Quality Assessment of Emulsion Type Poultry Meat Products

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Abstract

Quality of emulsion type poultry meat products is a challenge facing meat industry owing to the absence of Egyptian limits that regulate the usage of mechanically deboned poultry meat in meat industry, in addition to the different types of meat additives added during processing. which might have bad health impact on consumers. A total of 48 different commercial poultry emulsion type luncheon samples were collected from Cairo and Ismailia Provinces (Egypt) factories and markets, and examined for their technological criteria, sensory evaluation; proximate chemical analysis and histological examination. For sensory evaluation the mean value of for appearance, color, flavour, juiciness, binding and overall acceptability were 5.4±0.25, 5.8±0.24, 6.6±0.21, 6.5 ±0.14, 5.9±0.19 and 6.1±0.19 respectively. For technological criteria; the discoloration characteristics of examined samples of fading, starchy, green core and shrinkage were 91.6%, 50%, 0% and 8.3% respectively.Good binding and Bad binding were 50% and 50%.Jelly pockets, Air pockets, Fat cap and seperated were 20.8%, 100%,0% and 0% respectively. The mean values for chemical Prosperities as moisture % in the examined samples was 66.79 ±0.43, while that for protein, fat, ash, lean meat, nitrogen and calcium content was 12.9±0.22, 17.5±0.46, 3.28±0.29, 61.96±1.8, 2.35±0.04 and 2094.00±240.28 respectively. The histological examination showed great variability between the samples of different origin in the muscle fiber, fat content, cartilage, bone and skin content.

Key words: Poultry luncheon, sensory, chemical, histological, examination

Introduction

The demand for further processed meat products is mainly a consequence of the fast progress in urbanization and increased income among city dwellers **(*Suresh et al., 2014*).**The massive increase in poultry production worldwide, parallel to the change in

consumers eating attitude from consumption of whole chicken to cuts and fillets, resulted in huge amounts of skin, bone frames, giblets and necks. Mechanical recovery process provides the magic utilization of these left-over materials with production of MDPM (Mechanically deboned poultry meat) that has technological properties, provide low cost products in addition to improve nutritional value which enhance its use in poultry and meat processing industry. Poultry luncheon meat sausage product is one of the most common emulsion type sausages in Egypt which made from skeletal muscle, variety meats, fat tissue in addition to mechanically deboned poultry meat ***(Tyburcy et al., 2005).*** Nonmeat ingredients such as water, salt, nitrites, sugars, ascorbate, spices, flavorings, and antioxidants and phosphates are added to improve the quality, taste, and flavor of sausage. Nutritional value and chemical components of MRPM vary with raw materials (necks, backs, frames and skin) used in its production ***(Navarro, 2005).*** No Egyptian limits were exist to regulate the usage of MRPM in meat industry resulting in products of low quality and has bad health impact on consumer, therefore this study concerned with investigation of different quality attributes of one of the most popular Egyptian meat products produced by different processing plants by evaluation of sensory, technological and chemical quality of the emulsified poultry luncheon meat products in addition to histological examination of the examined samples.

Materials and Methods:

1 Collection of Samples:

A total of 48 different commercial poultry emulsion type luncheon samples were collected from Cairo and Ismailia Provinces (Egypt) factories and markets under different trade names during the year 2019. All the samples were identified then transported in icebox container to the Central Lab, Faculty of Veterinary Medicine, Zagazig University, Faculty of Agriculture of Zagazig and Faculty of science of Suez Canal University, for their organoleptic, sensory evaluation; proximate chemical analysis and histological examination.

2. Sensory and technological evaluation:

It was conducted according to ***Kirk et al., Varman and Sutberland (1995), ES No 1696 (2005 d)*** and ***AMSA (2015)***. For technological evaluation the following parameters was evaluated in the examined samples: Discoloration

characteristic (Fading, Starchy, Green core, Shrinkage), Emulsion Properties (Good binding and Bad binding) and General technical(Jelly pockets, Air pockets, Separated and Fat cap) while For sensory evaluation it was performed using 9 experienced panelists (from both sexes in the age range of 26 to 50 years) were chosen from the staff members of the Department of Food Hygiene and Control at Faculty of Veterinary Medicine, Suez Canal University, Egypt. Each panelist evaluated three replicates of bites-sized samples in a randomized order and were asked to assign a numerical value between 1 and 9 for following attributes: appearance, color, flavor, juiciness, binding and overall acceptance where 9 denote extremely acceptable and 1 denotes extremely unacceptable.

3. Proximate chemical analysis;

3.1 Preparation of Samples: The samples were prepared and examined according to the technique recommended by ***(AOAC, 2003)*** as follows:

Each sample was grounded by passing through food chopper three times then the chopped material was thoroughly mixed and transferred to suitable container with airtight cover.

3.2 The determination of Moisture; Protein; Fat Content; **Ash and Carbohydrate** Contents were carried out **according** to the technique recommended by ***(AOAC, 2003)***

3.3 Calculation of Red Meat Content *(McLean, 2007*): The calculation of red meat content (Fat Free Meat Content) was occurred by the following equation:

Red meat % = Total Nitrogen % - Non-Meat Nitrogen% / NF×100

Where:

Non-Meat Nitrogen = carbohydrate % × CNF/100

CNF = the Carbohydrate Nitrogen Factor = 0.02

NF is the Nitrogen Factor 3.50 **(AMC, 2014).**

3.4 Determination of calcium content:

3.8.1 Digestion method: *(Hamasalim and Mohammed, 2013).* The ash determined in **3.3.5** was dissolved in 5 ml of HCl acid and 5 ml of distillated water and put on a hot plate for 5 min after which it was topped up to 25 ml with double distillated water.

3.8.2 Elemental analysis of samples. The calcium **(Ca)** in poultry emulsion type luncheon samples was determined directly on each sample of the final solutions by using Atomic Absorption Spectrophotometer Technique in **PERKIN-EIMER2380** (model).

4. Histological examination: *(Banchroft et al., 1996).*

Results and Discussion

Meat emulsions products gain its importance based on their wide consumption as value added food items. They possess a diversity of physicochemical and sensory quality attributes due to the variety of ingredients and processing conditions.

1. Sensory examination

The results given in **Table (1a)** showed the statistical analytical results for examined samples of poultry Emulsion type luncheon in which the minimum, maximum and mean value ± S.E for appearance were 2.6, 7.4 and 5.4±0.25, for color were 3.0, 7.4 and 5.8±0.24 for flavour were 4.8, 8.4 and 6.6±0.21, for juiciness were 4.8, 7.8 and 6.5±0.14, for binding were 3.2, 7.2 and 5.9±0.19 and for overall acceptability were 3.7, 7.6 and 6.1±0.19 respectively. Results obtained for appearance were lower than ***Abdullah (2007)*** and higher than ***Abo El-Ezz (2018)*** while those for color were nearly similar to that obtained by ***Jantawat and Carpenter (1989), Abdullah (2007)*** and ***Elbazidy et al. (2017)*** but higher than recorded by ***Abo El-Ezz (2018).*** Nearly similar results for flavour were obtained by ***Jantawat*** and ***Carpenter (1989)*** and ***Abdullah (2007)*** but it was higher than those obtained by ***Elbazidy et al. (2017)*** and ***Abo El-Ezz (2018).*** For juiciness, nearly similar results were obtained by ***Jantawat and Carpenter (1989)*** and ***Abdullah (2007)*** but it was higher than that obtained by ***Elbazidy et al. (2017)*** and ***Abo El-Ezz (2018).*** Our results for binding were higher than ***Elbazidy et al. (2017)*** and ***Abo El-Ezz (2018).*** The obtained results for overall acceptability were nearly similar to that obtained by ***Jantawat and Carpenter (1989), Abdullah (2007) and Elbazidy et al. (2017)*** but higher than that obtained by ***Abo El-Ezz (2018).*** Appearance, color and binding were fairly accepted due to poultry luncheon meat additives as starch, milk powder and spices which interfere with color and binding ability.

The results given in **Table (1b**) showed the statistical analytical results of technological criteria of poultry Emulsion type luncheon. The discoloration characteristics as fading, starchy, green core and shrinkage were 91.6%, 50%, 0% and 8.3% respectively. Good binding and Bad binding were 50% and 50%.Jelly pockets, Air pockets, Fat cap and seperated were 20.8%, 100%,0% and 0% respectively. There's no available data to compare our results with other authers but we can compare the technological criteria of the results obtained

with that recorded by ***Aiedia (1995)*** on the traditional emulsion type Egyption luncheon where shrinkage and jelly pockets were nearly equal with ***Aiedia (1995),*** but our results were higher than ***Aiedia (1995)*** in fading, starchy, air pockets and bad binding. The results recorded by ***Aiedia (1995)*** were higher than our results in green core, fat cap, seperated and good binding.

2. Chemical examination

The results given in **Table (2)** revealed that the statistical analytical results of chemical content of the examined samples of poultry emulsion type, the minimum of moisture, protein, fat, ash, nitrogen and lean meat was 63.80,10.5, 13.02, 0.2, 2.1 and 50.4 respectively. The maximum of moisture, protein, fat, ash, nitrogen and lean meat was 72.80, 15.2, 22.2, 8.5, 2.7 and 72.76 respectively. The mean ± S.E of moisture, protein, fat, ash, nitrogen and lean meat was 66.79±0.43, 12.9±0.22, 17.5±0.46, 3.28±0.29, 2.35±0.04 and 61.96±1.8. The results obtained for moisture were nearly similar to those obtained by ***Al-Abdullah and Al-Majali (2011), Elbazidy et al. (2017),*** and higher than that recorded by ***Lengkey and Lobo (2016), Gaafar. (2017)*** and ***Abo El-Ezz (2018).*** While the results were lower than that recorded by ***Abdelrahman and Meawad (2016)*** and ***Ibrahim (2016).*** These variations in the results were attributed to the high fat content and addition of water according to technological procedure as mentioned by ***Ahmed and Srivastava (2007).***

The protein content was nearly agreed with those reported by ***Al-Abdullah and Al-Majali (2011), Abdelrahman and Meawad (2016)*** and ***Elbazidy et al. (2017).*** However, higher finding of protein contents were reported by ***Abdullah (2007), Ibrahim (2016)*** *and* ***Lengkey*** *and* ***Lobo (2016)*** *a*nd lower results were reported by ***Gaafar (2017)*** and ***Abo El-Ezz (2018).*** The variation in the results obtained were attributed to the addition of mechanically deboned poultry meat decreases protein content and increase amount of binding material increase the protein content.

Nearly results for fat were reported by ***Abdullah (2007)*** *and* ***Huda et al. (2010)*** while higher results were found by ***Choi et al. (2010)*** and ***Gaafar (2017).*** Lower results reported by ***Abdelrahman and Meawad (2016), Ibrahim (2016), Elbazidy et al. (2017)*** and ***Abo El-Ezz (2018).*** The results of Ash nearly agreed with ***Elbazidy et al. (2017), Gaafar (2017)*** *and* ***Abo El-Ezz (2018)*** but lower than those obtained by ***Mai et al. (2016)***. Nearly

similar results of total nitrogen were obtained by ***Kirk et al. (1991) and AMC (2014)*** for whole carcass. Lower results for lean meat were recorded by ***Gaafar (2017).***

The results given in **Table (3)** showed the technological criteria in comparsion to the **ES: No.1696** ***(ES, 2005 d),*** where 44 (91.66%), 38(79.16%) and 0(0%) of the examined samples were matching for shrinkage, jelly pockets and air pockets respectively, while the not matching samples of them were 4(8.30%), 10(20.80%) and 48(100%) respectively. Also the matching samples of moisture, protein, fat, ash and lean poultry meat were 36(75%), 33(68.75%), 48(100%), 24 (50%) and 0(0%) respectively while the not matching samples for them were 12(25%), 15(31.25),0(0%), 24(50%)and 48(100%) respectively.Meanwhile the histological characterisitic as the presence of bone tissue, cartilage tissue and foregin materials that not matching E.S were 40(83.3%), 48(100%) and 20(41.6%) respectively. Meanwhile the number and percentage of the matching samples were 8(16.6%), 0(0%) and 28(58.3%) respectively.

The results given in **table (4)** showed the minimum, maximum and mean value ± S.E of Calcium content in the examined samples as 451.61, 6234.30 and 2094.00±240.28 respectively. These results were higher than those reported by ***Ibrahim (2016), Mai et al. (2016)*** *and* ***Tasić et al. (2017).*** High calcium content in the examined luncheon samples reflect the percentage of bone that minced with poultry meat as result of the use of whole poultry carcass in the emulsion.

Table (5) showed that as 12(25%) of samples was exceed the upper tolerable level intake (UL). The increase in calcium content in the final product over the UL leads to Hypercalcemia, calcium /phosphorus imbalance in children, osteomalacia in adults, weakness of the bone, creates kidney stone, interfere of the work of heart and brain and finally overactive of parathyroid glands. ***(Mayoclinic 2020).***

3. Histological examination

The results given in **Table (6)** showed the histological evaluation and revealed that 48(100%) of samples had skin, 40(83.3%) had bone tissue, 48(100%) had cartilage tissue and 20(41.6%) had foreign materials.

The **images (1,2,3,4)** showed a great variability between the samples of different origin in the muscle fiber, fat content, cartilage, bone and skin content. It`s noticed that lower muscle tissue which confirmed by the low lean meat content, bone

particle and cartilage, while foreign materials and debris of feather in other samples revealed the bad manufacture practice. Nearly similar results were obtained by ***Abo El-Ezz (2018).***

Table (1a): *Statistical analytical results of sensory evaluation of poultry luncheon*

	Appearance	Colour	Flavour	juiciness	Binding	O.A
Min.	2.6	3.0	4.8	4.8	3.2	3.7
Max.	7.4	7.4	8.4	7.8	7.2	7.6
Mean	5.4	5.8	6.6	6.5	5.9	6.1
S.E	0.25	0.24	0.21	0.14	0.19	0.19

Table (1b): *Statistical analytical results of technological criteria of poultry luncheon*

	Discoloration characteristic								Emulsion Properities				General technical							
Item	Fadind		Starchy		Green core		Shrinkage		Good binding		Bad binding		Jelly pockets		Air pockets		Fat cap		Seperated	
NO	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
48	44	91.6	24	50	0	0	4	8.3	24	50	24	50	10	20.8	48	100	0	0	0	0

Table (2): *Proximal chemical composition*

	Moisture%	Protein %	Fat %	Ash%	Nitrogen%	Lean meat %
Minimum	63.80	10.5	13.02	0.2	2.1	50.4
Maximum	72.80	15.2	22.2	8.5	2.7	72.76
Mean	66.79	12.9	17.5	3.28	2.35	61.96
S. E	0.43	0.22	0.46	0.29	0.04	1.8

Table (3): *Statistical analytical results of matching Criteria in comparison to ES: 1696 (2005)*

Types of components	No	Matching		Not Matching	
		No	%	No	%
Shrinkage	48	44	91.66	4	8.30
Jelly pockets	48	38	79.16	10	20.80
Air pockets	48	0	0	48	100.0
Moisture%	48	36	75	12	25
Protein %	48	33	68.75	15	31.25
Fat %	48	48	100	-	-
Ash%	48	24	50	24	50
Lean Poultry Meat%	48	-	-	48	100
Bone tissue	48	8	16.6	40	83.3
Cartilage tissue	48	0	0	48	100
Foreign materials	48	28	58.3	20	41.6

Table (4): *Proximal chemical composition Percent of calcium*

	Calcium content /ppm
Minimum	451.61
Maximum	6234.30
Mean	2094.00
S.E	240.28

Table (5): *Statistical analytical results of examined poultry luncheon samples in comparison with the upper tolerable level intake*

No	Samples exceed the UL		Samples not exceed UL	
48	NO	%	NO	%
	12	25	36	75

Table (6): *Histological evaluation of the examined samples of poultry luncheon*

No.	Skin		Bone tissue		Cartilage tissue		Foreign materials	
48	No	%	No	%	No	%	No	%
	48	100	40	83.3	48	100	20	41.6

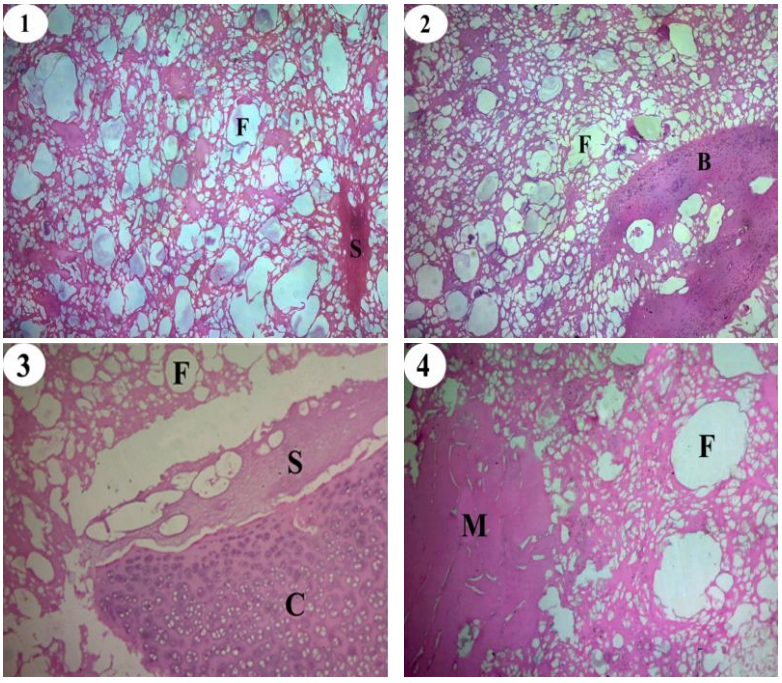

Image 1. Histological section of Egyptian poultry Emulsion type luncheon stained with H&E showed fat cell (F) and skin (S).
Image 2. Histological section of Egyptian poultry Emulsion type luncheon stained with H&E showed fat cell (F) and bone (B).
Image 3. Histological section of Egyptian poultry Emulsion type luncheon stained with H&E showed fat cell (F), skin (S) and cartilage (C)
Image 4. Histological section of Egyptian poultry Emulsion type luncheon stained with H&E showed fat cell (F) and muscle (M)

Conclusion

In the light of the previous achieved results, it could be concluded that the most of investigated poultry emulsion type luncheon samples were adulterated and had unacceptable sensory, chemical and technological criteria which are not matched with the Egyptian standard. Histological technique can be used as a safe and accurate method for detection of adulteration of meat emulsion products.

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الملخص العربي

تقييم جودة منتجات لحوم الدواجن المستحلبة

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جودة منتجات لحوم الدواجن تعتبر تحديا يواجه صناعة الدواجن فى مصربسبب عدم وجود حدود لاستخدام لحوم الدواجن المنزوعة العظم ميكانيكيا بالاضافة الى كثرة وتنوع اضافات اللحوم مما قد يسبب خطورة على صحة المستهلك لذلك تم تجميع تم فحص 48 عينة من لاشون الدجاج المستحلب التي جمعت من مصادر مختلفة من المصانع الرئيسية والأسواق في محافظة القاهره والاسماعليه لتقيم المعايير التكنولوجية ، التقييم الحسي ؛ التحليل الكيميائي والفحص النسيجي.وكانت نتائج القيم المتوسطة بالنسبة للتقييم الحسي ، كا لمظهر واللون والنكهة والطراوة والقبول العام هي 5.4 ± 0.25 و 5.8 ± 0.24 و 6.6 ± 0.21 و 6.5 ± 0.14 و 5.9 ± 0.19 و 6.1 ± 0.19 على التوالي. وبالنسبة للمعايير التكنولوجية ؛ كانت خصائص تغير لون العينات من الخبو والنشويات والنواة الخضراء والانكماش 91.6٪ و 50٪ و 0٪ و 8.3٪ على التوالي ، والتماسك الجيد وغير الجيد 50٪ و 50٪. جيوب جيلي وجيوب هوائية وغطاء دهني منفصلة 20.8٪ ، 100٪ ، 0٪ و 0٪ على التوالي. كانت القيم المتوسطة للتحليل الكيميائي للرطوبة٪ هي 66.79 ± 0.43 ، بينما

كانت نسبة كل من البروتين والدهون والرماد واللحوم الصافية والنيتروجين والكالسيوم هي 12.9 ± 0.22 و 17.5 ± 0.46 و 3.28 ± 0.29 و 61.96 ± 1.8 و 2.35 ± 0.04 و 2094.00 ± 240.28 على التوالي. وقد أظهر الفحص النسيجي تباينًا كبيرًا بين العينات ذات المنشأ المختلف في ألياف العضلات ومحتوى الدهون والغضاريف والعظام والجلد. ومن النتائج التي تم الحصول عليها يتبن ان العسنات التي تم فحصها غير مطابقة للمواصفه القياسية المصريه مم يدل علي التدليس التجاري لهذا المنتج وعدم اتباع وتطبيق المواصفة القياسية في التصنيع.