Chemical and technological studies on some formula from seeds and beans

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ABSTRSCT

Consumption of meat had faced some problems such as microbial growth and shortage of the shelf life because of the cross contamination during processing and handling . In this study,wheat, lentil, chickpea, carrot, soybean and mushrooms were used to prepare burger formula from planted sources and these formula comparing with commercial burger which produced from meat. Chemical composition, PH value, color , total volatile nitrogen, thiobarbituric acid value, microbiological evaluation and sensory evaluation weredetermined in tested samples. From the results, it could be found that the planted burger had high quantity of ash , carbohydrates and low content of fat.The color changes during storage was rapid than the plant burger sample . The total volatile nitrogen content was more pronounced in commercial burger than burger samples. Commercial burger had higher microbial count than the burger samples at the beginning of storage and spoiled after only 15 days at 4ºC, while the plant burger samples was spoiled after 30 days. Organoleptic evaluation showed that the burger samples had the best order of over acceptability followed by the Beefburger.

الملخص العربي

استهلاك اللحوم قد تواجة بعض المشاكل مثل النمو الميكروبي ونقص العمر الافتراضي لها بسب التلوث الذي يحدث اثناء عملية التجهيزوالمعالجة المتبادلة. في هذه الدراسة تم استخدام بعض المكونا ت مثل القمح والعدس والحمص والجزر وفول الصويا وعيش الغراب لاعداد خلطات من البرجر من مصادر نباتية ،وهذة الخلطات يتم مقارنتها مع منتجات البرجر التي تنتج تجاريا من اللحوم.

التركيب الكيميائي واللون ومجموع النتروجين وحمض الاسكوربيك والاس الهيدروجيني وتم اجراء التحليل الحسي والميكربيولوجي تم تقديرها في العينا ت المختيرة.

ومن النتائج وجد ان البرجر النباتي يحتويكميةكبيرةمنالرماد،ومنخفضة في محتواها من الدهون.

اللون يتغير اثناء التخزين بسرعة اكبرمن عينات البرجر النباتي.المحتوي من النتروجين الغازي اكثر وضحوحا في البرجر التجاري من البرجر النباتي.

وجد ان البرجر التجاري عالي في محتواه من الميكروبات حيث ان عينا ت البرجر في بداية فترة التخزينفقط لمدة ١٥يوم علي درجة حرارة ٤ سليلوز حدث لها فساد وبينما عينات البرجر النباتي حدث لها فاسد بعد ٣٠يوم من التخزين .

وأظهر التقيم الحسي ان عينا ت البرجر النباتيكان ترتيبها افضل علي مدي القبول ثم يتابعهاالبيف البرجر.

INTRODUCTION

Meat and meat products are one of the most consumed foods in Western diets.
Meat has a high nutritional value due to its high content of macronutrients, such as highly nutritious proteins, and micronutrients, such as iron, which makes meat a good product for everyone.

However, some essential micronutrients for human health are not present naturally in meat or meat products. One example is folic acid (FA), a water-soluble vitamin that is almost absent from meat products and that plays an important role in human metabolism. Folic acid is important mainly for the biosynthesis of purines and pyrimidines, methionine and serine; it is also implicated in the metabolism of histidine andhomocysteine**(Stranger, 2002).**

Wheat is one of the oldest food crops grown by man, which has achieved a central role as a staple food for all the nations and cultures. This is because of its flour having unique property of forming a cohesive dough and thus to be made into leavened bread and many range of noodles, soups, pasta and other foods. Wheat contributes most of the nutrients to humans compared to other cereals. About 44% of protein and 40% of fat are provided by wheat compared to other cereal grain sources. This highlights the importance of wheat as food grain. Wheat grain develops proteins, starch, lipids and sugars that accumulate in the endosperm for the embryonic wheat plant***(*Uthayakumaran and Wrigley, 2010).**

The nutritional potential of these seeds is based on their high level of protein and, depending on species, a high proportion of either starch or oil. They are generally good sources of slow-release carbohydrates and are rich inproteins (18-25%); soybean is unique in containing about 35-43% proteins. Along with macronutrients, leguminous seeds contain appreciable amounts of vitamins, minerals, dietary fiber and a number of health-promoting bioactive substances including phenolics**(Guillon and Champ,2002).**

Vegetables are an important part of human diet. it provide, not only the major dietary fiber component of our food, but also a range of micronutrients, including minerals, vitamins and antioxidant compounds, such as carotenoids and polyphenols. The nutritional value of fruit and vegetables is often associated with their antioxidant capacities **(Vinson *et al*. 1998 and Chu *et al*. 2002)**.

Legumes, an excellent source of protein, play an important role in human nutrition and are the staple food in many regions of the world. Biotechnological processes such as germination and fermentation are simple and economic methods to improve the nutritive value of legumes by causing desirable changes in nutrient availability, texture and organoleptic characteristics ***(*Granito *et al* .2005*)***.

Grain legumes are important sources of food proteins and dietary fibers, as well as, basic constituents of the Mediterranean diet. Mediterranean diet has proven to be beneficial in human health***(*Pérez-López *et al.*2009*)***.

Lentils are an important dietary source of complex carbohydrates, fiber,minerals, vitamins, antioxidant compounds, and proteins, although the quality of the protein is low***(*Porres *et al* .,2003*)***with a chemical score of 88 and a protein digestibility-corrected amino acid score of 71.2 ± 0.42***(*Porres *et al* .2001*).***

Mushrooms belong to macro-fungi which are grown worldwide. There are more than 14,000 species of mushrooms, and at least 2000 of them have various degrees of edibility, of which about 200 edible mushrooms are wild species **(Chang, 2008 and Kala. 2012).**

Edible mushrooms with a special umami taste belong to the food group with exceptionally rich nutritive value in vegetable proteins, vitamins, minerals and chitin, while low in calories and fat ***(*Ranogajec*et al.*2010*).*** Specific organoleptic characteristics of mushrooms and urge for a well-balanced diet led to a worldwide increase in consumption of edible mushrooms ***(*Ranogajec *et al.* 2010*and* Wasser, *2011).***

Mushrooms can also be used for therapeutic purposes, since they can produce a large variety of secondary metabolites, such as organic acids, alkaloids, terpenoids, steroids and phenolic compounds ***(Jayakumarset al.* 2011*)***.

Soybeans [Glycine *max* L. (Merr.)] are one of the major agricultural commodities in the world. This species is a widely used crop because of its valuable beneficial health effects on several chronic diseases, including the prevention of cancer, cardiovascular disease, and multiple conditions ameliorated by antioxidants ***(*Zhang *et al.* 2011*)***.

All the ingredientsthe definition of dietary fiber (DF) proposed by American Association of Cereal Chemists (AACC) defines DF being made up of edible part of plants or analogous carbohydrates that are resistant to digestion and absorption in the human small intestine as well as having beneficial physiological effects such as laxation, blood glucose attenuation and/or blood cholesterol attenuation ***(*AACC, *2000*).*** More specifically, dietary fiber means carbohydrate polymers with ten or more monomeric units, which are not hydrolyzed by the endogenous enzymes in humans These non-digestible carbohydrate (NDC) polymers should occur naturally in the food as consumed and have been obtained from food raw material by physical, enzymatic or chemical means and which have been shown to have a physiological effect of benefit to health as demonstrated by generally accepted scientific evidence to competent authorities(**Codex, 2001*)***.

MATERIALSAND METHODS

Materials

All ingredients ofmeat, wheat, lentil, chickpea, carrot, soybean and mushrooms were purchasedfromthe local markets .atChemicals which used in this study were obtained from GomhoriaCo. Dokki,Giza.

Methods

Preparation of beef burger

Beef burgers as control samples were prepared using the following formula The using ingredients are summarized in Table (A).

Beef meat minced and all ingredients were mixed in Hobart (modelC.100) speed no.2(a laboratory cutter) for 10 min. The mixture was then shaped in a circular burgers of 10 cm diameter , 0.5 cm thickness and about 60 gm weight. Each piece was surrounded with two pieces of butter paper before packaging in polyethylene bags (about 0.5kg capacity) ***(Bennion andBamford, 1973)***.

Table(A): Recipes used in the preparation of experimental burger samples containing different levels of components.

Ingredients(%)	Control	Sample(1)	Sample(2)	Sample(3)
Leanmeat (beef)	67.00	-	-	-
Toasted bread meal	17.00	-	-	-
Whole egg	7.00	7.00	7.00	7.00
Salt	1.70	1.70	1.70	1.70
Black pepper	0.30	0.30	0.30	0.30
Onion	7.00	7.00	7.00	7.00
Wheat	-	47.30	47.3	47.30
Cicerarietinum	-	-	15.00	-
Cicer	-	15.00	-	-
Vignamungo	-	11.70	-	11.70
Lens culinaris	-	-	11.7	
Mushrooms	-	10.00	-	10.00
Carrot	-	-	10.00	-
Soybean	-	-	-	15.00

Cooking of the burgers

All the burgers sampleswere cooked during 2 min on each side using a grill previously heated to 150 °C. The temperature inside the burger samples reached approximately 60 °C, as measured by a portable digital thermometer (Testo model 735; Testo, S.A., Barcelona, Spain). This treatment was sufficient to obtain a good final degree of doneness. All samples were storage at cold temperature 4ºC for 45 days.

Analytical methods

Moisture,protein (T.N×6.25,micro-Kjeldahl method using semiautomatic apparatus,Velpcompany ,Italy), Fat (Soxheltsemiautomatic apparatus Velp company, Italy, petroleum ether solvent), ash and fiber contents were determined using the methods described in the **(A.O.A.C,1995).**Carbohydrates calculated by Differencesas follows:

Carbohydrates (%) =100 - (% moisture+% protein+% fat+% Ash+% Fiber).

The PH value was measured by a PH meter according the method of **Aitken *et al.* (1962).**

Color of the samples was measured using a spectrocolorimeterTristimulus color Machine, with CIE Lab Color Scale. This color assessment system is based on Hunter L,a and b coordinates according to **Hunter (1958).**

Total volatile nitrogen (TVN) was estimated by the method of **Winton and Winton (1958) .**

Microbiological examination:

Aerobic plate count was determined on plate count agar medium after inoculation with a suitable dilution. The poured plates were incubated at 32ºC for 48 h. (**Harrigan and Margaret, 1966)**.

Sensory evaluation and statistical analysis

Sensory evolution of the control beef burger and different burger samples with different plants(wheat, lentil, chickpea, carrot, soybean and mushrooms) was carried out. Firstly, fifteen panel testers were employed to evaluate organoleptic flavor to chose the best burger formula. Secondly, the panelist were employed to evaluate organoleptically the color, odor, taste , texture and over all acceptability of all samples under investigation. Sensory of properties evaluated in Nutrition and Food Science Department,Minufia University according to **Bennion and Bamford,(1973).**

Ranking method was used to find out the best product which had the lowest sum of ranks. The critical values of differences among the sum of ranks were used for testing the significant differences between the products where the significant is attained when the rank sum differences are greater than or equal to the critical differences (**Basker,1988**).

Results and discussion

1- Gross chemical composition

Table (1) shows proximate gross chemical composition of cooked commercial and planted burgers on wet weight base.From these data, it could be observed that commercial beefburgur contained 32.01% moisture, 28.76% protein, 36.51% fat, 1.79% ash and 0.93% carbohydrates. Sample A contained high level of carbohydrates and Sample C had higher content of protein, fat and ash when compared with the other planted burger samples.From the Table(1), it could be noticed that the commercial hamburger had higher content of moisture than the other samples , this may be due to the high ercontent of moisture in raw material. Sample C had higher content inprotein more than the other plant burger sample , this due to the high content of soy bean . All plant burger samples were lower in fat than the commercial hamburger and it could be healthy for more diseases as diabetics, hypercholesterolemic and heart disease**(*Guillon and Champ, 2002)***.

Table (1): Chemical composition of cooked plant and commercial burger samples on wet weight base.

Components %	beefburger	Sample A	Sample B	Sample C
Moisture content	32.01	12.2	13.93	12.2
Protein content	28.76	14.43	13.5	22.68
Fat content	36.51	2.13	2.1	5.80
Ash content	1.79	2.54	2.8	3.21
Total carbohydrates	0.93	68.7	67.67	56.11

2-The PHvalue of planted burger and commercial burger samples during cold storage at 4ºC.

The PH values of planted burger and commercial burger samples were measured during cold storage. obtained results are shown in Table (2) it was noticed that , slight differences were found between burger samples in the beginning of storage, but the values of PH values were decreased at the end of storage period. This may be ascribed to The effectof hydrolytic contaminant bacteria (**Kala,2012).** From the Table(2), it could be noticed that commercial hamburger sample recorded a little lower values of PH than the other samples during storage. The highest ph value at the end of storage period was recorded by plant burger (sample C) which was 5.5, this may be referred to higher phenolic compounds, vitamin A and C which found in burger sample which play a role as an antimicrobial effect ***(Chu et al., 2002).***

Table (2): The PH value of plant burger and commercial burger samples during cold storage at 4ºC.

Samples	Storage period			
	0	15	30	45
Hamburger	5.3	5.1	4.8	4.6
Sample A	5.9.	5.9	5.3	5
Sample B	6.1	6	5.7	5.3
SampleC	6.1	5.9	5.9	5.5

3-Changes in hunter color values of the plant burger and commercial burger samples during cold storage.

Hunter color values of the different plant burger samples and commercial hamburger were measured during cold storage at 4 C up to 45 days as L, a and b values. Results are shown in Table (3). From the obtained results, it could be observed that, the Hunter "L" value of commercial at zero time of storage (35.82) was higher than the other samples followed by the planted burger (sample C) (35.69). The differences between these samples were not pronounced. Plant burger sample A had the lowest "L" value (34.08). It could be also noticed that

"L" values increased during storage of all samples while decreased for the hamburger sample. From the same Table(3), It could be found that the commercial hamburger was the most reddish as hunter "a" (7.5) . However, concerning plant burger samples, it could be stated that, sample contained mushrooms,chickpea and lentil increased the "+a" value .This may be due to the effect of protein and phenolic acids content of on the samples color. The red color degradation of commercial hamburgerwas more than that of the plant samples. From the same table, it could be noticed that , the hunter yellowness values (+b) increased during cold storage plant burger samples while, in case of commercial hamburger was decreased .

Table (3): Changes in hunter color values of plant burger and commercial burger samples during cold storage at 4ºC.

Samples	Hunter color	Storage period			
		0	15	30	45
Beefburger	L	35.82	35.71	34.72	33.34
	a	+7.50	+7.07	+5.43	+4.18
	b+	+13.52	+13.32	+12.11	+11.64
Sample A	L	34.08	34.22	35.13	37.30
	a	+5.44	+5.30	+5.29	+5.09
	b+	+15.6	+15.55	+15.41	+16.02
Sample B	L	34.55	35.36	35.62	39.05
	a	+5.83	+5.84	+5.60	+5.43
	b+	+14.66	+14.50	+14.78	+15.44
SampleC	L	35.69	35.80	35.76	40.54
	a	+6.65	+6.14	+5.80	+5.50
	b+	+14.90	+14.80	+14.23	+15.88

4-Total volatile nitrogen values of planted burger and commercial burger samples during cold storage at 4ºC.

Table (4) indicates total volatile nitrogen (T.V.N.) in cooked planted burger and commercial burger samples during storageat4ºC up to 45 days. From the obtained data, it could be observed that , there was gradual increase in TVN during cold storage of commercial Beefburger. This due to protein hydrolytic activity of contaminatingorganisms. The increasing of this parameters may be led to insanitary procedure during processing of commercial burger**(Stranger, 2002**) . The value of TVN was higher in case of sample A followed sample B and the last one sample C. This may be due to antimicrobial effect of phenolic acids and the antioxidants content of plant burger samples(**Ranogajec*et al.*2010)**.

Table (4): Total volatile nitrogen values of plant burger and commercial burger samples during cold storage at 4ºC.

Samples	Storage period (days)			
	0	15	30	45
Beefburger	14.5	14.9	23.6	40.9
Sample A	14.0	14.5	21.3	32.5
Sample B	13.7	14.9	20.8	30.9
SampleC	12.8	13.5	17.8	23.9

5- Microbial evaluation of planted burger and commercial burger samples during cold storage at 4ºCupto 45days..

From Table (5), it could be found that there is no microbial count at zero time for all samples which was due to cooking until internal temperature of 75 ºC . This is due to the heat of cooking which led to kille the vegetative cells ***(Brock,2009)***. After 15 days in the cold storage, the total count was still in the range of allowance because it was less than 1×105 cfu/g ***(Speck, 2008)***. After 30 days, the total count they increased. This count led to increasePHvalue and TVN and after 45 days storage they increased and become spoilage because the range was higher than the total count limit .

Table (5): Microbial evaluation of plant burger and commercial burger samples during cold storage at 4ºC.

Samples	Storage period			
	0	15	30	45
Beefburger	2×10^4	5×10^5	7×10^7	5×18^8
Sample A	3×10^2	7×10^3	1×10^5	5×10^7
Sample B	1×10^2	6×10^3	2×10^6	4×10^6
SampleC	1×10	2×10^2	2×10^3	5×10^4

6- Sensory evaluation of planted burger and commercial burger samples during cold storage at 4ºC.

The samples under investigation were sensorially evaluated for color, odor, texture, taste and over all acceptability and the results were statically analyzed . The results are shown in tTable (6). From these data, it could be noticed that, the best color was that of the commercial hamburger followed that sample C with nonsignificant differences. There is no significant differences between samples in case odor , taste, texture and over all acceptability.Adding the carrot, soy bean , lentil and mushroom led to improve the sensory properties of the samples when compared to commercial hamburger***(*Pérez-López *et al.*,*2009**).

Table (6): Sensory evaluation of plant burger and commercial burger samples during cold storage at 4ºC.

Samples	Storage period(days)				
	Color	odor	Taste	Texture	Over all acceptability
Hamburger	9^a	9^a	9^a	9^a	9^a
Sample A	8^b	9^a	9^a	8.7^a	8.9^a
Sample B	8^b	9^a	9^a	8.8^a	9^a
SampleC	8.5^a	9^a	9^a	9^a	9^a

Conclusion

From the obtained results it could be concluded that , using mixture of wheat ,lentil, chickpea with carrot , mushroom and soybean to produce three formulas according burger methods led to obtain products had low content of fat , high in ash and carbohydrates . The color , PH value and sensory properties were nearly when compared with commercial hamburger.

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