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Study of some chemical, quality, sensory and bacteriology characteristics of frozen beef meat imported to Sulaimani as compared to local meat

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Abstract

The study is aiming to know the shelf-life of some imported frozen beef meat (Fakher, Reem, Bertin) to Sulaimani as compared to local meat by evaluation of some chemical, quality, sensory and bacterial characteristics. Within the chemical characteristics, the highest percent protein was observed in the local (21.78±0.62) while the lowest was noticed in the Reem Company (16.52±0.69). The highest percent fat obtained in Reem (7.65±0.43) but the local and Bertin gave the lowest percent (3.86±0.3 and 3.13±0.23 respectively). Quality characteristics studied the highest free fatty acids (FFA) observed in the local (1.91±0.25) and Bertin (1.91±0,21) beef meat samples, while the water holding capacity (WHC) in the Fakher was the highest (64±2.52) and the lowest in the local(41±4.48) . However, the meat pigment studied of the local was highest (136±0.91) as compared with the other studied companies. The higher significant differences in pH obtained in local (6.22) but the other companies were differed significantly. The Regarding sensory characteristics studies (Tenderness, juiciness, flavor and public acceptability), the local meat was better and higher significantly than other companies. Higher significant differences in the aerobic plate counted in the Fakher, while the lowest was in the local samples. Total coliform bacteria and pscyrophilic bacterial count showed that; the lowest value was given by the local meat but the higher in the Reem.

دراسة تقييم بعض الصفات الكيميائية والنوعية والحسية والميكروبية لبعض أنواع لحوم الابقار المجمدة المستوردة الى السليمانية

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الخلاصة

تهدف الدراسة الحالية الى معرفة مدى صلاحية بعض لحوم الابقار المجمدة المستوردة (فاخر، ريم، بيرتن) الى السليمانية مقارنة مع عينات لحم بقر محلية عن طريق تقييم بعض الصفات الكيميائية والنوعية والحسية والميكروبية. في الخصائص الكيميائية، كانت أعلى نسبة بروتين في العينات المحلية (21.78±0.62) بينما أقلها في شركة ريم(16.52±0.69). تم الحصول على أعلى نسبة دهون في شركة ريم (7.65±0.43) بينما أدناها كانت في العينات المحلية وبيرتن(3.86±0.3 and 3.13±0.23) على التوالي. اما الخصائص النوعية فلوحظت أعلى نسبة الأحماض الدهنية الحرة في عينات اللحم المحلية (1.91±0.25) وبيرتن(1.91±0,21). في حين أن اعلى قدرة استيعابية للمياه كانت في عينات شركة فاخر(64±2.52) وأدناها في المحلية(41±4.48). في حين أن صفة صباغ اللحم المدروسة كانت الأعلى في عينات اللحم المحلية(136±0.91) مقارنة مع غيرها من الشركات التي شملتها الدراسة. تم الحصول على فروقات معنوية في درجة الحموضة (6.22) في العينات المحلية بينما إختلفت كثيرا بين الشركات الأخرى. كانت عينات اللحم المحلية الافضل والاعلى معنويا في جميع الخصائص الحسية المدروسة (الطراوة والعصيرية والنكهة والقبول العام) مقارنة بالشركات الاخرى. لوحظ وجود اختلافات معنوية كبيرة في العد الكلي للبكتريا في عينات لحوم شركة فاخر بينما ادناها كانت في عينات المحلية. كانت أدنى المعدلات للعد الكلي لبكتيريا القولون والبكتيريا المحبة للبرودة في اللحوم المحلية ولكن أعلاها في عينات شركة ريم.

الكلمات الدالة :
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Introduction

Food security is a complex issue, where animal proteins such as meats, meat products are generally regarded as high risk commodity in respect of pathogen contents, natural toxins and other possible contaminants and adulterants (Yousuf *et al.,* 2008).Red meat contains high biological value protein and important micronutrients those are needed for good health throughout life. While the nutritional composition will vary somewhat according to breed, feeding regimen, season and meat cut (Williams, 2006).

Muscle has an exceptional nutritional value making them ideal for the human diet. Muscle flesh is rich in elenium, calcium, iron, magnesium, phosphorous and vitamins (A, B1, B2, B6, B12 and C) (Vareltzis, 1996). The chief constituents of meat are water, protein, fat, phosphorus, iron and vitamins. Age and sex of the animal has a major influence on the quality of meat that is produced from animals. Most meat have high water content corresponding to the water activity approximately 0.99 which is suitable for microbial growth (Rao *et al.,* 2009).

Meat is considered to be spoiled when it is unfit for human consumption. Meat is subjected to changes by its own enzymes, by microbial action and its fat may be oxidized chemically, microorganisms grow on meat causing visual, textural and organoleptic change when they release metabolites (Jackson *et al.,* 2001). In fact, tissue from healthy animal are sterile however, it has been pointed that during slaughter, dressing and cutting, microorganisms came chiefly from the exterior of the animal and its intestinal tract but that more added from knives, clothes, air, carts and equipment in general. It has been reported that gram negative bacteria account for approximately 69% of the cases of bacterial food borne disease (Clarence *et al.,* 2009).

The possible sources of these bacteria are likely to come from the skin of the animal from which the meat was obtained. Other potential sources of microbial contaminations are the equipment used for each operation that is performed until the final product is eaten, the clothing and hands of personnel and the physical facilities themselves are all implicated (Rombouts and Nouts, 1994). The application of meat preservation methods that delay or prevent changes that make the meat unfit for use as food or reduce some of the quality, properties, chemical and microbiological (Lawrence, 2004).Spoilage can be defined as any change in a food product that makes it unacceptable to the consumer from a sensory point of view (Gram, 2002). In the case of meat, microbial spoilage leads to the development of off-odors and often slimes formation, which make the product undesirable for human consumption (Hilario, 2004 and Jay, 2000)

Microbial growth destroys vast quantities of food, causing economic problems and loss of significant nutrient sources (Madigan *et al*., 2000). Spoilage is not only due to the visible growth of microorganisms, but also to the production of end metabolites which result in off-odors, gas and slime production (Forsythe, 2000)**.** Spoilage of raw red meat will result in off -odors, possible slime production, discoloration of a specific area and undesirable flavours due to metabolic end products formed (De Beer, 2005).

At the moment and as a result of economic openness winning in Iraq and the lack of oversight bodies as the standardization and quality control, companies began to import many kinds of frozen meat, and origins are different, coming to Iraq without control standards, so the present work aimed to examine the market beef meat, for its quality and safety for human consumption through assessment of bacteriological quality. In addition, the sensory parameters and chemical composition will be analyzed to assure quality in the aspects of consumer acceptability, degree of freshness and nutritive value.

Materials and Methods

Samples of frozen meat incorporating samples of frozen beef on four brands (Local, Reem, Bertin, and Al- Fakher). A total number of 16 samples by 4 replicates for each brand was given (sample), these samples kept in a freezer on the degree of (- 18 C°) after then brought to the laboratory. After the production the samples stored for six month for the different companies while the local stored for four month.

Sensory evaluation

The sensory evaluation was carried out on the beef meat products using trained panelists, where the products were prepared according to the method recommended by the manufacturer and AMSA (1995). Table sensory evaluation as Lee (1997).

Name: - Date evaluation:-

Tenderness	Juiciness	Flavor	Public acceptability
1. Very soft	1. Very juice	1. Very good	1. Very acceptable
2. Soft	2. Juice	2. Good	2. acceptable
3. Middle	3. Middle	3. Middle	3. Middle
4. Hard	4. Dry	4. Weak	4. unacceptable
5. Very hard	5. Very dry	5. Very weak	5. Very unacceptable

Characteristic				Treatment
Public acceptability	**Flavor**	**Juiciness**	**Tenderness**	
				1
				2
				3
				4

Chemical Analysis for Meat

Moisture content: Moisture content was observed according to the method of Association of Official Analytical Chemistry (AOAC, 2000).

Ash percentage: Ash percentage was determined by Gravimetric method as described by (AOAC, 2000).

Total protein content: Protein content was determined according to the method as described by (AOAC, 2000).

Fat content: Total fat content was extracted in Soxhlet Extraction Unit as described by (AOAC, 2000).

Calculation of caloric value

Hit where the percentage of protein in 4 and the percentage of fat in the 9 and the percentage of carbohydrates in 4 and collect the outputs of these beatings we get the caloric value per 100 gm meat (Atwater and Woods, 1986).

Chemical quality tests

Estimation of total pigment in the meat

It was estimated using te method of Pruse and Kregel (1984).

Free Fatty acids (FFA)

FFA were estimated by the way of (Egan *et al.*, 1981).

pH measurement

pH of meat sample were measured according to (Naveena and Mendiratta, 2001) meat samples (10 gram) were homogenized with 50 ml of distillated water then filtered through whatman No.1 filter paper .The pH of filtrate samples were measured using digital pH meter (WTW 2f40-11420 D. Germany).

Culturing and Enumeration

All the chemicals and reagents used were of analytical grade, obtained from Sigma Chemical Co. Ltd, England. Media used in this study included: Nutrient Agar (NA) and Peptone Water (PW) as general enriched media. All media were prepared according to the manufacturer's specification and sterilized at 121C° I bar for 15 min. From the 10-fold dilutions of the homogenates; 0.1ml of 10^{-2}, 10^{-3} and 10^{-9} dilutions of the homogenate was plated in replicate on different media (in duplicates), using pour plate method. The plates were then incubated at 37°C for 24-48 hr. MacConkey agar was used for coliform enumeration. Total viable aerobic bacteria count was performed on nutrient agar. At the end of incubation periods, colonies were counted using the illuminated colony counter (Gallenkamp, England). The counts for

each plate were expressed as colony forming unit of the suspension (cfu/g).

Microbiological test of frozen meat

Constructed bags of frozen meat were cut lengthwise using a sterilized knife and cut nto small pieces, fired in a sterile beaker, mixed well and took 25 gm of their cloud and transferred to a bottle of mitigating the first container on 99 ml of water peptone record at 0.1% and sterile already. Mix the bottle and the mitigation of this first-level mitigation 101- and attended a series of reduction and mitigation autoclave and transfer 1 ml each time to 9 ml of peptone water in tubes numbered ease.

Aerobic total plate bacteria

Nutrient agar was transferred 1 ml of the appropriate number of dilutions to sterile petri dishes and poured in rural dishes listed after the sterilized and cooled. And mixing with the sample inside the center well and then left to harden. Incubate the plates upside down in an incubator at 37 ° C for 24hrs, then calculated the number of colonies in each dish.

Psychrophilic bacterial count

Using a pea-center nutrient agar and followed the steps mentioned in paragraph estimate the number of total bacteria, excluding the bosom of dishes at a temperature of 5◦ for 10 days and then calculated the number of colonies in each dish.

Coliform count

Using MacKonky agar to calculate and numerate the coliform bacteria as mentioned above.

Statistical analysis

Data was statistically analyzed using Completely Randomized Design Model (CRD) procedure by (SPSS-17 Package program for windows). Duncan's multiple range test was used to determine the significance of differences among treatments means (Duncan, 1955). Analysis of variance was carried out on all data.

Results & Discussion:

The observation from table (1) indicated that the chemical composition of frozen beef meat imported from different companies Reem, Bertin, Fakher and local beef meat, gave significant differences in dry matter, moisture, fats, protein, and minerals whereas no significance differences found in carbohydrate percent.

The percent of the dry matter was higher than the other companies (24.46%), in the opposite of the dry matter, the higher the moisture percent, the lower the dry matter. From table (1) it was noticed that moisture percent within the international standards in the local beef meat (USOA, 2004 and Romans and Ziegler, 1977), but higher in other companies and agreed with (Al- Obaidi, 2005), since the moisture percent was higher than the international standards in frozen beef meat imported to Iraq. Fat percent was lower than the international standards in all meat samples mentioned above than the international standards (Ziegler and Romans, 1977) and agreed with (Al- obaidi, 2005) in fat percent of Indian beef meat imported to Iraq. Protein percent in all meat samples agreed with the international standards except the Reem while the ash was within the international standards (Romans and Ziegler, 1977).

In general, the concentration of myoglobins in the frozen meat samples was lower than the fresh one due to the effect of freezing. There were a significant differences among the samples in free fatty acids (FFA) ranging between (1.41- 91) % and within the limits in the Reem recommended by the device standardization and quality control (1987) as it is not more than 1.5% but the samples of Fakher and Bertin was not within the limits as a result of fat analysis in these samples of meat.

The value of pH ranged within (5.52- 6.22) as significance differences observed among meat samples due to the stress of the animal before slaughtering , the differences of the local samples with other studied companies as a result of adding of preservatives with low pH that reflected on these meat samples(Al-Marazany, 2007). Low pH leads to the analysis of meat composition due to the acids added for preservation, in another way being bacteria that produce acids in meat and lowest the pH (Luck, 1998) that agree with the studied results in which obtaining high number of bacteria and relatively low pH .A significant difference was noted for water holding capacity (WHC) among meat samples, the local samples was lower than other companies that significantly differ from the Fakher.

Table (2) shows that the tenderness was better in Local then the Reem which was better significantly than the Fakher and the Bertin, while the latter recorded the lowest tenderness that was not differed significantly from the Reem. The Juiciness in the Reem recorded highest than the Fakher because of the high moisture as in table (2), while the Fakher being the lowest Juiciness that differ significantly than the Bertin and no significant differences observed in Fakher and local samples. The best flavor in the local, the lower flavor noticed in the Bertin samples as there are no significances among the studied companies. The public acceptability character was significant in local as compared with other studied companies. Al- Rubeii *et al.* (2000) observed significant differences for the effect of genetics on the tenderness, public acceptability, flavour and juiciness that agree with the

studied results according to the different companies with different meat samples.

As a result, the bacterial total count (Table 3) with different companies differ significantly, the Fakher obtained highest CFU as compared with the local that have the lowest one; that disagreed with that of standardization and quality control of Iraqi properties (1992) and (Dempster, 1986); they conclude that the CFU must be with the range $10^3 - 10^7$ CFU/ gm meat.

The highest CFU in *E. coli* of the studies was in Reem but the lowest in the local; the contamination of the samples with the coliform due to the present of some species and colonized in the intestine and contaminate the carcass; some strains of coliform resist freezing and cooling, could divide slowly under the (6.6 C), also resist low pH (3.6-7) for long time (CDC, 2002 and Borch and Arinder, 2002).

The presence of Scyrophilic bacteria in the Reem was higher than other companies but the local meat had the lowest number. Due to the bad storage condition and thawing that leads to prepare a suitable condition for their growth, or during handling and storage the till reached to the consumers (Berry 1998 and Inoue and Ishikawa, 1997).

Table 1: Show the chemical and quality analysis of samples of frozen beef imported and local meat.

Brand	Reem	Bertin	Fakher	Local
Moisture (%)	74.48±0.4901a	73.9±0.4856ab	74.25±0.2472ab	72.89±0.5753b
Dry matter (%)	25.5±0.4968b	26.09±0.4856ab	25.74±0.2472ab	27.1±0.5753a
Protein (%)	16.52±0.6962c	21.63±0.5859a	18.42±0.3043b	21.78±0.6259a
Fat (%)	7.65±0.4334a	3.13±0.2319c	6.01±0.2625b	3.86±0.3086c
Ash (%)	0.75±0.02b	0.76±0.01b	0.74±0.01b	0.85±0.02a
Energy (kcal/100 gm)	137±2.72a	116±1.98c	130±1.82b	124±2.83b
Free fatty acid (FFA, %)	1.41±0.1a	1.91±0,21a	1.74±0.18a	1.91±0.25a
Water holding capacity (WHC, %)	51±2.83b	44±2.28b	64±2.52a	41±4.48b
Meat pigment Mg/100 gm meat	125±0.87b	127±0.89b	127±1.07b	136±0.91a
pH	5.77±0.05c	6.05±0.03b	5.52±0.04d	6.22±0.02a

Table 2: show the sensory evaluation samples of frozen meat imported and local meat.

Brand	Reem	Bertin	Fakher	Local
Tenderness	2.19±0.37b	4.06±0.28a	3.46±0.32a	2.13±0.13b
Juiciness	2.46±0.25b	3.73±0.38a	3.26±0.33ab	2.79±0.22ab
Flavor	2.99±0.34a	3.33±0.31a	3.19±0.44a	2.59±0.22a
Public acceptability	2.59±0.37bc	3.79±0.28a	3.13±0.32ab	2.19±0.8c

Table 3: Show the differences in colony number (CFU) for frozen beef imported and local meat.

Brand	Reem	Bertin	Fakher	Local
Total Plate Count	175±3.42b	150±6.79c	200±3.56a	58±1.7d
Total Coliform Bacteria	62±1.1a	57±0.85b	43±2.02c	29±1.49d
Psychrophilic Bacterial Count	61±1.68a	28±3.49c	45±1.63b	14±1.49d

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