

Quality Assessment of the Imported Canned Beef Sold in Sulaimani Markets

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Abstract : The aimed of this study is to assess the quality of imported four brands of corned beef including Bordon, Lordoon, King Beef and Exeter using different quality standard inspection tests ; these are, determination the chemical compositions of moisture, protein, fat, ash, energy and as well as studying the changes in the organoleptic characters represented by measuring peroxide value, free fatty acids, thiobarbituric acid and total volatile nitrogen were carried out. The microbiological investigations involved examination of total bacteriological count, coliform bacteria, proteolytic, lipolytic and sporofforming bacteria (anaerobic) also were tested. In addition, sensory attributes were measured. Chemical analyses indicated that Lordoon trademark of canned meat had the highest percentage of moisture 64.79% compared to the lowest percentages of Exeter trademark 57.66% and high protein contents were in Bordon and king beef trademarks, while lower contents were in Lordoon trademark. Bordon, Lordoon and King Beef trademarks contained low percentage of lipid, while Exeter trademark contained a high percentage of lipids. Lordoon and King Beef appeared to have higher contents of ash as compared to other trademarks. And the total volatile nitrogen values for the all trademarks were non-significant. The highest free fatty acids (FFA) observed in the King Beef (0.07 %). Also P.V. and TBA values were through the allowance limits for all trademarks. Microbial tests indicated anaerobic bacterial counts which were between the allowances limits and there were no aerobic bacteria in any of these trademarks. Non-significant differences in the sensory properties among the four trademarks observed, while significant differences in the overall acceptability of the four trademarks.

Key words: Corned beef, quality analysis, sensory evaluation and microbial test.

INTRODUCTION

Food composition data are important to a spectrum of users ranging from international organizations and private individuals: to food assistance programs, epidemiologists correlate patterns of disease with dietary components and nutritional assessment of individual intake and dietetic counseling (Rand *et al.*, 1991). Each of these activities requires accurate data on the composition of foods, and requires that these data be in a form that permits easy access, intelligent manipulation, and confident usage (Almeida *et al.*, 2006).

Red meat provides an average of 20-24g of protein per 100g (raw), with lean red meat providing a higher proportion of protein compared to fattier cuts. Dietary protein is essential for growth, maintenance and repair within the body, as well as providing energy. Red meat is an important source of high biological value protein as it contains the eight essential amino acids required in the adult diet and histidine, which is considered to be essential for children (PSB, 2012).

Meat and meat products provide the majority of the nutrients required for human health. Meat is recognized as a significant source of high biological value protein and micronutrients including for example vitamins A, B6, B12, D, E and iron (Williamson *et al.*, 2005).

Belcher (2006) described four criteria that dictate packaging system utilization for fresh meat delivery. The first criterion on the list is the need to obtain the longest quality-life, which can only be achieved in conjunction with excellent temperature control and hygiene.

Acuff (2006) clarified the difference between spoilage organisms and pathogens by stating, "spoilage organisms won't make you sick, as in instigating an infection and creating a real illness." However, spoilage organisms make food undesirable. The meat industry works diligently to prevent, reduce and eliminate both pathogenic and spoilage bacteria before meat are delivered to consumers for purchase.

Canned meat stored for a long time (2-4 years) are canning (Canning) and is called the product canned meat (Canned meat) and so-called beef canned (Canned beef) or (Corned beef) this name date back to the British Empire (Anglo-Saxon times) the word (Corned) means that meat has treated with saline solution (curing) to save it from deterioration (FSIS, 1995).

The nutritional value of canned (Corned beef) is excellent, it is a good source of protein, vitamin B12, as well as rich in mineral elements mainly the main sodium and then come after zinc, and contains high levels of saturated fats (Saturated Fat), cooked canned beef contains a high percentage of cholesterol. Although containment of canned meat on a high percentage of food additives, including industrial as preservatives and high content of saturated fat and cholesterol (USDA 2004)

As one of ways to keep safety of food in Sulaimani-Iraq, this study aims to assess the quality of canned meat by parameters used in quality control included sensory, physical, chemical, microbiological, also having knowledge about International and national food laws of meat and poultry act, prevention of food adulteration Act and food additives.

MATERIAL and METHODS

Sampling

This study was conducted in the laboratories of Faculty of Agricultural Science and quality control laboratories of Veterinary Directorate. Samples included canned beef to four different trademarks (Bordon, Lordon, king beef and Exeter) of Brazilian origin. The trademarks are most commercially available in Sulaimani governorate. The total number of samples used in the study was 24 samples of 6 replicates for each trademark. And taken into account when the acquisition of samples to be close date.

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

Ash content: 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: The caloric value of 100 g meat was calculated according to (Atwater and Woods, 1986).

Free Fatty acids (FFA): was estimated by the way of (Egan *et al.*, 1981).

Thiobarbituric acid (TBA): value analysis was measured by the way of (Tarladgis *et al.*, 1960 as adopted by Witte *et al.*, 1970)

Peroxide value (PV): was analyzed by the way of (Egan *et al.*, 1981)

Total volatile nitrogen (T.V.N.): was estimated by the way of (Malle & Poumeyrol, 1989).

Bacteriological Analyses

Sample Preparation

For the microbiological analysis of all trademarks, 25g of samples, taken from different parts of the canned meat, was homogenized using a waring blender at 6000 rpm in 225 ml of sterile salt solution (0.85% NaCl). All the tests performed on the samples were determined by the power plate technique. Decimal dilutions were prepared, and then by using a pipette, 1 ml of each dilution was put into separate, duplicate, sterilized and appropriately marked petridishes. Under suitable temperature for each test, the petridishes were incubated but in a reverse manner. Finally the colonies were calculated. The whole procedure was done according to (APHA, 1984).

The performed tests are as follows: Total Viable Aerobic Count

The aerobic bacteria were enumerated on nutrient agar (Himedia labs. Pvt. Ltd) incubated at 35 °C for 48 h.

Total Coliform Bacterial Counts

Coliforms were determined on MacConkey agar containing bile salts (Himedia labs Pvt. Ltd) incubated at 37 °C for 48h.

Proteolytic Bacterial Counts

Proteolytic bacteria were determined using nutrient agar medium plus 10% sterilized skim milk. The plates were inoculated with the diluted sample homogenated and incubated at 30 °C for 72 hrs and examined for clear zone around growth to indicate proteolytic activity.

Lipolytic Bacterial Counts

They were determined using nutrient agar medium plus 10% sterilized olive oil and plates were incubated at 30 °C for 48h. The lipolytic colonies were identified by copper sulphate 20% where blue colonies were counted.

Total Sporforming Bacterial Counts

Enumeration is carried out for bacteria belonging to species of (*Clostridium* and *Bacillus*), where the former is anaerobic while the latter is aerobic, using diluted solution 10^{-1} and 10^{-2} and were heated to 80 °C for 10 minutes. Then 1 ml of each diluted solution was transferred to a sterilized petridish. Consequently sterilized nutrient agar was added and incubation was done as suitable for each bacterium. The plates were incubated for *Clostridium* in anerobic circumstances and at 37 °C for 72 hrs while for *Bacillus* species they were incubated aerobically at 35 °C for 48 hrs.

Sensory Evaluation

Sensory evaluation was carried out by a nine-member semi trained panel. Panel members with ages ranging from 25 to 50 were from faculty members and graduate students of Animal production Department of Sulaimani University, Faculty of Agricultural Science and all were experienced in sensory evaluation of various food products. Panelists were asked to evaluate the samples of each trademark for tenderness, juiciness, flavor, color and overall acceptability. The descriptions of sensory properties and how to rate a sample for the particular sensory property were on the evaluation form Table 1.

Statistical analysis

All data were subjected to one-way analysis of variance (ANOVA) using XL Stat program for windows. Differences between the means were tested by LSDs tests. The level of significance was chosen at $P < 0.05$ and the results are presented as mean (Steel *et al.*, 1996).

Table 1. Evaluation Form for Descriptions of Sensory Properties for All Trademarks

Overall acceptability	Color	Flavor	Juiciness	Tenderness
5. Very acceptable	5. Very dark	5. Very good	5. Very juice	5. Very soft
4. acceptable	4. Dark	4. Good	5. Juice	4. Soft
3. Middle	3. Acceptable	3. Middle	3. Middle	3. Middle
2. unacceptable	2. Light	2. Weak	2. Dry	2. Hard
1. Rejected	1. Very light	1. Very weak	1. Very dry	1. Very hard

RESULT and DISCUSSION

Moisture, dry matter, protein, fat, ash and energy contents of corned beef are described in Table 2. There were significant differences ($p < 0.05$) in the chemical composition (moisture, dry matter, protein, fat, ash and energy) amongst the four trademarks of corned beef examined. Lordoon contained high percentage of moisture (64.79%), while Exeter contained low percentage (57.66%). It is clear from the same table that the percentage of dry matter was on the exactly the opposite proportion of moisture, the highest ratios had achieved in canned meat containing the lowest percentage of dry matter so that the moisture content and dry matter to be as a whole constitute 100%. The percentage of moisture in the canned meat of Bordon, Lordoon and King Beef was high on the permissible limits by the Central Agency for Standardization and Quality Control (1988) but Exeter trademark was within the allowed limits.

High protein contents were shown in Bordon and King Beef trademarks while lower contents were in Lordoon trademark. Exeter trademark contained a moderate percentage (20.21%) of protein. Some studies reported similar protein content in corned beef, Al-obaidi, (2005) recorded the range of protein was between 20.28 – 21.17% in corned beef. Romans and Ziegler (1977) found that the percentage of protein in fresh beef was 20% and in the canned meat (Corned beef) 22% meat and luncheon meat (Luncheon) 11%. Thomas and Corden (1977) stated the chemical composition of different types of food, noticed that the percentage of protein in the canned beef (Corned beef) was 20.9%. The proportion of protein in the majority of transactions are comparable to the minimum allowed, which amounts to 21% and this is not acceptable that we need a relatively high-protein sources to increase the protein consumption locally.

Bordon, Lordoon and King Beef trademarks contained low percentage of lipid (10.70, 12.95 and 8.90 % respectively) while Exeter trademark contained

high percentage of lipid. Fat in the canned meat samples were within the limits allowable of the standard of Iraq but the percentage of fat in the Exeter trademark is 18.61% and this value is not matching the Central Agency for Standardization and Quality Control (1988).

NACI (2004) has published the components of the products of beef, including beef canned (Corned beef), stated that the percentage of fat for these products (Corned beef) was 16% of products exported to Caribbean countries, and the source to the other countries, including Iraq was fat ranging 14-17%, while the percentage of fat of beef luncheon meat (Luncheon beef) did not exceed 15%. The Central Agency for Standardization and Quality Control (1988) recorded that the percentage of fat in beef canned (corned beef) must not greater than 16%.

Significant difference in ash was shown among the four trademarks of canned meat. Lordoon and King Beef appeared to have higher contents of ash. Al-obaidi, (2005) recorded the range of ash between 2.95 – 2.55 % in corned beef. Ash content was high in some samples, especially in the sample king beef 3.06%; as the ash content is an indication of the content of salts, it might indicate that preservatives present are salts in concentrations higher than specified. The ratio of carbohydrates came within the limits allowable which must not exceed 2%.

Figure 1 shows the total volatile nitrogen value for four trademark of canned meat. No significant differences between the values of total volatile nitrogen for canned meat samples at a level ($p < 0.05$) and these values range from (12.3-12.8) mg N/ 100 g meat. These results were within the limits allowable of Iraq and the international specification (the Central Agency for Standardization and Quality Control 1987), while the free nitrogen from proteins in canned meat does not exist and chemical changes as well as non-existent because the canned meat have detected components of salt and nitrate, which helps to province the meat in cans inside from spoilage.

Table 2. Proximate Analysis of Four Trademarks of Canned Beef in Sulaimani Markets

Trademark	Moisture%	Dry matter%	Protein%	Fat%	Ash%	energy
Bordon	63.60±0.35 b	36.39±0.35 b	22.99±1.67 a	10.70±1.00 bc	2.20±0.01d	191.2±0.1c
Lordoon	64.79±0.005 a	35.21±0.005 a	18.45±0.66 b	12.95±0.82 b	2.77±0.005 b	194.5±1.1b
King beef	63.98±0.03 b	36.017±0.03 b	22.84±0.69 a	8.90±0.77 c	3.06±0.005 a	176.7±0.2d
Exeter	57.66±0.04 c	42.33±0.04 c	20.21±0.90 ab	18.61±1.00 a	2.44±0.01 c	251.9±1.5a
LSD _{0,05}	0.65	0.65	2.9	3.4	0.03	2.04

Means having the same letter in the same sections are not significantly different at $P = 0.05$

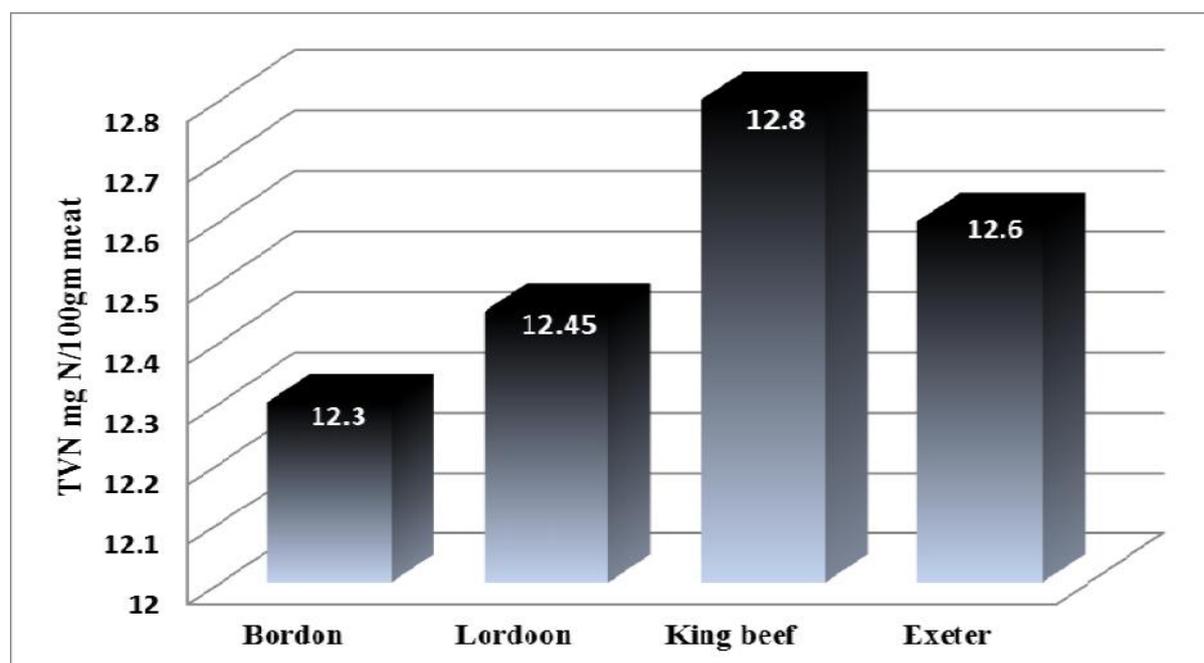


Figure 1. Total Volatile Nitrogen Value for Four Trademarks of Canned Meat (mg N/ 100g)

Free fatty acid (FFA), peroxide value and thiobarbituric acid for all trademarks of corned beef are shown in table 3. Bordon, Lordoon, King Beef and Exeter recorded 0.06, 0.03, 0.07 and 0.065% FFA respectively, significant differences are found among trademarks ($p < 0.05$). These percentages were within the limits recommended by the Central Agency for Standardization and Quality Control (1987), the corned beef was acceptable if the percentage (FFA) not more than 1.5%. USDA (2004) reported that the percentage of the FFA are high cooked canned beef (cooked corned beef) and low in cooked canned meat (raw corned beef). Peroxide values (PV) for Bordon, Lordoon, King Beef and Exeter were 0.92, 0.60, 0.65 and 0.75 meq oxygen/kg fat, respectively. Overall were acceptable, the reason for the decline is due to the addition of nitrate salts and ascorbate and this is reduce the value of PV in meat (Al- Obaidi, 2005 and Richards *et. al.*, 1998). Thiobarbituric acid (TBA) values showed significant differences for all trademarks. The higher value of TBA in Lordoon trademark 1.35 mg malonaldehyde/kg fat but the lower value of TBA in Bordon trademark 0.54 mg malonaldehyde/kg fat. And it was acceptable because it no more than 2 mg.

The microbiological evaluation of the four trademarks of corned beef (Bordon, Lordoon, King beef and Exeter) are shown in table 4. No significant difference ($p < 0.05$) were found in Total aerobic bacteria, coliform bacteria, proteolytic bacteria, lipolytic bacteria and *Clostridium* but in Bordon and Lordoon counted 2×10^{-2} and 2×10^{-2} cfu/gm respectively for *Bacillus*. This rate is situated within the limits allowed in the standard specification of Iraq

(the Central Agency for Standardization and Quality Control 1992) identified between 10^1 to 10^4 / gram. The cause of low numbers of bacteria indicates the preparation of this meat and canned correctly and possibly to add some preservatives to it, especially nitrates, which have an important role in reducing the growth of anaerobic bacteria and their inhibition, especially *Clostridium* (Al- obaidi, 2005). According to my results, the process of canning was scientifically occurs and the handling and transporting were correctly occurred so we have not any contamination or means indicator do not aerobic bacteria. The results in table 5 show No significant differences ($p < 0.05$) in the sensory properties (tenderness, juiciness, flavor and color) among the four trademarks of corned beef, while significant differences ($p < 0.05$) in the overall acceptability of the four trademarks of corned beef by a sample of consumer existed. Bordon trademark scored between 3 to 3.8 for tenderness, juiciness, flavor, color and overall acceptability. And Lordoon trademarks character dry and weak for juiciness and flavor respectively, while King Beef trademarks character hard and dry for tenderness and juiciness respectively but acceptable color and middle flavor. And Exeter trademark scored between 3 to 4 for tenderness, juiciness, flavor, color and overall acceptability. Al-Rubeii *et al.* (2000) observed significant differences for the effect of genetics on the tenderness, public acceptability, flavor and juiciness that agree with the studied results according to the different companies with different meat samples.

Table 3. Lipid Oxidation Evaluation for Four Trademarks of Corned Beef in Sulaimani Market

Trademark	Free fatty acids %	Peroxide value (meq oxygen/kg lipid)	Thiobarbituric acid (mg malonaldehyde/kg lipid)
Bordon	0.06±0.005 a	0.92±0.09 a	0.54±0.005 c
Lordoon	0.03±0.005 b	0.60±0.07 a	1.35±0.05 a
King beef	0.07±0.003 a	0.65±0.07 a	0.92±0.01 b
Exeter	0.06±0.008 a	0.75±0.12 a	0.63±0.05 c
LSD0.05	0.001	0.35	0.13

Means having the same letter in the same sections are not significantly different at $P = 0.05$

Table 4. Microbial Assessment for Four Trademarks of Corned Beef

Trademark	Total aerobic bacteria	Coliform Bacteria	Proteolytic bacteria	Lipolytic bacteria	<i>Bacillus</i>	<i>Clostridium</i>
Bordon	0.00	0.00	0.00	0.00	2.00±1.00 a	0.00
Lordoon	0.00	0.00	0.00	0.00	2.00±1.00 a	0.00
King beef	0.00	0.00	0.00	0.00	0.00±0.00 b	0.00
Exeter	0.00	0.00	0.00	0.00	0.00±0.00 b	0.00
LSD0.05	0.00	0.00	0.00	0.00	1.3	0.00

Means having the same letter in the same sections are not significantly different at $P = 0.05$

Table 5. Sensory Evaluation of Four Trademarks of Corned Beef

Trademark	Tenderness	Juiciness	Flavor	Color	overall acceptability
Bordon	3.80±0.25 a	3.00±0.70 a	3.20±0.70 a	3.60±0.25 a	3.20±0.40 ab
Lordoon	3.80±0.28 a	2.60±0.47 a	2.80±0.47 a	3.40±0.47 a	3.00±0.40 b
King beef	2.40±0.25 a	2.40 ± 0.64 a	3.20±0.40 a	3.60±0.25 a	2.80 ±0.25 b
Exeter	3.20± 0.47 a	3.00±0.40 a	3.20± 0.40 a	3.20±0.40 a	4.00±0.25 a
LSD0.05	1.48	1.35	1.3	1.08	0.91

Means having the same letter in the same sections are not significantly different at $P = 0.05$

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