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Study of Using some Legumes for Household Meat Substitute "Luncheon"

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ABSTRACT

Processed meat and/ or chicken are considered globally preferred to consume, although its association with high percentage of nitrosamine compounds, fats and sodium contents. This study aims to produce cheap, safe and healthy luncheon at household level. Six formulae were prepared: F1, F2, F3, F4, F5 and F6 and stored at 5°C for 15 days. Chemical analysis, fatty acids, amino acids, microbiological and sensory evaluations of the samples under study were performed. The data revealed that F1 was of the highest protein content ≈30% (on dry matter basis), while fat content 37% was of the highest value with F6 and F5 formulae. Providing chickpea to the meat and cheese formulae raised Na, K and Mg concentrations (512, 588 and 68 mg/ 100g dry matter basis, as well as, essential and non-essential amino acids. Moreover, F6 and F5 were more acceptable in sensory evaluation than others. Microbial analysis proved that, all samples had acceptable results concerning total coliform, feacal coliform and *Staph. aureus* counts and the same negative results for the food poisoning microorganism *Salmonella spp.* among the whole experiment. In conclusion: F6 and F5 were the highest and preferable than others in proximate analysis, mineral, protein quality, microbiology and sensory evaluation.

Keywords: Luncheon, chickpea, Faba-Bean, proximate analysis, household level, microbial and sensory evaluation.

INTRODUCTION

Processed meat (hot dogs, frankfurters, ham, sausages, corned beef, canned meat and meat-based preparations), refers to meat (red meats, poultry, offal, or meat by-products) that has been transformed through salting, curing, fermentation, smoking, or other processes to enhance flavor or improve preservation (WHO, 2015). Processed meat are globally gaining ground in popularity and consumption volume. (Gunter Heinz and Hautzinger Peter 2007).

The 2005 US Dietary Guidelines for Americans recommend that consumption of red and processed meat should be moderated. However, its relationships with many diseases, incidence of microbial contamination, nitrites and nitrates constitutes that transformed to nitrosamines, which have a carcinogenic effect. (Ruiz, and Claudio 2010, Joosen *et al.,* 2009). Also mentioned that, processed (nitrite-preserved) red meat additionally contains high concentrations of preformed mutagenic nitroso compounds (NOC). Supplements of nitrate have been shown to increase feacal NOC levels, (Joosen *et al.,* 2009).

It is recognized that, since soaring food prices crisis started in 2008, had negative effects on households' purchasing power and nutritional status especially for the poor (FAO, 2011).

Legumes and pulses are rich source of protein especially lysine which is an important essential amino acid, in addition they contain a large soluble vitamins and minerals (Ruiz, and Claudio 2010).

In Egypt (EULC, 2016) 357 published thesis & researches since1987-2015, studied chemical analysis, heavy metal, micro-organisms, chemical residues in luncheon in different governorates in Egypt, they all proved that most of tested samples collected from local markets were out of Egyptian Organization for Standardization and Quality (EOSQ, 2000), due to unsafe storage and handling procedures. The study aimed to use legumes for preparing cheap, safe and healthy different meat substitutes "luncheon" formulae at household level.

MATERIALS AND METHODS

Materials:

All ingredients were purchased from local markets, Giza, Egypt. It includes minced meat, processed cheese, wheat flour (72%), dry legumes (Faba bean and chickpea), egg, corn oil, garlic bulb, cardamom powder, salt, and dried beet roots table 1.

Preparation of raw materials:

Faba bean and chickpea were washed, soaked in water for 2 hours, boiled till get tender, rinsed and mashed into pasta, beet roots were cleaned, washed, sliced, dried using air draft oven at 65°C then grounded into powder.

Production of luncheon formulae:

Preparation:

Ingredients of each formula were prepared, blended and homogenized in blender. The mixture was packaged thermal polyethylene bags and warped with aluminum foil, then cooked in boiling water for 60 minute till tender.

The cooked formulae were transferred in ice-box (under refrigeration) to food safety laboratory where it was opened under sterilized condition. Each sample was divided into 5 bags (100 g per each) and stored in refrigerator at 5°C to be analyzed through time intervals (0, 2, 5, 9, 12,19, 26 and 28 day). The rest of all formulae were dried at 50°C over night to be analyzed.

Methods:

Chemical analysis:

The chemical analysis has been done in the Regional center for food and feed- Agriculture Research Center. Proximate analysis including moisture, total protein, fat, ash, minerals and crude fiber were carried out according to the methods described by (AOAC, 2005). Carbohydrate content was calculated by difference. Fat was extracted by using Soxelet apparatus (FOSS Tecator, Auckland, NZ). The fatty acids methyl esters were analyzed by gas liquid chromatography (Shimadzu GC2010) using DB-wax column after fatty acids methylation. The carrier gas was helium and the used detector was flame ionization detector (FID). The fatty acids were identified

according to standard fatty acids methyl esters(FAME). The fatty acids profile of luncheon formulae were performed as mentioned by (AOAC, 2012) using Gas-Liquid Chromatography (GLC) technique. Minerals determination (Sodium Na, Potassium K, Magnesium Mg, Iron Fe, Calcium Ca and Phosphorus P) with Optima 2000DV inductively coupled plasma spectrometer with full PC control (Perkin Elmer). Concentrations were obtained based on calibration curves developed by using (Merck). ICP standards.

Table 1. composition of different luncheon formulae.

Ingredients	Meat* (F1)	Cheese* (F2)	Meat/ F.bean (F3)	Cheese/ F.bean (F4)	Meat/ chickpea (F5)	Cheese/ chickpea (F6)
Processed cheese (g)	14	18.3	14	17	14	17
Eggs(g)	39.1	50.7	39.2	35	39.1	35
Flour extract (72%)(g)	4	12.5	4	11.6	4	11.6
Mashed boiled legumes(g)	0	0	15	19	15	19
Minced meat(g)	29.8	0	15	0	15	0
Gallic bulbs(g)	1.1	1.6	1.1	1.5	1.1	1.5
Corn oil(g)	8.7	12.5	8.7	11.6	8.7	11.6
Cardamom powder(g)	0.1	0.2	0.1	0.2	0.1	0.2
Ascorbic acid(g)	0.5	0.6	0.5	0.6	0.5	0.6
Red beet root powder(g)	2.2	3	2.2	2.5	2.2	2.5
Salt (g)	0.5	0.6	0.5	0.6	0.5	0.6

*** Abu Mosallam, (1996)**

Amino acids determination was performed according to (AOAC, 2007) using amino acids analyzer (Biochrom 30) through ion exchange resin via ninhydrin post-column derivatization. The protein quality assessment of the test formulae were based on their amino acids content according to (Mitcheland and Block 1946).

Chemical prediction of protein quality indexes:

Chemical estimation:

Protein quality assessment of the studied formulas were calculated using amino acids profile of egg as reference protein (Mitchel and Block,1946) and (Sarwar *et al.,* 1985).

Calculation of amino acid score as follows:

$$\text{Amino acid score} = \frac{\text{mg of amino acid in 1 gm tested protein}}{\text{mg of amino acid in requirement pattern}} \times 100$$

Essential Amino Acid Index (EAAI %) was performed by (Mente *et al.,* 2002) using the amino acid pattern of whole egg protein according to (Hidvégi and Békés, 1984) as reference protein and follows formula: expressed by the amino acids results were expressed as µmoles of amino acid per gm of flour samples (µmole / g) and as gm per 100 g determined amino acid for reference egg protein.

$$\text{EAAI \%} = \sqrt[n]{aa1/AA1 \times aa2/AA2 \ldots\ldots\ldots X\ aa11/AA11}$$

Where: aa1 is the essential amino acid (A/E) ratio in the protein sample [(EAA/total EAA + tyrosine) ×100], AA1 is the A/E ratio in the egg [(EAA/total EAA+ tyrosine) ×100].

Microbiological Evaluation: The following microbial groups

Total plate counts: were estimated on glucose yeast extract nutrient agar medium (Difco, 1989) using pouring plate technique. Suitable plates were counted after incubation at 37 °C for 48 hours.

Total Coliform and feacal coliform counts: were determined on MacConkey agar (Difco, 2003) using pouring plate technique. Suitable plates were counted after 24 hours incubation at 37 °C and 44.5 °C for total coliform and feacal coliform counts.

***Staphylococcus aureus* counts:** The numbers of *Staph. aureus* were determined on Baird Parker agar medium (Baird Parker and Devenport, 1965). The plates were incubated at 37 ºC for 48 hours

***Salmonella* detection:** Twenty-five grams of each sample were added to 225 ml peptone water as pre-enrichment medium and incubated at 37° C for 24 hours. Twenty-five ml form pre-enrichment medium cultures were added to 225 ml tertrathionate broth (Difco, 2003) as enrichment medium with incubation at 37° C for 24 hours. Then, cultures were streaked on Difco brilliant green agar plates and examined after 18-25 hours (Georgela and Boothroyd, 1965; and Khan and McCaskey, 1973). On the medium, presumptive Salmonella appears as pink colonies surrounded by bright red medium.

Sensory evaluation:

The sensorial criteria (taste, flavor, texture and color) of the six luncheon formulae were evaluated by twenty-five panelists. Luncheon samples were cut into 2 mm thick slices and served in numerically-coded glass petri dishes. Each panelist received sex coded samples (one from each tested samples) then independently evaluated the luncheon meat for texture, flavor, color and taste using a 5-point hedonic scale (1= extremely poor, 2 = poor, 3= acceptable, 4= good, 5= excellent), according to the method described by (Lavrova and Krilov,1975).

Statistical analysis:

Analysis of variance (ANOVA) and Duncan's test were conducted using a Statistical Analyses System (SAS, 2004). A probability to ($P \leq 0.05$) was used to establish the statistical significance.

RESULTS AND DISCUSSION

Proximate analysis:

Data presents in table (2) show the proximate analysis of different prepared luncheon formulae. Data revealed high protein content in basic meat formulae compared to cheese basic, 29.56 g/100g versus 18.66 g/100g. Also, it was observed that protein contents of

faba bean containing luncheon were higher than their corresponding chickpea luncheon. El-Bab and Sayed, (2005) found that, mean protein content were around 19 g/100g dry mater for 30 luncheon samples analyzed from governorates (Cairo, Giza, Zagazig, Alexandria and Beni-Suef).

Fortunately, cheese luncheon was the highest fat contents 37.16 g/100g, while cheese/ faba bean recorded the lowest fat 32.58 g/100g. Chickpea containing formulae showed higher fat concentration than faba bean. The fat contents in tested formulae were similar with (Kortoma and Mohamed, 2009); and (El-Bab and Sayed, 2005).

Regarding fiber contents, chickpea was the highest fiber content while cheese luncheon recorded the lowest fiber content (8.30 versus 1.87 g/100g respectively). The concentration of fiber contents in meat, cheese and the mixture of faba bean with meat and cheese were similar to fiber contents reported by (Kortoma and Mohamed, 2009). Total carbohydrates (CHO) were higher in F4 and F6 formulae (25 and 23g/ 100g dry mater) respectively, while meat luncheon showed the lowest CHO content (12g/ 100g), on the opposite, (Sharaf El-Deen, 2015) found that canned luncheon samples had higher percentage values for both total carbohydrates (48.5%) and crude lipid contents (22.5%).

Table 2. Chemical composition of the different luncheon formulae "% Dry matter basis"

Proximate analysis	Meat (F1)	Cheese (F2)	Meat/ F. bean (F3)	Cheese/ F.bean (F4)	Meat/ chickpea(F5)	Cheese/ chickpea (F6)
Dry matter DM (g)	34.37	33.78	40.28	38.52	41.67	43.88
Crude Protein	29.50	18.66	26.32	21.81	23.52	20.51
Crude Fat	34.8	37.16	34.88	32.58	37.06	35.14
Crude Fiber	2.56	1.87	2.38	2.86	8.30	6.24
Ash	21.53	21.32	17.63	17.39	16.08	15.04
Carbohydrates[(a)]	12.01	20.99	18.79	25.36	15.04	23.07
Energy [(b)]	477.64	493.04	494.36	481.90	487.73	490.58

a) Total carbohydrates were calculated by difference.
b) Energy calculated= (carbohydrates g × 4) +(protein g×4)+ (fat g ×9).

Finally, it could be concluded that previous luncheon studied varied in its protein contents, while they all have almost similar fat contents. Meat luncheon was the highest protein followed by chickpea luncheon types.

Mineral contents:

Data in table (3) summarize the mineral contents in luncheon formulae. The results revealed that the minerals concentration varied depending on the ingredients and the used levels in the recipes. According to the Egyptian Food Composition Table (NNI, 2006), Chickpea consider the richest source of potassium, calcium and iron were (855,155 and 5.8 mg/ 100g respectively edible portion). Potassium in tested formulae was the highest concentration among other minerals (587.85mg/100gm), therefore meat with chickpea (F5) registed the highest potassium content, while cheese luncheon (F2) registed the lowest potassium contents 441.1 mg P /100g (Table 3).

Table 3. Minerals composition of the different formulae on 100g/ dry matter

Mineral	Concentration (mg/100g) dry matter basis					
	Meat (F1)	Cheese (F2)	Meat/ F.bean (F3)	Cheese/ F. bean (F4)	Meat/ chickpea (F5)	Cheese/ chickpea (F6)
Na	231.1	223.6	533.1	442.5	444.2	512
K	581.75	441.12	537.9	457.25	587.85	534.45
Mg	39.53	34.26	41.97	65.1	64.28	67.94
Fe	2.9	1.85	2.35	2	2.6	2.4
Ca	122.65	190.25	124.5	135.65	123.7	161.75
P	445.95	500.95	456.6	462.7	403.5	417.35

Calcium contents recorded the highest concentration in F2 (190.25 mg/100g) followed by chickpea types meanwhile in, F1 it was (122.56 mg/100g) the lowest calcium content, this is due to the concentration of Ca in processed cheese and chickpea according to (NNI, 2006).

According to (NNI, 2006) the concentration of iron in chickpea followed meat (5.8 and 2.7 mg Fe/100gm) respectively, on contrary processed cheese contains (0.5 gm Fe/ 100gm) subsequently, F1 versus F2 showed the highest and lowest Fe concentration (2.9 and 1.85 mg Fe/ 100gm) respectively.

The results obtained are in agreements with (Connie *et al.,* 2014). Also replacing meat (which is expensive) by legumes like bean and chickpea will enrich the nutritional value of the processed food. Similar findings have been reported by (Salvatore *et al.*, 2016).

Amino acid composition:

Amino acids composition (essential amino acids in particular) normally reflects the nutritive value of the protein source (Millward, 2011). Amino acids content of different luncheon formulae are shown in Table (4). Essential amino acids (46.8 g/16g protein) was the highest in F6 than other luncheon formulae. F2 recorded higher total essential A.A. than F1 (43.03 versus 34.61 g/16g protein) respectively. This mainly due to the egg added (17.8%) in F2 which was more than F1 (14%).

The content of essential amino acids in F5 and F6 were relatively higher than F3 and F4 which agree with composition database (FAO, 2017; and Jukanti *et al.*, 2012). Consequently, F5 and F6 were higher than F3 and F4. With respect to an essential A.A. glutamic and aspartic were the highest NEAA in all samples which agree with (FAO, 2017; and Jukanti *et al.*, 2012).

Protein quality assessments:

Chemical score was calculating according to scoring pattern gm/g protein requirement for egg as reference protein (FAO, 2011).

The most limiting amino acid have indicated a first approximation of its efficiency of utilization, allowing a correction of the protein requirement for the quality of dietary protein. Data in table (5) indicated that sulfur AA was the first limited AA its value ranged from (51.5 to 64.5) F5 meat/ chickpea was the highest sulfur amino acid this agreed with (Amjad Iqbal *et al.,* 2006), Isoleucine and threonine were the second and third limited AA respectively in F1, F3 and F5, moreover threonine and isoleucine were the second and third limited AA respectively in F2, F4 and F6. Lysine, cysteine and methionine are sulfur AA, cysteine was the lowest scoring in all formulae. F6 was the highest threonine as secondary limited AA. and third limited AA.

Table 4. Amino acids profile of luncheon formulae (g A.A. / 16 g N)

A.A.	Meat (F1)	Cheese (F2)	Meat/ F.bean (F3)	Cheese/F.bean (F4)	Meat/ chickpea (F5)	Cheese /chickpea (F6)	Egg amino acids reference
			(g A.A. / 16 g N)				
Essential amino acids (EAA)							
Tyrosine	3.44	4.72	3.8	5.14	4.51	5.17	4.2
Phenyl alanine	4,02	5.25	4.33	5.82	5.78	6.53	5.7
Aromatic AA	7.46	9.97	8.13	10.96	10.29	11.70	9.9
Cysteine	1.13	1.02	0.95	0.92	1.19	1.07	2.4
Methionine	2.34	2.25	2.20	2.06	2.55	2.29	3.4
Sulfuric AA	3.47	3.27	3.15	2.98	3.74	3.36	5.8
Leucine	6.29	8.09	6.8	8.62	7.91	8.63	8.8
Lysine	5.26	5.95	5.93	6.74	6.97	6.83	7
Valine	4.64	6.75	5.47	6.65	6.80	6.53	6.8
Iso- Leucine	3.85	4.98	4.03	5.64	4.93	5.46	6.3
Threonine	3.64	4.02	3.8	4.17	4.46	4.29	5.1
tryptophan	NA	NA	NA	NA	NA	NA	2.4
Total E.A.A	34.61	43.03	37.31	45.76	45.1	46.8	51.2
Alanine	4.88	5.63	4.98	5.41	5.48	5.66	-
Aspartic	7.22	7.5	7.56	8.99	9.06	9.70	-
Serine	4.40	6.16	4.83	6.14	5.78	6.14	-
Glutamic	11.27	14.68	13.26	15.27	14.50	15.50	-
Glycine	3.30	3.32	3.34	3.48	3.83	3.66	-
Proleine	4.09	9.0	3.84	5.27	4.97	4.63	-
Histidine	2.47	2.63	2.47	2.93	2.85	2.97	-
Arginine	5.09	6.00	5.81	7.24	6.42	7.51	-
Total N.E.A.A	42.72	54.92	46.09	54.73	52.89	55.77	-

Essential amino acid index (EAAI) estimates protein quality based on the content of all essential amino acids compared with egg reference amino acid. It is a rapid method to evaluate an optimize the amino acid content of food (Suzanne, 2010). F1 was the lowest EAAI 59.3% on the opposite, the percentage of EAAI in chickpea reached 82.5% and 80.8% in F6 and F5 respectively.

Table 5. Protein quality evaluation of luncheon formulae:

	Meat (F1)	Cheese (F2)	Meat/ F.bean (F3)	Cheese/ F.bean (F4)	Meat/ chickpea (F5)	Cheese/ chickpea (F6)
EAAI(gm)*	59.30	74.10	62.20	77.40	80.80	82.50
			Chemical score (CS)			
First	sulfur	sulfur	sulfur	sulfur	sulfur	sulfur
	59.83	56.38	54.31	51.38	64.48	57.93
Second	Iso-leucine	threonine	Iso-leucine	threonine	Iso-leucine	threonine
	61.11	78.80	64	82.00	78.25	84.12
Third	threonine	Iso-leucine	threonine	Iso-leucine	threonine	Iso-leucine
	109.45	79.05	74.5	89.50	87.45	87.00

*** EAAI: Essential amino acid index**

In conclusion, F6 was the highest in the concentration of an essential and non-essential amino acids as well as the percentage of EAAI. The first limited AA was sulfur AA in all tested formulae, meanwhile threonine and isoleucine were second and third limited AA.

Fatty acids s profile:

Data presented in Table (6) revealed the fatty acids s profile of different luncheon formulae. The major fatty acids s were C18:1, C16:0 and C18:2, followed by C10:0 and C12:0 which ranged between 7-11% for all formulae. The percentage of both saturated and unsaturated FAA were almost ranged about 50% for each in all luncheon formulae and this agreed with (Raya, 2013), F5 had 50.29% (Shamsia, 2009) while F6 had the lowest value (46.37%). The presence of meat fat, oil, processed cheese and egg are the main sources of fatty acids (polyunsaturated, monounsaturated and saturated fatty acids) (Jukanti, *et al.,* 2012).

USFAs in the diet support prevention of cancer, heart diseases, thrombosis, arterial hypertension, hyperlipidemia, Alzheimer's depression and rheumatoid arthritis (McManus, et al., 2011). Polyunsaturated fatty acids are very essential to human nutrition (Shamsia, 2009 and Narmuratova, et al., 2006) Mono-unsaturated fatty acids do not cause accumulation of cholesterol as saturated fats and do not turn rancid as readily as polyunsaturated fatty acids s (Collomb, et al., 2006). Moreover, they have a positive effect on the concentration of high density lipoproteins (HDL), transporting cholesterol from blood vessel walls to the liver, where it is degraded by bile acids, which are afterwards excreted from the organism. At the same time, monounsaturated fats reduce the concentration of low density lipoproteins (LDL), when circulating over the entire organism are deposited in blood vessels (keszycka, et al., 2013).

Table 6. Fatty acids composition (%) of luncheon formulae

Fatty acids		Meat (F1)	Cheese (F2)	Meat / F.bean (F3)	Cheese/ F.bean (F4	Meat /chickpea (F5)	Cheese /chickpea (F6)
C10:0	Capric acid	8.35	11.05	11.41	8.37	10.24	7.78
C12:0	Lauric acid	7.01	10.3	7.45	8.91	6.85	6.76
C14:0	Myristic acid	2.92	3.7	3.01	3.39	3.51	2.67
C16:0	Palmitic acid	17.24	15.19	16.58	16.89	18.55	17.6
C16:1n9		1.11	0.84	1.09	0.87	0.68	0.66
C17:0	Heptadecanoic acid	0.44		0.19			0.23
C18:0	Stearic acid	10.03	8.54	9.26	7.94	10.11	9.6
C18: 1n9	Oleic acid	26.29	22.4	25.75	23.6	26	28.9
C18: 2n6	Linoleic acid	23.41	25.16	22.58	24.78	20.75	21.6
C18: 3n3	Linolenic acid	2.64	2.6	2.21	2.41	1.82	1.8
C20:0	Arachidonic acid	0.2	0.2	0.2	0.2	0.47	0.73
C20: 1n9	Gadolic acid	0.16		0.12	0.22	0.33	0.6
C20: 3n3		0.2		0.15	0.18		
C22:0	Behenic acid				0.41	0.56	1.0
C22:1n9						1.03	
ω3		2.62	2.38	2.18	2.59	1.82	1.8
ω6		23.41	25.16	22.58	24.78	20.75	21.6
TSFA		46.19	48.98	48.1	46.11	50.29	46.37
TMUFA		27.56	23.24	26.96	26.24	27	30.2
TPUFA		26.25	27.76	24.94	27.37	22.57	23.4
n-6/n-3 ratio		8.24	10.57	10.36	9.57	11.40	12.00

Microbiology:

The presented results in table (7) showed that, total plate count was similar at the beginning of the experiment and ranged from zero to 40×10 cfu/g in F4 and F5 samples respectively. Whereas, all samples under investigation were negative for total coliform and *feacal coliform* and *staph. aureus* counts and the same was for the food poisoning microorganism. *Salmonella spp.* among the whole experiment.

Table 7. Microbiological evaluation of different luncheon during storage at 5°C (CFU/g)

Formula No.	Micro-organism	Days 0	2	5	9	12	19	26	28
F1	T.P.C.	6×10	70×10	34×10^6	$>10^5$	$>10^5$	$>10^5$	$>10^5$	$>10^5$
	T. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	F. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Staph. aureus	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
F2	T.P.C.	33×10	50×10	12×10^5	$>10^5$	$>10^5$	$>10^5$	$>10^5$	$>10^5$
	T. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	F. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Staph. aureus	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
F3	T.P.C.	30×10	20×10^2	17×10^2	30×10^2	33×10^6	$>10^5$	$>10^5$	$>10^5$
	T. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	F. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Staph. aureus	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
F4	T.P.C.	N.D.	N.D.	N.D.	N.D.	$>10^5$	$>10^5$	$>10^5$	$>10^5$
	T. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	F. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Staph. aureus	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
F5	T.P.C.	40×10	40×10^2	37×10^2	40×10^2	36×10^2	30×10^2	$>10^5$	$>10^5$
	T. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	F. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Staph. aureus	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
F6	T.P.C.	30×10	20×10^2	30×10^2	17×10^2	33×10^6	$>10^5$	$>10^5$	$>10^5$
	T. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	F. C. C.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Staph. aureus	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

T.P.C. Total Plate Count
T.C.C. Total Coliform Count
F.C.C. Feacal Coliform Count
ND. Not detected

On the other hand, the Egyptian Standardization and Quality for packed and canned luncheon (EOSQ, 2000), set the acceptable level up to 10^4 cfu /g. Accordingly, results in table (7), showed that F1 and F2 stand for only 2 days in cold condition 5°C, while the rest of formulae which contain legumes extend up to nine days during cold condition 5°C.

By comparing the results obtained from the current study with results of (Nahla, 2017), it noticed that luncheon samples presented in the retailed markets were contain $2.7x10^5$ and $6.7x10^3$ cfu /g as a mean number of total coliform and feacal coliform bacteria which indicate that the hygienic conditions are not followed during processing.

Sensory Evaluation:

The sensorial criteria (texture, flavor, color and taste) of the tested luncheon formulae were evaluated and presented in Table (8). F1 was more preferable than F2 in flavor, taste and color, although the differences were not statistically significant. Comparing between luncheon containing legumes, it was observed that F5 and F6 registed the significant acceptance higher score in texture, flavor, taste, color and overall acceptance than other luncheon formulae.

Table 8. Sensory evaluation of the different luncheon formulae (Mean ± SD).

	Texture	Flavor	Taste	Color	Over Acceptability
F1	3.17 ± 0.3^{b}	3.0 ± 0.4^{c}	3.17 ± 0.3^{b}	3.17 ± 0.5^{b}	3.33 ± 0.2^{b}
F2	3.33 ± 0.3^{b}	2.83 ± 0.4^{c}	2.83 ± 0.3^{b}	3.0 ± 0.3^{b}	3.17 ± 0.2^{b}
F3	3.0 ± 0.3^{b}	$3.17\pm0.3^{b\,c}$	3.17 ± 0.3^{b}	3.33 ± 0.2^{b}	3.17 ± 0.3^{b}
F4	3.5 ± 0.2^{b}	3.17 ± 0.4^{bc}	2.83 ± 0.3^{b}	3.17 ± 0.3^{b}	3.33 ± 0.4^{b}
F5	4.67 ± 0.2^{a}	4.17 ± 0.3^{ab}	4.67 ± 0.3^{a}	4.33 ± 0.2^{a}	4.67 ± 0.2^{a}
F6	4.5 ± 0.2^{a}	4.50 ± 0.2^{a}	4.5 ± 0.3^{a}	4.33 ± 0.3^{a}	4.5 ± 0.3^{a}
LSD(0.05)	0.7611	0.9895	0.8102	0.9048	0.8383

Results of the same letters in same column are not significantly different at (P≤ 0.05)

CONCLUSION

This study aims to prepare cheap, safe and healthy types of meat substitute "luncheon" at household level; sex luncheon formulae were studied "F1, F2, F3, F4, F5 and F6. Meat formulae were higher in protein content than cheese formulae. On the other hands, F5 and F6 improves all studied characteristics (approximate, minerals, protein quality, preservation and sensory evaluation. The study demonstrated that using legumes is good approach to improve the quality and acceptability of luncheon meat.

REFERENCES

Abu Mosallam Mohamed Gamal Et-Din Megahed Selem (1996): Evaluation of Some Food Emulsifying Agents in the Production of Different Kinds of Meat Products (Ph.D. thesis)

Amjad Iqbal, Iqtidar A. Khalil, Nadia Ateeq and Muhammad Sayyar Khan (2006): Nutritional quality of important food legumes. Food chemistry, 97: 331–335

AOAC, (2012): Official Methods of Analysis. 19 th ed. Gaithersburg, MD: AOAC International.

A.O.A.C. (2007): Official Methods of Analysis 18th Ed., Gaithersburg, MD: AOAC International, Method 2007.04

A.O.A.C. (2005): Association of Official of Analytical Chemists, Official method of analysis 18th Ed., Association of Official Analytical Chemists, Arlington, VA. Cereal foods Ch. 32; P.27

Baird- Barker, A.C. and Davenport, E., (1965): The effect of recovery medium on the isolation of *Staphylococcus aureus* after heat treatment and after the storage of frozen or dried cells. J. Appl. Bacteriol.28: 390-402.

Collomb, M., Schmid, A.,Sieber, R.,Wechsler, D. and Ryhnanen, E.L.(2006): Conjugated linoleic acids in milk fats. Variation and physiological effects. Int.Dairy J 16: 1347-1361.

Connie M Weaver; Johanna Dwyer; Victor L Fulgoni III;Janet C King; Gilbert A Leveille; Ruth S MacDonald; Jose Ordovas and David Schnakenberg (2014): Processed foods contributions to nutrition. The American Journal of clinical nutrition, vol.99 (6), PP 1525-1542.

Difco, (1989): Difco Manual of dehydrated culture media and reagents for microbiological and clinical laboratories products. Ninth Edition difco laboratories, Detriot Mi: Chgan, USA.

Difco, Manual (2003): Difco manual of dehydrated culture media and reagents for microbiological and clinic laboratories Detroit Michigan, USA.

El-Bab, G. F. A. F. and Sayed, E. M. (2005): Some bacterial and chemical investigations on chicken luncheon and beef luncheon. Veterinary Medical Journal Giza; 53(3):855-862. 28.

NNI (2006): Notational Nutrition Institute - Food Composition Tables for Egypt for Egypt. 2nd edition, May, Cairo, A.R.E.

EOSQ (2000): Egyptian Organization for Standardization and Quality for packed and canned luncheon. no.1114.

EULC (2016): Egyptian Union of Universities. http://srv1.eulc.edu.eg/eulc_v5/libraries/start.aspx?ScopeID=1.&fn=ApplySearch&criteria1=1.&OrderKey=publishYear+desc&SearchText1=Luncheon+meat&ItemType=

FAO (2011): The state of food insecurity in the world. How does international price volatility affect domestic economies and food security?

FAO (2017): http://www.fao.org/infoods/infoods/tables-and-databases/faoinfoods-databases/en/

Georgela, D.L. and Boothroyd, M. (1965): A system of detection Salmonellae in meat and meat products. J. Appl. Bacteriology, 28:206.

Gunter Heinz and Hautzinger peter (2007): Meat processing technology for small to medium scale producers. FAO P ii

Hidvégi, M., and F. Bekes (1984): Mathematical modeling of protein quality from amino acid composition. Proc. Int. Assoc. Cereal Chem. Symp. Ed., by R. Lasztity and M., Hidvégi, p. 205. Akademiai Kiad Budapest (cited from Mubarak (2001), Nahrung / Food, 45 (4):241-245.

Joosen, A.M.C.P.; G.G.C. Kuhnle; S.M. Aspinall; T.M. Barrow, E. Lecommandeur; A. Azqueta; A.R. Collins and S.A. Bingham (2009): Effect of processed and red meat on endogenous nitrosation and DNA damage. Carcinogenesis, 30: 1402-1407.

Jukanti A. K.; Gaur P. M.; Gowda C. L. L. and Chibbar R. N. (2012): Nutritional quality and health benefits of chickpea (*Cicer arietinum L.*): a review. British Journal of Nutrition. 108, S11-S26.

keszycka M.; Runoweska,G.C.; Lipinska,P. and Wojtowski, J (2013): Fatty acids profile of milk – A Review. Bull Vetinst Pulawy 57: 135-139.

Khan, N.A. and McCaskey (1973): Incidence of salmonellae in commercially prepared sandwiches for the vending trades. J. Milk Food Technol. 39:315.

Lavrova, L.P and Krilova, V.X. (1975): Luncheon meat technology, in Russian, Moscow: Food' Industry pp. 325-326

McManus A., Merga M., Newton W. (2011): Omega-3 fatty acids. What consumers need to know? Appetite 57: 80-83.

Mente, E., P. Coutteau, Dominic Houlihan, I. Davidson and P. Sorgeloos (2002): Protein turnover, amino acid profile and amino acid flux in *Juvenile Shrimp Litopenaeus Vannamei*: Effects of dietary protein source. The Journal of Experimental Biology. 205:3107-3122.

Mitchel H. H., and R. J. Block (1946): Journal of biological chemistry 163:599.

Millward D. Joe (2011): Amino acid scoring patterns for protein quality assessment. British Journal of Nutrition, 108, S31–S43.

Mitcheland H. H., and R. J. Block (1946): Journal of biological chemistry 163:599

Nahla, Y. M. (2017): Microbiological studies on ready to eat food stuffs retailed in Egyptian markets (Thesis)

Narmuratova M., Konuspayeva G., LoiseauG., Serikbaeva A., Barouh N., MontetD., Faye B., (2006): Fatty acids s composition of dromedary Bactrian camel milk in Kazakhstan. J. Camel Practical. Res. 13: 45–50.

Rayan, Islam Attia Abd El-Hamed (2013): Trans fats in meat products, Ph.D. thesis

Ruiz, A.J., and Claudio, V.S. (2010): Basic Nutrition for Filipinos. 6th ed. Meriiam &Webster Bookstore, INC., pp. 77-81

Salvatore Multari; Madalina Neacsu; Lorraine Scobbie; Louise Cantlay; Gary Duncan; Nicholas Vaughan; Derek Stewart and Wendy R. Russell (2016): Nutritional and Phytochemical Content of High-Protein Crops. J Agric Food Chem. *64* (41), pp 7800–7811.

Sarwar, G., R. W. Peace and H. G. Botting (1985): Corrected relative net protein ratio (CRNPR) method based on difference in rat and human requirements for sulfur amino acids. J. Assoc. off. Anal. Chemi., 68: 689-693.

SAS Institute Inc, (2004): SAS/STAT1 User's Guide, Version 8, SAS Institute Inc, Cary, NC.

Sharaf El-Deen; Mostafa Abd-El-Ghfar Mostafa (2015): Pollution of heavy metals. Thesis (M. S) - Mansoura University. Faculty of Agriculture. Department of Agriculture chemistry

Shamsia, S. M. (2009): Nutritional and therapeutic properties of camel and human milks. International Journal of Genetics and Molecular Biology Vol. 1:52-58.

Suzanne, S. Nielsen (2010): Food analysis4th edition. Part III: chemical properties and characteristic of foods P. 274

WHO (2015): International agency for research on cancer. Press release No. 24. October, 2015

دراسة استخدام بعض البقوليات كبديل للحوم عند صناعة الانشون منزليا

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المركز الإقليمي للأغذية والأعلاف – مركز البحوث الزراعية

تعتبر اللحوم والدواجن المصنعه من أفضل الأطعمة استهلاكا علي مستوي العالم، وعلي الرغم من ذلك فهي مرتبطه بارتفاع معدل الإصابة ب ٤٢%من أمراض القلب والأوعية، و١٩% من ارتفاع معدل الأصابة بأمراض السكري، بالإضافة إلي التأثيرات المسرطنه لمركبات النيتروز. والهدف من هذه الدراسة لإنتاج ستة مصنعات لانشون منزليا "لانشون لحم(F1)، لانشون جبن (F2)، لانشون لحم بالفول(F3)، لانشون جبن بالفول(F4)،لانشون لحم بالحمص(F5) ، لانشون جبن بالحمص(F6) وهي لإنتاج أصناف صحيه وأمنه ورخيصه. تم إجراء تحليل كيميائي والأحماض الدهنية والأمينية وتقييم ميكروبيولوجي وحسي للعينات تحت الدراسة. أثبتت نتائج الدراسات أن لانشون اللحم أعلي الأصناف في البروتين "ما يقارب ٣٠% "، بينما سجلت أصناف لانشون الجبن واللحم بالحمص أعلي نسبة من الدهون ٣٧%، أثبتت الدراسة أن إضافة الحمص إلي اللحم والجبن سجلت أعلي نتائج في نسبة الصوديوم، البوتاسيوم والماغنسيوم (٥١٢، ٥٨٨ و ٦٨ ملجم/ ١٠٠ جم كمادة جافة) ، وكذلك سجلت أعلي نتائج في الأحماض الأمينية الأساسية وغير الأساسية، وكانت أفضل الأنواع في المواصفات الحسية. سجلت نتائج التحليل الميكروبيولوجي نتائج سلبية لكل من بكتيريا القولون الكلية ،وبكتيريا القولون البرازية. وميكروب *staph aureus*، وكذلك بكتيريا التسمم الغذائي.*Salmonella spp*