. This replacement is done due to the several reasons such as for quality health or economic purposes. As an example, the replacement of ingredients from animal origin with that of plants has been applied in food industries which are used to achieve different functionalities on the final product (Egbert and Payne, 2009).

Table 3. Amino acids composition of chicken meat and chickpea

Treatment	Essential A A*									Non Essential AA (mg/100 g P)									
	Thr	Lys	Val	Leu	Phe	Met	Ile	His	Total	Asp	Ser	Glu	Pro	Gly	Cys	Arg	Ala	Tyr	Total
Chicken meat	1.90	14.00	4.10	8.30	3.80	2.50	4.60	7.30	46.50	3.30	2.90	9.20	0.70	1.90	4.40	12.30	3.80	3.40	41.90
Chickpea	3.70	6.80	4.60	7.20	5.70	1.50	4.40	3.10	37.00	11.20	4.50	17.60	4.60	4.20	1.30	9.10	4.60	3.60	60.70

AA*(amino acids)

The changes on some chemical composition of chicken burger with different levels of chickpea (5%, 10% and 15%) were determined and the results are presented in Tables 4, 5 and 6. The result of moisture content of manufactured chicken burger substituted with different levels of chickpea was decreased for untreated sample and sample with 15% chickpea, during frozen storage as given in Table 4. This could prevail in freezer atmosphere to be as a common problem in the commercial processing industry. This decrease may be attributed to the decreases in pH value during storage which reduced the ability of meat protein to bind water and thereby, the loss of moisture increased (Afifi 2000). Data presented in Table 4 show that the pH values was gradually decreased by 1.2-fold for untreated sample and sample with 5% chickpea and 1.4-fold for the sample with 15% chickpea during frozen storage but still within the permissible limits of EOSQC (2005).The decrease in pH may be attributed to the breakdown of glycogen to the formation of lactic acid. These results agreed with Singh *et al*. (2011) and Kamel (2015) and disagreed with, El-Arby (2004) and Bahmani *et al*. (2011) who recorded that the pH always increasesed according to storage time due to the partial proteolysis leading to increase of free alkalin groups depending on the condition of storage, but the pH value does not offer a certain criteria of spoilage. Also, results were in disagreement with Kumar *et al*. (2014) who recorded that the frozen storage of chicken meat products did not affect the pH of the samples, over a period of 90 days. The acidity is an important criteria in assessing the initial quality of poultry meat products and its behavior during storage (Allen *et al*., 1998).

Data presented in Table 5 show that the substitution of chickpea lead to increase the protein (%) in chicken burger according to the (%) of addition from 23.00% to 23.78% in case of 5% substitution , from 23.00% to 24.50% in case of 10% and from 23.00% to 25.70% in case of 15% substitution. Data presented in Table 5 also show protein content in chicken burger samples during frozen storage at -18°C for 6 months. It is clear from the Table 5 that the decrease in protein content in control was from 23.00% to 17.50%, which is lower than the decrease in other treatments, where in case of substitution of chickpea by 5% the decrease was from 23.78% to 19.00%. While, in case of substitution of chickpea by 10% the decrease was from 24.50% to 19.50%. Finally, the decrease in case of substitution of chickpea by 15% was from 25.70% to 20.20%. This finding may be due to substitution of chickpea as a source of plant protein.A loss of protein content was noticed by 4% to 5.5%. In all investigated chicken burger samples from these data, it could be concluded that the loss in total protein content might be attributed partially to the breakdown of proteins by proteolytic enzymes which are not completely inactivated during frozen storage as well as due to the loss of nitrogen compounds, either as volatile substances caused by microbial effect or separated in drip during thawing the frozen meat samples (Miller *et al*., 1980).

In contrast, Pandey and Mohandernant (1979) revealed that freezing of chickens at -16°C for 60 days did not affect the protein content. Changes in such parameter reflect the extent of water holding capacity (WHC) of meat and directly affect yield of meat during cooking. These results agreed with Kenawi *et al*. (2011) and Kamel (2015). They recorded loss of moisture combined with increasing of water holding capacity of meat upon longer storage due to the activity of protolytic enzymes.

Table 4. Effect of frozen storage on chicken burger substituted with (5, 10 and 15%) chickpea on moisture content and pH value

Chicken burger substituted with chickpea	Moisture (%)							pH						
	Freezing storage period (month)													
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
0%	74.20	73.75	73.30	72.75	72.30	72.22	71.26	6.27	6.26	6.18	6.14	6.04	5.94	5.17
5%	71.20	70.92	70.54	69.37	68.87	67.37	66,37	6.44	6.28	6.09	6.05	5.87	5.35	5.13
10%	69.00	68.66	67.87	66,07	65.45	65.00	64.07	6.52	6.22	6.09	6.07	5.84	5.30	5.04
15%	67.50	67.00	66.05	65.90	65.37	64.02	62.10	6.73	6.22	6.05	6.00	5.50	5.18	5.00

Table 5. Effect of frozen storage on chicken burger substituted with (5, 10 and 15%) chickpea on protein content and WHC%

Chicken burger substituted with chickpea	Protein (%)							WHC (%)						
	Freezing storage period in month													
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
0%	23.00	22.80	21.80	20.00	19.00	18.50	17.50	53.30	53.33	55.40	58.22	63.77	65.64	66.40
5%	23.78	23.30	22.80	21.75	20.00	19.50	19.00	55.66	55.66	59.80	62.68	62.68	66.03	68.36
10%	24.50	24.00	23.30	22.90	22.00	21.00	19.50	57.30	57.30	59.64	61.64	62.61	63.35	63.64
15%	25.70	24.80	24.00	23.05	22.80	21.95	20.20	58.74	58.74	59.47	59.47	60.08	60.99	61.30

Table 6. Effect of frozen storage on chicken burger substituted with (5, 10 and 15%) chickpea on fat content and TBA

Chicken burger substituted with chickpea	Fat (%)							TBA						
	Freezing storage period in month													
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
0%	2.21	2.21	2.18	2.12	2.10	2.05	2.00	ND	0.05	0.22	0.48	0.79	0.86	0.94
5%	2.47	2.40	2.35	2.30	2.20	2.00	1.90	ND	0.06	0.27	0.52	0.84	0.92	1.04
10%	2.72	2.65	2.50	2.40	2.35	2.20	2.00	ND	0.06	0.32	0.55	0.90	0.95	1.25
15%	2.98	2.90	2.80	2.65	2.45	2.30	2.12	ND	0.07	0.36	0.58	0.93	0.97	1.42

ND (Not determined)

Table 6 shows the effect of frozen storage (-18^{o}C) for 6 months on the fat content of chicken burger substituted with different level of chickpea. Decrease was observed during five months, while, by the end of frozen storage the decrease reached to 1.90% to 2.12%. These results may be attributed to lipid deterioration and liberation of free fatty acid during the long storage of chicken burger (Murad *et al*. 2013). Additionally, the present results agreed with those reported by Al-Hakim and Al-Aswad (1990).

Lipid oxidation is one of the major causes of quality deterioration in meat. The thiobarbituric acid (TBA) test is among the most widely used to quantify lipid oxidation products in meat and meat products because it is simple and fast. The TBA test determines the amount of malondialdehyde (MDA), the major secondary by-product of lipid oxidation and is routinely used as an index of lipid oxidation in meat products during storage The TBA values of the chicken burger samples substituted with different levels of chickpea are shown in Table 6. The malondialdhyed concentration, increased gradually (0.051 to 0.97) in all treatment during frozen storage to reach the maximum limits at the 5th month, which agree with (EOSQC 2005). The increase in TBA values during storage might be attributed to oxygen permeability of packaging material (Brewer *et al*. 1992) that led to lipid oxidation. Similar results were recorded by Bhat *et al*. (2013), Das *et al*. (2013), Kumar *et al*. (2014) and Kamel (2015). All TBA values were higher in burger substituted with chickpea than those for the control .It is clear that as the concentration of chickpea increased the numbers of TBA increased. This might be possibly due to high content of unsaturated fatty acid of chickpea. These results are confirmed by (Jukanti *et al*. 2012) who reported that the chickpea is rich in polyunsaturated fatty acids (66%) and monounsaturated fatty acid (19%). Contrarily El-Arby (2004) indicated that thiobarbituric acid value of chicken nuggets tends to decrease after 180 days of frozen storage at -18°C and they interpreted their reaction in TBA value to the formation of carbonyl addition products that would possibly account for the apparent loss in malnaldehyde during frozen storage. A rancid flavour is initially detected in meat products between TBA values of 0.5 and 2.0 (Abdulla *et al*. 2013). Moreover, the rancid flavour can develop rapidly during refrigerated or frozen storage of chicken cuts-up which are more susceptible to rancidity because of their high contents of unsaturated fatty acids (Edris *et al*. 2012).

The thiobarbituric acid number (TBA) was increased to the critical values indicating oxidative rancidity and incipient spoilage of the samples after the 5th month of freezing as during long freezing period lipid deterioration, liberation of free fatty acids and producing of thiobarbituric acid increased.

Organoleptic examination is one of the main indicators which measure quality of most foods. The results in Table 7 represented the organoleptic properties of chicken burger substituted with different levels of chickpea including colour intensity, firmness, flavour, juiciness and overall acceptability.At zero time the data in Table 7 show a significant decrease ($P < 0.05$) in firmness score between the control sample and those substituted with chickpea. However, no significant difference was found between the control sample and those substituted with chickpea in flavour, juiciness and overall acceptability till the second month of storage. Meanwhile, the colour intensity showed a significant decrease ($P< 0.05$) beginning from the 4th month of storage. This may be due to the freezing and thawing processes which had a significant effect on colour and decrease in pH value which lead to the paleness of the colour. These results agreed with (Darwish *et al.*, 2011) who, used a different non meat ingredient (sweet potatoes) in formulation of beef burger freezing stored at -18°C for 12 weeks induced significantly reduction ($P < 0.05$) of the sensory panel scores for all the investigated parameters. The most pronounced effect was the effect on the flavour and overall acceptability. Also, (Saleh and Ahmed 1998) reported that there was an improvement in colour of beef patties due to the addition of boiled carrot and sweet potatoes. Abd El-Fatah (2013) recorded a significant increase ($P < 0.05$) in the taste and texture of noodles supplemented with chickpea

Table 7. Effect of frozen storage on chicken burger substituted with (5, 10 and 15%) chickpea on the organoleptic properties

Organoleptic property	Chicken burger substituted with chickpea	Storage months						
		0	1	2	3	4	5	6
Colour intensity	**0%**	8±0.89^{A}	8±0.89^{A}	8 ±0.22^{A}	7.5±0.67^{A}	7.5±0.44^{A}	7.5±0.67^{A}	7±0.44^{A}
	5%	8.5±0.67^{A}	8.5±0.67^{A}	8.5±0.44^{A}	8.5±0.67^{A}	8±0.44^{A}	7.5±0.67^{A}	7±0.44^{A}
	10%	8±0.89^{A}	8±0.89^{A}	8±0.44^{A}	7±0.44^{A}	7.5±0.44^{AB}	7±0.44^{AB}	6.5±0.67^{AB}
	15%	8±0.89^{A}	8±0.89^{A}	7.5±0.67^{A}	7.5±0.67^{A}	7±0.44^{B}	7±0.67^{B}	6±0.44^{B}
Firmness	**0%**	8.5±0.67^{A}	8.5±0.44^{A}	8.5±0.67^{A}	8.5±0.67^{A}	7.5±0.67^{A}	7.5±0.67^{A}	6.5±0.67^{AB}
	5%	8±0.89^{AB}	7.5±0.67^{AB}	7.5±0.89^{AB}	7.5±0.67^{AB}	7±0.44^{AB}	7±0.67^{AB}	6±0.44^{AB}
	10%	7.5±0.67^{AB}	7.5±0.67^{AB}	7.5±0.67^{AB}	7.5±0.67^{AB}	7.5±0.67^{AB}	7.5±0.67^{AB}	6.5±0.22^{BC}
	15%	7.5±0.67^{AB}	7.5±0.67^{B}	7.5±0.67^{B}	7±0.44^{B}	5.5±0.67^{B}	5.5±0.44^{B}	5±0.67^{C}
Flavour	**0%**	8±0.89^{A}	8±0.89^{A}	8±0.44^{A}	8±0.89^{AB}	8±0.44^{AB}	8±0.89^{AB}	6±0.44^{AB}
	5%	8.5±0.67^{A}	8.5±0.67^{A}	8±0.44^{A}	8±0.44^{A}	8±0.44^{B}	8±0.44^{AB}	5.5±0.67^{B}
	10%	8±0.89^{A}	8±0.89^{A}	7.5±0.67^{AB}	7.5±0.67^{B}	7.5±0.44^{BC}	7±0.67^{BC}	6.5±0.22^{BC}
	15%	7.5±0.67^{A}	7.5±0.67^{A}	7±0.44^{B}	7±0.44^{B}	6.5±0.67^{C}	5.5±0.22^{C}	5.5±0.22^{C}
Juiciness	**0%**	8.5±0.67^{A}	8.5±0.67^{A}	8.5±0.67^{A}	8±0.44^{A}	7.5±0.67^{A}	7±0.44^{A}	6±0.44^{B}
	5%	8.5±0.67^{A}	7.5±0.67^{A}	8.5±0.67^{A}	7.5±0.67^{A}	7.5±0.67^{AB}	7.5±0.67^{AB}	6±0.44^{AB}
	10%	7.5±0.67^{A}	7.5±0.67^{AB}	7.5±0.67^{AB}	7.5±0.67^{AB}	7±0.44^{AB}	7.5±0.67^{AB}	6.5±0.22^{BC}
	15%	7.5±0.67^{A}	6±0.44^{B}	7.5±0.67^{B}	6.5±0.67^{B}	6±0.67^{B}	6.5±0.67^{B}	6±0.44^{C}
Overall acceptability	**0%**	8.5±1.11^{A}	8.5±1.11^{A}	8.5±0.44^{A}	8.5±0.67^{A}	8.5±0.44^{A}	8±0.67^{AB}	6±0.44^{B}
	5%	8±0.89^{A}	7.5±0.89^{A}	7.5±0.67^{AB}	7.5±0.67^{AB}	7±0.44^{AB}	7.5±0.67^{B}	6±0.89^{BC}
	10%	7.5±0.67^{A}	7.5±0.67^{A}	7.5±0.67^{AB}	7.5±0.44^{BC}	7.5±0.67^{BC}	7±0.44^{BC}	6±0.44^{BC}
	15%	6.5±1.11^{A}	6.5±1.11^{A}	6.5±0.67^{B}	6.5±1.11^{C}	5.5±0.67^{C}	5.5±1.11^{C}	5.5±0.67^{C}

Column carrying different subscript letter are significantly different with each other at $P < 0.05$.

seed powder, while colour significant increased ($P < 0.05$) relative to control noodles. These results are in disagreement with (kumar *et al.* 2014). They found that the organoleptic attributes, as appearance, flavour, texture and overall palatability were not affected due to frozen storage except juiciness which decreased significantly after three months of storage. These results also are disagreed with Berry (1990) and Kamel (2015) who revealed that 6th month storage at freezing temperature (-18°C) is the longest period for which broiler chicken fillets may be found to have impeccable sensory properties especially colour, odour and flavour and still within the acceptable range. These results are confirmed by (Abu-Ruwaida *et al.* 1996) who reported acceptability of chicken meat after 6-9 months of storage at –18ºC as there is no significance of the sensory parameter scores of the examined samples ($P < 0.05$).

Conclusion

This study has been demonstrated the effect of substitution by chickpea to the minced chicken breast meat as a source of plant protein, at different levels 5%, 10% and 15%. Study the physicochemical properties of chicken meat and chickpea. Also study the effect of freezing storage at a temperature of -18°C for six months on physicochemical properties in terms of humidity and water-holding capacity as well as protein, pH ratio as well as the percentage of fat and thiobarbeturic acid. Also investigate the sensory properties of the manufactured burger all over the period of storage. From the obtained results it can be concluded that the substitution of chicken minced meat by chickpea lead to the lifting of the nutritional value by increasing the protein content in the product without affecting on the technologically advanced.

REFRENCES

Abd El-Fatah, N., A.A. Metwalli and O.S. Shams (2013). Preparation and evaluation of instant noodles supplemented with natural sources of high lysine content. Egypt J. Agric. Res., 91 (3): 1065-1081.

Abdulla, G., M.G. El-Araby and A.O. Toliba (2013). Egyptian leek extract as a natural antioxidant: application on beef burger. Alex. J. Fd. Sci. and Technol., 10 (1): 1-10.

Abu-Ruwaida, A.S., W.N. Sawaya, B.H. Dasthi, Z.H. Baroon and H.A. Al-Othiman (1996). Microbiological shelf life and quality of frozen boiler chicken under stimulated market temperatures. Fleischwirschaf, 76: 827–830.

Afifi, J.S.A. (2000). Chemical studies on some poultry meat products M.V.Sc. Thesis, Fac. Vet. Med. Zagazig Univ., Egypt.

Al-Hakim, K.K.A. and M.B. Al-Aswad (1990). Effect of gaining and freezing on the chemical composition of old ewes meat. Mesoptamia J. Agric., 22 (4): 53-64.

Allen, C.D., D.L. Fletcher, J.K. Northcutt and S.M. Russell (1998). The relationship of broiler breast meat color to meat quality and shelf-life. Poult. Sci., 77 : 361-366.

AOAC (2005). Official Method of Analysis. Association of Official Analytical Chemists, 16th Ed., Gaithersburg, DC, USA.

Bahmani, Z.A., M. Rezai, S.V. Hosseini, J.M. Regenstein, K. Bohme and A. Alishahi (2011). Chilled storage of golden gray mullet (*Liza aurata*). Food Sci. and Tecnol., 44 (9): 1894- 1900.

Balamatsia, C.C., E.K. Paleologos, M.G. Kontominas and I.N. Savvaidis (2006). Correlation between microbial flora, sensory changes and biogenic amines formation in fresh chicken meat stored aerobically or under modified atmosphere packaging at 4°C: possible role of biogenic amines as spoilage indicators, Antonie van Leeuwenhoek, Springerlink, 89, 9-17.

Barbut, S. (2002). Meat Color and Flavor. Poult. Prod. Proc.: An Ind. Guide. CRC Press, New York, USA, 448–453

Berry, B.W. (1990). Changes in quality of all beef and soy extended patties as influenced by freezing rate, frozen storage temperature, and storage time. J. Food Sci., 55 (4): 893-897.

Bhat Z.F., V. Pathak and H.F. Bhat (2013). Effect of refrigerated storage on the quality characteristics of microwave cooked chicken seekh kababs extended with different non-meat proteins. J Food Sci. Technol., 50, (5): 926–933

Brewer, M.S., W.G. Ikins and C.A.Z. Harbers (1992). TBA values, sensory characteristics and volatiles in ground pork during long-term frozen storage: effects of packaging. J Food Sci., 57(63)558-580.

Chang, C.C., J.H. Yang, C.K. Chou and T. Tseng (2010). Effect of replacing pork lard with carrot and onion on the quality of chinese style sausage. J Agric. Assoc Taiwan, 11 (4): 374–386.

Chillo, S., J. Laverse, P.M. Falcone, A. Protopapa and D. Nobile (2008). Influence of the addition of buckwheat flour and durum wheat (*Cicer arietinum* L.): a Rev. British J. Nut., 108 (1): 11-26.

Dal Bosco, A., E. Mourvaki, R. Cardinali, B. Sebastiani, S. Ruggeri, S. Mattiolo, A. Taticchi, S. Esposto and C. Castellini (2012). Effect of dietary supplementation with olive pomaces on the performance and meat quality of growing rabbits. Meat Sci., (92): 783-788.

Darwish, A.M., A.M. Ibrahim, O.A. Ataala and A.A. Abdelsalam (2011). Effect of some nutritional additives on the quality and formulation cost of beef burger. World J. Dairy and Food Sci., 6 (2): 180-188.

Das, A., D.R. Nath, S. Kumari and R. Saha (2013). Effect of fermented bamboo shoot on the quality and shelf life of nuggets prepared from desi spent hen. Vet. World, 6 (7): 419–423.

Edris, A.M., M.I. Hemmat, F.A. Shaltout, M.A. Elshater and F.M.I. Eman (2012). Chemical analysis of chicken meat with relation to its quality. Benha Vet. Med. J., 23 (1): 87-93.

Egbert, W.R. and C.T. Payne (2009). Plant proteins. In Ingredients in Meat Products: Properties, Functionality and Applications, Tarte, R., Ed., New York: Springer Science Business Media, LLC., 111-129.

El-Adawy, T.A. (2002). Nutritional composition and antinutritional factors of chickpeas (*Cicer arietinum* L.) undergoing different cooking methods and germination. Plant Foods for Human Nutr., 57 (1): 83–97.

El-Arby, G.H. and A.O. Toliba (2013). Egyptian leek (*Allium ampeloprasum* var. kurrat) extract as a natural antioxidant : Application on beef burger. Alex. J. Fd. Sci. and Technol., 10 (1):1-10.

El-Arby, G.M. (2004). Studies on some meat products. M.Sc. Thesis Fac, Agric., Zagazig Univ., Egypt.

EOSQC (2005). Egyptian organization for standardization and quality control. Standards of Poult. Meat Prod., Minist. Indus., 3493 Egypt.

Esmat, A.A., I.M.F. Helmy and G.F. Bareh (2010): Nutritional evaluation and functional properties of chickpea (*Cicer arietinum* L.) flour and the improvement of spaghetti produced from its. J. Am. Sci., 6 (10) : 1055-1072.

FAO/WHO (2014). Food Security Indicators. FAO Statistics website (available at http:// www) fao.org.

Fernandez-Lopez, J., N. Zhi, L. Aleson-Carbonell, J.A. Perez-Alvarez and V. Kuri (2005). Antioxidant and antibacterial activities of natural extracts: Application in beef meatballs. Meat Sci., 69: 371–380.

Food Regulations (1985). Kuala Lumpur, Malaysia: MDC Publishers SDN BHD.

Goni, I. and G.C. Valentin (2003). Chickpea flour ingredient slows glycemic response to pasta in healthy volunteers. Food Chem., 81 (4): 511-515.

Guerrero, L.I. and Y.H. Hui (2010). Handbook of Poultry Science and Technology, 2nd Proc., 2 : PP.1-14.

Ibrahim, H.M., R.A. Amin, I.A. Ibrahem and F.Y. Ola (2015). Isolation of enterobacteriacaea from poultry products in El-Behera and Alex. Governorates. Benha Vet. Med. J., 27 (1): 109-117.

Jukanti, A.K., P.M. Gaur, C.L.L. Gowda1 and R.N. Chibbar (2012). Nutritional quality and health benefits of chickpea (*Cicer arietinum* L.): A Rev. British J. Nut., 108 (1): 11-26.

Kamel, A.S. (2015). Effect of preservation on chicken fillets quality. M.V.Sc. Thesis, Meat Hygiene. Fac. Vet. Med., Zagazig Univ., Egypt.

Kenawi, M.A., M.M.A. Zaghlul and R.R. Abdel-Salam (2011). Effect of two natural antioxidants in combination with edible packaging on stability of low fat beef product stored under frozen condition. Biotechnol. Anim. Husbandry, 27 (3): 345-356.

Kumar, S.H., U. Kumar and M.C. Kumar (2014). Changes in the quality of dressed chicken obtained from different sources during frozen storage. Xplor Anim. Med. Res., 4 (1): 95-100.

Mbougueng, P.D., D. Tenin, C. Tchiégang and J. Scher (2015). Effect of starch type on the physicochemical and textural properties of beef patties formulated with local spices. Am. J. Food Sci. and Technol., 3 (2): 33-39.

Miller, W.O., R.L. Saffle and S.B. Zirkle (1980). Factors which influence the water holding capacity of various types of meat. J. Food Technol., 22:1139.

Millipore, A.H. (1987). Liquid chromatographic analysis of amino acids in feed and foods using a modification of the Pico-Tag Method. Milford, MA: Millipore Corp.

Mohammed, H.N. (2013). Study of some chemical, physical, sensory and bacteriology characteristics of canned chicken meat imported to Sulaymaniyah markets, Iraq. Int. J. Nut. and Metabolism, 7 (5): 128-133.

Molina, E., A.B. Defaye and D.A. Ledward (2002). Soy protein pressure-induced gels. Food Hydrocolloids, 16: 625-632.

Mothershaw, A.S., T. Gaffer, I. Kadim, N. Guizani, I. Al-Amri, O. Mahgoub and S. Al-Bahry (2009): Quality characteristics of broiler chicken meat on salt at different temperatures. Int. J. Food Propt., 12: 681-690.

Murad, H.O.M., B.M.A. Al-Jaff and H.H. Salih (2013). The physiochemical quality of imported frozen chicken thighs sold in Sulaimani markets. J. Tikrit Univ. for Agri. Sci. 1st Sci. Conf. Food Sci.

Muzquiz, M. and J.A. Wood (2007). Chickpea Breeding and Management. 1st Ed., 101-143.

Pandey, M.R. and T.D. Mohadernant (1979). Effect of chilling and frozen storage on quality of chicken Meat. Indian Poult. Gazette, 63 : 64.

Pearson, A.M. and T.A. Gillette (1996). Processed Meats. 3rd Ed New York Albany, Bonn, Boston, London.

Saleh, N.T. and Z.S. Ahmed (1998). Impact of naturalsource rich in provitamin on cooking characteristics, color, texture and sensory attributes of beef patties. Meat Sci., 50: 285-293.

Singh, V.P., M.K. Sanyal, P.C. Dubey and S.K. Mendiratta (2011). Quality assessment of vacuum packaged chicken snacks stored at room temperature. J. Stored Prod. Post. Res., 2 (6):120–126.

Snedecor, G. and W. Cohran (1980). Statistical Methods 7th Ed. Iowa States Univ., Press, Ames, USA.

Thapliyal, P., S. Sehgal and A. Kawatra (2014). *In vitro* digestibility and antinutrients as affected by soaking, dehulling and pressure cooking of chickpea (*cicer arietinum* L.) varieties. Asian J. Dairy and Food Res., 33 (2) : 131-135.

United States Patent and Trademark Office (2010). IC 030. US 046. G and S: prepared sandwiches for consumption on or off the premises.

Wang, N., D.W. Hatcher, R.T. Tyler, R. Toews and E.J. Gawalko (2010). Effect of cooking on the composition of beans (*Phaseolus vulgaris* L.) and chickpeas (*Cicer arietinum* L.). Food Res. Int., 43 : 589-594.

Zedan, N.S.M. (2007). Chemical and microbiological studies on chicken meat products. M.Sc. Thesis, Fac. Specific Ed., Kafr El-Sheikh Univ., Egypt.

الخواص الفيزيوكيماوية والحسية لبرجر الدجاج المستبدل بقيم مختلفة من الحمص أثناء التخزين بالتجميد

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يوجد اهتماماً كبيراً لتقييم وفحص المواد الطبيعية المضافة للوجبات السريعة التي تؤثر على صحة الإنسان، لذا كان الهدف الرئيسي من هذه الدراسة هو التحقق من الآثار المترتبة على استبدال لحوم الدواجن بنسب مختلفة بالحمص كمصدر للبروتين النباتي وتأثير التجميد والتخزين لمدة ستة أشهر على التركيب الكيميائي والخصائص الحسية للبرجر، نتائج التحليل الكيميائى لصدور الفراخ المستخدمة فى تصنيع البورجر كانت كالتالى: نسبة الرطوبة (٧٣.٥٨%) والبروتين (٢٣.١٧%)، والدهون (٢،٢١%)، الرماد (١.٠٤%)، والألياف والنشا صفر (%)، والرقم الهيدروجيني ٦.١٤وأخيرا حمض الثايوباربتيوريك ٠.١١٢ ونتائج التحليل الكيميائى للحمص الذى استبدل مكان لحوم الدواجن كانت نسبة الرطوبة (٤.٥%) والبروتين (٢٤.٣%)، والدهون (٤.١٧%) والرماد (٣.١١%)، النشا (٦٢.٧٦%) والألياف بنسبة (٢.٠٩%)، ومن هذه الدراسة تبين أن استبدال لحم الدواجن بالحمص أدت إلى انخفاض الرطوبة (من ٧٤.٢ إلى ٦٧.٥%)، وزيادة البروتين من (٢٣% إلى ٢٥.٧) وزادت قيمة درجة الأس الهيدروجينى من (٦.٢٧ إلى ٦.٧٣) وأيضا زيادة القدرة على الاحتفاظ بالمياه (WHC) من ٥٣.٣% إلى ٥٨.٧٤، وكذلك زيادة نسبة الدهون من ٢.٢١ إلى ٢.٩٨، وتم دراسة تأثير التخزين بالتجميد في درجة حرارة - ١٨°م على بعض الخصائص الفيزيوكيميائية والحسية للبرجر المصنع من صدور الدجاج عند استبداله بالحمص.

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