Effect of the Partial Replacement of Meat with Some Legumes such as (Chickpeas) on Some of the Chemical and Sensory Characteristics of the Manufactured Burger

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Abstract

Local fresh veal meat of a year-old calf has been used with chickpeas (Cicer arietinum) in burger manufacturing with mixing percentage of (100% veal meat) (T1) with (50% flour of non-boiled chickpeas +50% veal meat) (T2). (50% boiled chickpeas + 50% veal meat) (T3) with, (75% flour of non-boiled chickpeas +25% veal meat) (T4) with (75% Boiled chickpeas+25% veal meat) (T5) and (25% flour non-boiled chickpeas + 25% cooked chickpea +50% veal meat) (T6). The results showed that the moisture content in the processed burger tablets, according to the first treatment where of the highest values recorded as it was (61.86%), while the fourth treatment has recorded the lowest values of (24.14%). The percentage of protein in the treatment, the fourth has recorded the lowest values of (19.25%), whereas the fifth-treatment recorded less values of (9.11. %). The percentage of fat in treatment, the first recorded the highest values of (3.18 %), while the fifth-treatment recorded lower values of (6.82%). The percentage of carbohydrates in the treatment where the fourth recorded the highest values of (42.46%), and the lowest values were the first treatment as it was (zero %).

The results showed that the Ash the second treatment recorded the highest values of (90.2%), while the first treatment recorded the lowest values of (1.10%). Fiber percentage in the treatment, the fourth treatment recorded the highest values of (2.55%), while the first treatment recorded the lowest values of (zero %). The results showed the caloric value in the treatment, the fourth treatment recorded the highest values of (74.328. kilo calories / 100 g), while the fifth-treatment recorded the least values of (181.74 kilo calories / 100 g). Values of the free fatty acids, the first treatment recorded the highest values of (2.02%), while the fifth-treatment recorded lower values of (0.68%). PH treatment, the fifth recorded the highest values of (9 0.3), while the first recorded the lowest values of (6.6). The study showed that changes after cooking showed that the method of frying by oil has led to a greater drop in the tablet weight ranged between (28.25% - 13.30 %) while change in the diameter of tablets ranged between (24.17% -91.22 %), and the change in the thickness of the tablets ranged between (85.20% -33.28%).

The results of the sensory assessment of the studied qualities have shown tenderness evaluation rate of (7.5) the taste was (7.8) the smell and the flavor were (7.3) texture was (7.4) the juiciness was (8.3) and the general satisfaction was (7.7) out of (9.0) degrees which indicates that the manufactured product has got a good rate for all the studied sensory qualities.

Introduction

Manufactured and half - raw meat business have been spread around the world, the burger tablets manufacturing being the most important of these industries. The world is also witnessing in recent times, health and nutrition risks caused by several reasons, the most important of all are high blood pressure, blood vessels and cholesterol problems, which are all due to excessive meat intake. Many studies have also indicated that vegetarians have fewer opportunities of infections with these diseases and less mortality rates at early ages compared with those who consume meats on a regular basis (Apply *et al*, 1999). The studies have also shown high percentage of infections with cardiovascular related diseases, with people who eat meat regularly compared with the vegetarians according to (Fu, BX and Sapirstien,1999). In addition to those health risks, one of the most important objectives of the nutritionists is to obtain food products of a high-quality and a low cost as the blending of vegetable protein and animal protein improves quality of the food products.

 Burgers are considered, one of the most important meat products, the most common and the most desirable, both domestically and worldwide. Therefore, it's important to develop the traits and sensory qualities of meat burgers and reduce the costs of this product (Vaisey *et al*,1979). Several other researches and studies have also shown the possibility of manufacturing bovine burger tablets from various types of animal meat, and manufacturing of bovine meat burgers by replacement with vegetable proteins or attempting to replace some other meats. The effect of flour of broad beans on some qualitative and sensory qualities of the burger (Alsakni *et al*, 1991)The partial replacement of meat with vegetable alternatives and their effects on some chemical properties of the beef burger (Addoori ,1992), Also the partial replacement of meats with vegetable alternatives and their effects on the chemical characteristics on the beef burger (Adoori and Elaswad, 1992) Effects of adding the re-wetted beans

powder and the fat level on the qualitative and the sensory qualities of the beef burgers cooked by different ways (Yusuf *et al*, 1995).

A number of other studies also have mentioned the possibility of replacements of the bovine meat with vegetable alternatives. Among those studies: (Elaswad *et al*, 2000) a study of the chemical assessment for the bovine burger replaced partially with some vegetable alternatives. (Elani *et al*. 2000) a study of the possibility of replacing bovine meat with the meat of aged female goatss as a substitute in the sensory and qualitative characteristics of the manufactured burgers. (Filic and Ali, 2003) in a study of the possibility of manufacturing burgers with fish meat .(Mahendvalsar *et al*, 2004) a study of manufacturing burgers by buffalo meats. (Ajumaili, 2005) the possibility of manufacturing burgers with aged chicken meats and adding proteins of soya bean in the manufacturing of burgers. (Al-Tamimi *et al*, 2007) a study of manufacturing of burgers by replacing the bovine meat with the meat of aged laying hens which is diluted with proteins of soya beans (Habib *et al*. 2008) a study of evaluation of sensory qualities and some other qualities after cooking of fish meat using (the Iraqi Juri fish meat). (Addoori *et al*, 2009). A study of manufacturing of burger tablets by Elauasih lamb and local goatss meats. The study also handled the preparation of healthy nutritional and economic meal for the consumer.

Methods and Materials

1-Meat: - fresh veal meat was used in the manufacturing as it has been obtained from the meat markets in Kirkuk city. Then, the meat was sliced into smaller pieces for a better grinding process later on the small pieces of the meat were put inside polyethylene bags and wrapped up tightly and stored at a temperature of (-18 ± 2) until the meat is used again.

2-Legumes: - one kilogram of dry chickpeas was obtained from the local markets in Kirkuk city and was boiled. Then, the boiled chickpeas were hashed by an electric mincer. Then, the dry chickpeas were milled directly by the lab milling machine and preserved at a temperature degree of (-18 ± 2) until use.

3-Garlic: - the garlic was peeled and mashed thoroughly in order to be ready for adding during the preparation process of the meat paste. Percentage of the applied garlic was (1.5%) of the weight of the manufactured product for each treatment.

4-Spices: - a variety of (black pepper, coriander, cumin, cinnamon and nutmeg) spices were obtained from the local markets and were mixed and made available in a way that suits the consumer's taste. Then, the mixture was put in glass jar until use. Percentage of the spices was (1%) of the weight of the manufactured product for each treatment.

5- Salt: - a purified and free of impurities table salt (NaCl) was added to the mixture. The percentage was (1%) of the weight of the manufactured product for each treatment. The experiment included six treatments, as follows: -

The first treatment: - (100% veal meat) (T_1).

The second treatment: - (50% non-boiled flour of chickpeas +50% veal meat) (T_2).

The third treatment: - (50% of boiled chickpeas +50% veal meat) (T_3).

The fourth treatment: - (75% flour of non-boiled chickpeas +25% veal meat) (T_4).

The fifth treatment: - (75% Boiled chickpeas+25% veal meat) (T_5).

The sixth treatment: - (25% of non-boiled flour of Chickpeas +25% Boiled chickpeas+50% veal meat) (T_6).

After calculation of the required quantities of meat and some legumes (chickpeas) the quantities were ground by an electric grinding machine twice in a row. Then, the specified percentages of the spices, salt and garlic were added. Each mixing process was carried out separately, and the burgers were manufactured by a special manufacturing machine.

 Burger tablets were put in polyethylene bags and separated by a layer made of nylon. Then the bags were tightly closed and placed into the refrigerator at a temperature of (-18 ± 2) (Cross, 1980) methods was applied for the assessment of degrees of evaluation of the appearance and degrees of sensory assessment according to the attached form.

6- Assessment of some of the chemical and physical properties: -

(A) Moisture, fat, proteins and ash contents were estimated according to the method adopted by (AOAC, 2004) by applying the drying oven to estimate moisture, applying (Sockslet) device for the estimation of fat, applying (Caldal) device for estimating the proteins and finally applying the (incineration) oven to estimate the ash.

B- Ratio of the Carbohydrates was estimated by calculating of the difference after collecting the protein, fat, ash and moisture ratios and subtracting them from 100. Then the difference will be representing the percentage of carbohydrates. While fibers have been calculated by the difference of the percentage (Rechcigl,1982).

C- Estimate of (PH): the (PH) was measured for the treatments by PH meter device and according to the method mentioned by (AOAC, 2004).

D- Estimate of free fatty acids (FFA): percentages of the free fatty acids have been estimated according to the method described by (Pearson, 1972).

7- Changes in weight, Thickness and Diameter:

Change in weight, thickness and diameter has been measured according to the methods suggested by (Borry, 1980) and (Engle, 1975).

$$\% \text{ for loss in weight} = \frac{\text{Weight before cooking (g) - weight after cooking (g)}}{\text{Weight before cooking (g)}} \times 100$$

$$\% \text{ for loss in diameter} = \frac{\text{Diameter before cooking (mm) – diameter after cooking (mm)}}{\text{Diameter before cooking (mm)}} \times 100$$

$$\% \text{ for loss in thickness} = \frac{\text{thickness before cooking (mm) - thickness after cooking (mm)}}{\text{thickness before cooking (mm)}} \times 100$$

Form of the Sensory Assessment/ Prepared by the Researcher

Traits ＼ degrees	Tenderness	juiciness	Smell & flavor	Texture	Taste	General Satisfaction
9 Excellent						
8 very good						
7 Good						
6 Average						
5 Accepted						
4 Rejected						

Results and Discussions

Results in Table (1) have shown that percentages of moisture content in the treated burger tablets according to the treatment were (61.86%, 36.8%, 60.9%, 24.14%, 60.52%, 48.52%) for the treatments T_1, T_2, T_3, T_4, T_5, T_6, respectively. Results were close to what has been found by (Abbas, 2009) in his study on the manufacturing of burger parallel by veal meat and some legumes (peas and beans), as the moisture contents in his study ranged between (50.78- 60.86 %). Results were also close to the findings of (Abdullah *et al*, 2009) in their study on manufacturing of burger tablets by a mixture of lambs and goats' meat, as moisture ranged between (46.12-59.73%). Results in Table (1) indicated that the protein ratio was (18.8%, 19.1%, 14.25%, 19.25%, 11.9%, 16.67%) for the treatments T_1, T_2, T_3, T_4, T_5, T_6, respectively. The results were close to the findings of (Abbas, 2009) in his study on the manufacturing of burger by veal meat and legumes such as (peas and cowpeas). As the protein content ranged between (8.5 - 22.7 %). The results were not confirming to the findings of (Addoori *et al*, 2009) in their study on manufacturing of burger tablets by the mixture of lambs and goats' meat, as the protein percentage has ranged between (28.68-35.98%). Its noted from table (1) that the percentage of fat was around (18.3%, 12.3%, 10.75%, 9.1%, 6.82%, 11.52%) for the treatments T_1, T_2, T_3, T_4, T_5, T_6, respectively. Results were close to what has been found by (Abbas, 2009) in his study on the manufacturing of burger parallel of veal meat and some legumes (peas and cowpeas) as the fat ratio ranged between (7.4-17.4%). The results were not confirming with the findings of (Addoori *et al*, 2009) in their study on manufacturing of burger tablets by the mixture of lambs and goats' meat, as the fat contents ranged between (11.15-16.29%). Table (1) indicates that the percentage of carbohydrates was about (Zero, 27.2, 12.15, 42.46, 18.19, 20.02%) for treatment T_1, T_2, T_3, T_4, T_5, T_6, respectively.

Results in table (1) have shown that the percentage of ash was (1.10, 2.90, 1.45, 2.51, 1.37, 1.77%) for the treatments T_1, T_2, T_3, T_4, T_5, T_6, respectively. Results were confirming to what has been found by (Abbas, 2009) in his study on the manufacturing of burger parallel of the veal meat and some legumes (peas and beans), as the ash content ranged between (1.5-3.8%). The results were not conforming to the findings of (Addoori *et al*, 2009) in their study of the manufacturing of tablets of burger by mixture of lamb and goats' meat, as the ash content ranged between (0.44-2.58%). Results shown in Table (1) that the percentage of total fiber was (zero, 1.70, 0.80, 2.55, 1.20, 1.25%) for treatment T_1, T_2, T_3, T_4, T_5, T_6, respectively. It's also noted from table (1) that the caloric value of the treatment was (239.9, 295.9, 202.35, 328.74, 181.74, 250, 44 kilocalories / 100 g) for the treatments for treatment T_1, T_2, T_3, T_4, T_5, T_6, respectively. The results were close to the findings of (Addoori *et al*, 2009) in

their study on the manufacturing of tablets of burger by mixture of lamb and goats' meats as the value ranged between (215.07-290.53) kilocalories / 100 g.

Table (1) representing some of the chemical characteristics of the manufactured Burger and the caloric values

Treatments	Moisture%	Proteins%	Fat %	Ash %	Carbohydrates %	Fibers %	Caloric values kilocalories / 100 g.
T1	61,8	18.8	18.3	1.10	-	-	239.9
T2	36.8	19,1	12,3	2,90	27,2	1,70	295,9
T3	60,9	14,25	10,75	1,45	12,15	0,80	202,35
T4	24,14	19,25	9,1	2,51	42,46	2,55	328,74
T5	60,52	11,9	6,82	1,37	18,19	1,20	181,74
T6	48,77	16,67	11,52	1,77	20,02	1,25	250,44

Table (2) represents the chemophysical changes for the treatments. The table shows that values of the free fatty acids were (2.02, 1.90, 1.25, 0.94, 0.68, 1.57%) for the treatments for treatment T_1, T_2, T_3, T_4, T_5, T_6, respectively. The results were close to the findings of (Abbas, 2009) in his study on the manufacturing of burger parallel by veal meat and some legumes (peas and cowpeas) as the values of free fatty acids ranged between (0.57- 2.03%). The results were confirming to the findings of (Addoori *et al*, 2009) in their study on manufacturing of burger tablets by the mixture of lambs and goats meat as the value of free fatty acids ranged in their study between (1.074-1.198%). Table (2) also indicated that the values of (PH) were (6.6, 6.9, 7.7, 8.9, 9.3, 7.2) conforming to for treatment T_1, T_2, T_3, T_4, T_5, T_6, respectively. The results were close to what has been found by (Abbas, 2009) in his study on the manufacturing of burger parallel by veal meat and some legumes (peas and cowpeas) as the PH values ranged between (6.5-9.4). The results did not correspond with the findings of (Addooriet al., 2009) in their study on the manufacturing of burger tablets by the mixture of lambs and goats meat as PH value ranged between (5.5-6.2).

Table (2) represents the PH values and the free fatty acids FFA

Treatments	FFA%	PH
T1	2,02	6,6
T2	1,90	6,9
T3	1,25	7,7
T4	0,94	8,9
T5	0,68	9,3
T6	1,57	7,2

Table (3) shows the changes after cooking. Frying by oil method, has led to a decline in the weight of the tablets as they were (30.13, 28.41, 28,82,25,28, 27.35, 26.21%) for the treatments T_1, T_2, T_3, T_4, T_5, T_6 respectively. The reason for this is that meat and meat products lose a variable parentage of the weight during cooking. The losses are mainly occurring with the dripping fluid on cooking (Cokking drip). The results were close to the findings of (Aljumaili, 2005) as It has been found that the percentage of weight loss in the beef burgers and the chicken meat was (28%) in products that are not supported with holding materials such as the soybeans as the percentage was (25.1%) in the materials supported by soybean. Results were close the findings of (Abbas, 2009) as it has been noticed that the loss percentage in weight ranged between (25.81% -36.13%) in the tablets parallel to the burgers manufactured by veal meat and some legumes. Results were not confirming to the findings of (Alddoori *et al* ,2009) in their study on the manufacturing of burger tablets by mixture of lamb and goats meat as the ratio of loss in weight after the cooking process (frying, boiling) ranged between (29% -39%).
Whereas, the change in diameter of the tablets (22,91,18,78,22,04,17,24,20,76,19,56%) for the treatments T_1, T_2, T_3, T_4, T_5, T_6 respectively. That was due to the loss in weight and decrease in the amount of the proteins and gathering of tissues of meat, causing the shrinkage of the manufactured burgers as a result of the partial replacement of meat with some legumes such as (chickpeas). These findings were close to the decrease of size of the chicken meat burgers which was (20%) (ALjumaili, 2005). Results were close to the findings of (Abbas, 2009) as he has noted that the rate of change in the diameter after cooking ranged from (18.51% -24.11%) in the

tablets of the burger mixture made of veal meat and some legumes. The results were close to the findings of (Alddoori *et al*,2009) in their study of the burger manufacturing by mixture of lamb and goats meat as the percentage of change in diameter after the cooking (frying, boiling) was between (20% -25%). The change in the thickness of the tablets was (28,33,22,19, 27,98,20,85,25,36,23,21%) for the treatments T_1, T_2, T_3, T_4, T_5, T_6 respectively. Results were close to the findings of (Abbas, 2009) as he has noted that the percentage of change in thickness after cooking ranged (22.23% -30.23%) in the tablets manufactured by mixture of lamb and goats meat. The results were confirming to the findings of (Alddoori *et al*, 2009) in their study of manufacturing of burger tablets by mixture of lamb and goats meat as the percentage of change in the thickness after cooking (frying, boiling) ranged between (19% -27%) Therefore, those changes that took place were due to adding of garlic and salt, which caused the withdrawal of the constituting water, causing it to become ready to dripple during the cooking as a liquid dripping after cooking.

Table (3) changes in some of the properties after cooking (frying)

Treatments	Trait	% for loss cooking(frying)
T_1	Weight(g)	30.13
	Diameter(m)	22.91
	Thickness(m)	28.33
T_2	Weight(g)	28.41
	Diameter(m)	18.78
	Thickness(m)	22.19
T_3	Weight(g)	28.82
	Diameter(m)	22.04
	Thickness(m)	27.98
T_4	Weight(g)	25.28
	Diameter(m)	17.24
	Thickness(m)	20.85
T_5	Weight(g)	27.35
	Diameter(m)	20.76
	Thickness(m)	25.36
T_6	Weight(g)	26.21
	Diameter(m)	19.56
	Thickness(m)	23.21

Table (4) shows results of sensory assessment of the properties studied, as the tenderness rate was (7.5), juiciness was (8.3), taste was (7.8), smell and flavor were (7.3), Texture was (7.4) and the general satisfaction was (7.7) out of (9.0) degrees which indicates that the manufactured product has got a good rate for all the studied sensory qualities Therefore, we will come to the conclusion that the possibility of manufacturing of burger tablets by partial replacement of meat with some beans (chickpeas) to prepare quick ready-to-cook meals with the attempt of improving some of the studied traits to conduct future studies , it's possible to add some holding materials to water to improve those qualities. Results are conforming to the findings of (Abbas, 2009), as he has noticed the degree of sensory assessment ranged between (7.3-8.1) in the tablet of the burger mixture made of veal meat and some legumes. Yet, the results were not conforming to the findings of (Alddoori *et al* ,2009) in their study of manufacturing burger mixture by the meats of lamb and goats, as he noticed the degrees of the sensory assessments have reached a total rate ranging from (6.5-8.0).

Table no (4) Degrees of the Sensory Assessment for Some of the Studied Traits

degrees / Traits	Excellent	Very good	Good	Average	Fair	Total rate
Tenderness		30,18	15,3	54	-	7,5
Juiciness	57,8	-	28,9	10,5	8,3	8,3
Taste	-	32,8	15,8	27,8	-	7,8
Smell & flavor	-	25,3	15,8	30,5	-	7,3
Texture	-	15,7	66,8	29,5	-	7,4
General satisfaction	15,1	35,4	30,1	25,8	-	7,7

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