PREPARATION OF MODIFIED CHICKEN BURGER BY PARTIAL REPLACEMENT OF CHICKEN MEAT WITH POWDERED OF OYSTER MUSHROOM AND STUDY IT IS PHYSICAL AND SENSORY PROPERTIES

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ABSTRACT

This study examined the effect of partial replacement for chicken meat with mushroom powder (MP) in chicken burger production, chicken meat was partially replaced by MP in ratios of 0,10, and 15%. physical properties, and sensory evaluation were done at zero time and after 3 and 7 days of storage at 6 ± 1°C. The results showed that 15% of beef meat could be replaced with MP and still providing good quality of burger. also burger formulated with 15% MP significantly p≤ 0.05 recorded the lowest reduction in weight loss during cooking , diameter and thickness 6.42, 5.95 and 12.52% as compared with control 32.48 , 18.04 , 37.82 %. The adding of MP has significantly increased the water holding capacity of manufactured burgers it was 30.13, 52 .25 and 58.03% for control , 10% and 15% substitute respectively .In the sensory evaluation, burger incorporated with 10 and 15 % MP had the highest scores for all sensory attributes. the juiciness and tenderness of these burgers was improved, So that values of these parameters were increased with increasing of replacement percentage of meat comparing with control treatment. the present study suggested that incorporation of MP up to 15 % to replace chicken meat improved flavor, juiciness , tenderness and acceptance.

Key word: chicken, manufacture, diameter, thickness, storage time, evaluation

تحضير برغر دجاج محور بالاستبدال الجزئي للحم الدجاج بمسحوق الفطر King oyster mushroom ودراسة صفاته الفيزيائية والحسية

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المستخلص

اجريت الدراسة لمعرفة تأثير الاستبدال الجزئي للحم الدجاج بمسحوق الفطر وبنسب هي صفر و10و 15 % في الصفات الفيزيائية والحسية للبرغر المصنع، اجري تقييم للصفات الحسية والفيزياوية بعد التحضير مباشرة وكذلك بعد مرور 3 و 7 ايام من الخزن على درجة حرارة 6 ± 1 °م. اظهرت نتائج الدراسة الحالية ان استبدال لحم الدجاج بنسبة 15 % من مسحوق الفطر ادى الى الحصول على برغر ذي نوعية عالية. وامتازت النماذج التي احتوت على 15 % من مسحوق الفطر على اقل نسبة تغير في الوزن والقطر والسمك بعد التصنيع التي كانت بواقع 6.420، 5,95 و12,52 % مقارنة مع نموذج السيطرة البالغة 32.48 ، 18,04 و37,82 %. وقد وجد ان لنسبة الاستبدال الاثر المعنوي في زيادة صفة قابلية حمل الماء البالغة 30,13، 52,25 و58,03 % في نموذج السيطرة ونماذج الاستبدال بنسب 10و 15% على التوالي. وعند اجراء التقييم الحسي للنماذج وجد ان استبدال لحم الدجاج بمسحوق الفطر حسن من صفات العصيرية والطراوة اذ ازدادت القيم بزيادة نسبة الاستبدال مقارنة مع معاملة السيطرة وكانت هذه الزيادة معنوية كما زادت الدرجات الممنوحة لصفة النكهة والتقبل العام وكانت الزيادة معنوية للاقراص المصنعة باضافة 10 و 15%.

الكلمات المفتاحية: الدجاج، تصنيع، القطر، السمك، فترة الخزن، التقييم الحسي.

INTRODUCTION

Mushrooms have been broadly used as food or food ingredients in various food products for a long time. Dry matters of mushrooms contain more than 25% protein, less than 3% crude fat and almost 50% of total carbohydrate (13). Mushrooms are considered to be healthy because they are low in calories, sodium, fat and cholesterol level. Therefore, they form an important constituent of a diet for a population suffering from atherosclerosis (8). It also contain appreciable amount of dietary fiber and β-glucan, vitamin B groups, D and other useful nutrients .Oyster mushroom have a great potential, due to their a great nutritional value since they are quite rich in protein, with an important content of essential amino acids and fiber, and poor in fat. Edible mushrooms also provide a nutritionally significant content of vitamins B1, B2, B12, C, D and E (10 ,11). Edible mushrooms could be a source of many different nutraceutical such as unsaturated fatty acids, phenolic compounds, tocopherols , ascorbic acid and carotenoids. Thus, they might be used directly in diet and promote health, taking advantage of the additive and synergistic effects of all the bioactive compounds present (9 and 17).The functions of mushroom include reducing cholesterol (3), lowering blood pressure, strengthening the immune system against diseases (19), combating tumors (14) and improving liver function (22). Freshly harvested oyster mushrooms were reported to contain high moisture content at more than 80% and low fat content in average ranged from 0.38% to 2.28%, indicated low calorific value (kcal) contribution of mushrooms on total daily energy intake (4). In previous study found that by replacing MP at 30% % level in formulation, substantial improvement in the protein and fiber contents can be achieved without affecting physical and sensory properties of burger (15). It is expected that by partially replacing beef meat with oyster mushroom powder into burger formulation, an improvement of nutritional composition especially dietary fiber without affecting sensorial properties can be achieved. Thus, the present study was designed to evaluate the effects of oyster mushroom powder added as different ratios 0, 10 and 15% to chicken burger formula as partial replacement on the cooking quality and sensory characteristics of chicken burger.

MATERIAL AND METHODS

Sample Preparation Chicken meat obtained from the local market in Baghdad, fresh oyster mushroom (king oyster mushroom) were obtained from Horticulture Department, College of Agriculture, University of Baghdad kept at 3– 4°C until needed for technological studies.

Preparations of Mushroom Powder

Oyster mushrooms were washed with cold water and blanched with steam for 7 min and dried in a thermostatically controlled oven with air fan to 60°C for 270 min and milled using a Laboratorial disc mill to pass through a 20 mesh/inch sieve, until using. However, steam blanching is necessary to remove the bitter taste from the mushrooms and to completely inactivated the polyphenol oxidase in mushroom (6).

Preparation of Mushroom Powder and Chicken Meat Blends

Mushroom were milled and sieved to obtain the flour. chicken meat was well blended with mushroom powder to produce individual mixtures containing 0, 10 and 15% replacement levels by substituted the chicken meat by Mushroom powder (MP). All samples were stored at 3–4°C until required.

Burger Preparation

Three treatments were prepared with three levels of MP 0, 10 and 15% as chicken meat substitute called C, T10 and T15. Burgers were prepared according to the procedure described by Wan Rosli *et al* (21) with slight modifications. The percentages of all ingredients are unchanged compared with the control sample, whereas the percentage of chicken meat decreases with the increase of MP content .The MP was incorporated into the chicken meat using the formulations described in Table 1. The chicken meat was manually cut using a cleaver and minced using a food processor. Starch , water , shortening, spices and Salt were also added to the minced meat and mixing was carried out using a Hobart mixer for 3 min. The finished chicken burger were then weighed into 70 g portions and then manually molded to produce a uniform burger with the diameter and thickness of 100 and 10

mm, respectively. The chicken burger were then packed in degradable plastic at 6 ± 1°C for 7 days until further analyses.

Table 1. Ingredients used in chicken patty formulated with different level of mushroom powder

Ingredients	Ground oyster mushroom level (%)		
	0	10	15
chicken meat	100	90	85
Fat	10	10	10
Water	25	25	25
Starch	10	10	10
Salt	1	1	1
Spices	10	10	10
Total	156	156	156

Cooking Procedure

Chicken burger were thawed then cooked on a pan-fried electric skillet for 7-8 min until an internal temperature of 72± 1°C was achieved.

Physical Characteristics of Burger

Loss in weight: measuring the weight of six burgers for each treatment and calculations of weight differences before and after cooking according to EL-Magoli *et al* (9).

$$\text{Loss in weight (\%)} = \frac{\text{weight before cooked} - \text{weight after cooked}}{\text{weight before cooked}} \times 100$$

Diameter reduction (%) calculated by using the following equation:

$$\text{Diameter reduction (\%)} = \frac{\text{raw burger diameter} - \text{cooked burger}}{\text{raw burger diameter}} \times 100$$

Changed In Thickness: Measuring the thickness of six chicken burgers for each treatment and calculations of thickness differences for burgers before and after cooking according to (9).

$$\text{Thickness reduction (\%)} = \frac{\text{raw burger thickness} - \text{cooked burger thickness}}{\text{raw burger thickness}} \times 100$$

Water Holding Capacity (W.H.C): calculated according to Denhetog – Meishchke (5) by mixing 50 g of burger with 50 g of water for 1 min, homogenized by blender then the mixture centerfugied at 5000g\min for 10 min, water holding capacity calculated by using the following equation

$$\text{Water holding capacity \%} = \frac{\text{water weigh before centrifugation} - \text{water weigh after centrifugation}}{\text{sample weight}} \times 100$$

Proximate analyses: for fresh and dried mushroom were conducted using A.O.A.C (1) for moisture, ash, fiber, protein by nitrogen conversion factor of 6.25 (Kjeldahl method) , and crude fat content using Soxhlet method, total carbohydrates were calculated by the difference:

Total carbohydrates =100– (g moisture + g protein + g fat + g ash).

Sensory Evaluation

All samples were evaluated by each untrained consumers according to the hedonic scaling method outlined by sensory evaluations were carried out according to baker and drafler (2). By staff of the food Sciences department, University of Baghdad. The cooked burger samples were equally divided into 6 portions. They evaluated samples for, tenderness, juiciness, flavor and overall acceptance on a 10 degree for each characters.

Statistical Analasis: The Statistical Analysis System- SAS (20) program was used to effect of treatments in study parameters. Least significant difference (LSD) test was used to significant compare between means.

RESULTS AND DISCUSSION

Chemical Composition of Oyster Mushroom

The chemical composition for fresh and dried mushroom *Pleurotus eryngii* (King oyster mushroom) are shown in Table 2.

Tabe 2. Chemical composition for fresh and dried mushroom

sample	Mois. (%)	Prot. (%)	Fat (%)	Ash (%)	Cab. (%)	Mois. (%)	Total dietary fibers (TDF)
Fresh mushroom	89.20	1.31	0.15	0.70	8.64	3.0	89.20
Dried mushroom	12.50	28.80	3.00	3.50	52.20	34.5	12.50

Freshly harvested oyster mushrooms were content 89.20, 1.31, 0.15, 0.70 and 8.64% moisture, protein, fat ash and carbohydrate respectively this results consistent with the results found by Dikeman *et al* (7).while Chye *et al* (4) found that fresh mushroom contain high moisture content at more than 80% and low fat content in average ranged from 0.38% to 2.28%, indicated low calorific value (kcal) contribution of mushrooms on total daily energy intake. Meanwhile dried mushroom which used in this study contained protein concentration of 28.8%, This value is close to the percentage range with those reported previously by Dikeman *et al* (7). They discovered that the protein content of various selected dried mushroom ranged from 23.4 to 43.5%. The fat concentration in oyster mushroom used in the present study is 3.0%. This value is close to the fat content of enokitake mushroom *(Flammulina velutipes)* which had 3.7% fat (7). The total ash content was recorded in oyster mushroom used in this study is 3.50%. Apart from that, dried oyster mushroom contained 34.5 g/ 100 g of TDF The present results were in agreement with the dietary fiber content of the fruiting body of other mushroom species which ranged from 30-40% dry weight (16).

The Physical Properties of Burger

Physical traits of cooked chicken patties incorporated with MP was studied. The percentage of loss in weight during cooked chicken burger incorporated with different level of oyster mushroom and control treatment are presented in Table 3.

Table 3. The changes in chicken burger weight formulated with different level of MP during cooking.

Replacement%	Time of storage at 6 ± 1°C (day)		
	0	3	7
C	32.48	32.9 1	34.20
T10	7.04	8.50	9.15
T15	6.42	7.23	8.10
L.S.D	*5. 84	*6. 02	*6.27

(P < 0 .0 5) *

The results in Tab 3 showed a significant reduction in percentage of loss in weight during cooking with increasing in substituting percentage of chicken meat by MP in burger formulations. At zero time (burger don't storage) It was 32.48,7.04 and 6.42% for C, T10 and T15 respectively, while the percentage of weight loss became 32.91, 8.50 and 7.23% for samples of burger which stored for 3days at 6 ± 1°C before cooking and 34.91,9.15 and 8.10% for samples of burger which stored for 7days at 6 ± 1°C before cooking .The results reveled that burger formulated with oyster mushroom showed a decrease ($P < 0.05$) in weight loss during storage . This is consistent with what was said (12) about the low percentage loss during cooking when using vegetable additives in the manufacture of burger .The loss in weight could be attributed to the high loss of moisture during cooking specially in control treatment. There were an inverse relationship between moisture retention and cooking yield with the level of mushroom used in the burger patty formulations. This is probably due to the in ability of fresh oyster mushroom fiber to create a tridimensional matrix within the patties. Table 4 shows the effects of MP addition on The percentage of change in diameter of beef patties The results refer to a significant decreased in diameter changes with increased in replacement pure beef meat by MP.

Table 4. The changes in diameter of chicken burger formulated with different level of MP during cooking

Replacement %	Time of storage at 6 ± 1°C (day)		
	0	3	7
C	18.04	19.81	20.32
T10	8.33	8.86	9.03
T15	5.95	6.70	7.15
L.S.D	* 4 .79	* 5 .33	* 4 .9 6

(P < 0 .0 5) *

The highest value in diameter reduction in control treatment and the lowest value in treatment which chicken meat substituted by 15% MP , at zero time for fresh burger it was 18.04, 8.33 and 5.95% for control ,T10 and T15 respectively while in samples which stored for 3 day at (6 ± 1°C) it was 19.81,8.86 and 6.70% and in samples which storage 7 days at the same temperature 20.32, 9.03 and 7.15%. Table 5 illustrated the changes in burger thickness after cooking, the results refer to that the thickness influenced by MP incorporation the reduction in thickness of

patty during cooking decreased proportionally with the level of MP in the formula. Oyster mushroom-based patties 15% substitute recorded lowest in reduction of thickness for all period of storage 12.52, 12.83 and 13.24 % and are significantly lower (P<0.05) than control patty which recorded 37.82, 38.77 and 39.81 % for the same period of storage.

Table 5. The changes in thickness of chicken burger formulated with different level of MP during cooking.

Replacement (%)	Time of storage at 6 ± 1°C (day)		
	0	3	7
C	37 .8 2	38 .77	39 .81
T10	1 6 .78	1 6 .90	1 7 .41
T15	1 2 .52	1 2 .8 3	1 3 .24
L.S.D	* 6 .41	6 .5 7 *	* 6 .38

(P < 0 .0 5) *

The results of water holding capacity of patties formulated with MP illustrated in tab 6 it was similar with the trend of the loss in weight during cooking result in Tab 3. The results showed that the substituted meat by MP significantly effected in increasing the water holding capacity, and this properties increased with the increased in percentage of MP this explains the reduced loss in weight during cooking patty. The reason may be due to the ability of plant proteins to hold the water and formation a network with it as functional properties **(**18**).** Oyster mushroom-based patties15% substitute recorded highest in water holding capacity for all period of storage 58.03, 62.42 and 64.65% and are significantly higher (P<0.05) than control patty which recorded 30.13, 31.15 and 32.24% for the same period of storage this results consist with results found by Wan Rosli *et al* (21) .

Table 6. The changes in water holding capacity of chicken burger formulated with different level of MP during cooking.

Replacement %	Time of storage at 6 ± 1°C (day)		
	0	3	7
C	30.13	31.15	32.2 4
T10	52.25	55.47	59.57
T15	58.03	62.42	64.65
L.S.D	* 5.86	*6.93	*5.36

Sensory Evaluation

Table 7 shows the effects of substituted chicken meat by MP on the flavor, juiciness, tenderness and acceptant of patties. Generally, all properties attributes investigated were influenced by MP substituted percentage.

Table 7.Effect of substituted chicken meat by MP on sensory evaluated of modified chicken burger

Characters	Rep. (%)	Storage time (day)		
		0	3	7
Flavor	0	8.50	8.00	7.25
	10	9 .00	8 .50	8 .5 0
	15	8 .25	8 .00	7.75
LSD	-------	0.75 NS	0.63 NS	0.77*
Juiciness	0	7.50	7.35	6.00
	10	8.25	8.00	7.50
	15	8.50	8.00	7.25
LSD	-------	0.62*	0 .71*	NS o.66
Tenderness	0	7.50	7.00	5.00
	10	8.50	8.50	8.25
	15	9.50	9.25	9.25
LSD		0 .83*	0 .77*	0 .81*
Acceptant	0	8.00	8.00	6.50
	10	9.00	8.50	8.25
	15	9.50	8.50	8.50
LSD		0 .64*	NS 0.69	0.72*
(P < 0 .0 5) * NS=non significant				

The juiciness and tenderness of these patties was improved, So that values of these parameters were increased with increasing of replacement percentage of MP comparing with control treatment. The scores of flavor were increased in treatments T10 and T15 compared with control, The juiciness of chicken patty increased proportionally with the level of MP. MP-based patties 10% recorded juiciness ranging from 8.25-7.50. through 7 days of storage and 15% ranged 8.50-7.25 which are significantly higher P<0.05 than control patty which recorded 7.50-6.00 through 7 days. The tenderness of chicken patties was also increased proportionally with the level of MP. chicken patty prepared without MP (control) was 7.50-5.00 lower compared to patties prepared with 10% (8.50-8.25) and 15% (9.50-9.25) MP. This increased in juiciness , tenderness could be attributed to the higher in water holding capacity of oyster mushroom . Similar trend was also recorded in acceptant addition of MP in chicken patties increased the acceptant of treatments patty. The acceptant for control recorded 8.00-6.50 significantly P<0.05 lower than the acceptant properties of burger s with 10% of MP 9.00-8.25 and within 15% MP ranged 9.50-8.50. From the above results we conclude that the adding of MP was improved the quality of processed product and give the best results without undesirable changes in physical and sensory properties, moreover that we can replace MP instead of chicken meat in processed chicken patties to reduce of meat, which consider as healthy additives for consumer who suffer from high concentration of cholesterol in blood.

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