

Effect of storage conditions on some sensory markers and bacteriological quality of corned beef cans stored at 4°C

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Received: 24 February 2018

Accepted: 05 April 2018

Online: 16 April 2018

ABSTRACT

This study was carried out at the college of veterinary medicine, University of Baghdad, for two months, the aim of the present study was to evaluate some bacteriological quality and sensory evaluation for opened canned corned beef and storage at 4°C in refrigerator for (0, 3 & 5) days. Data obtained revealed the following results: means of anaerobic total bacterial count were (0.56 – 0.65) cfu/g meat, total coliform were (0.45 – 0.51) cfu/g with significant differences in related criteria, whereas *Staphylococcus aureus* was not found in canned beef samples. Total bacterial mean log count was variable at different storage conditions under 4°C inside a refrigerator in which, non-obvious count was detected after soon opening the examined cans at time or periods zero, whereas the total bacterial count at day (3) was (0.58 -0.65) cfu/g meat and increased in period (5) days to reach (1.27 – 1.45) cfu/g meat. Significant differences in the sensory properties among the four trademarks observed, while there are non-significant differences in the palatability and color of the four trademarks. Therefore it is necessary to make sensory and microbial evaluation cautiously to keep a good nutritional value and quality of the meat for safe public health.

Keywords: Storage Conditions, Corned Beef Cans, Sensory Evaluation and Bacteriological Quality.

1. INTRODUCTION

The fresh meat was exposed to quick spoilage if we keeping under desperately storage conditions, therefore we keep it inside a refrigerator or freezer if we don't eat its directly, as a critical necessary during preservation and transportation of meat and meat products [1, 2], without affecting it's organoleptic contents and detrimental exchanges in its shelf life and bacteriological and chemicals quality [3]. We can storages the meat for short period in cooling 4°C (3 - 5) days, but if long period of storage (6- 12) months, under freezing at -32°C, or canning the meat for a long time (2-4 years) then it will exposed to different changes in its quality and assurance safety [4, 5, 6].

Canned meat is called the product of meat in closed sterilized cans and so-called canned beef or Corned beef this name date back to the British Empire (Anglo-

Saxon era) in which, the word (Corned) means that meat has treated with saline solution (curing) to save it from deterioration [5, 7]. Canning is an art of preserving foods and the industry expanded based on trial and error basis and skill of individual canners. During the 1990's, this method received much scientific scrutiny and has now developed into a sound and established technology to produce commercially sterilized safe foods having an almost infinite shelf life [8, 9]. United State department of agriculture (USDA, 2004) applying meat safety standards on a products as a part or shape policy decisions for human safety. Good food products have a high nutritional quality, as well as being free from physical, chemical and biological contaminations [10, 11, and 12].

Researchers in meat and meat products industries were interest in meat microbiology and safety and quality limits because its intercommunicated incriminates in meat spoilage and some species cause food-borne disease as an indictors to poor shelf life and poor microbiological quality by means of growth of coliform bacteria with enterotoxigenic *staphylococcus aureus* causing food poisoning [13, 14, 15].

The canned meat industry were you go through with many of processing treatments policies such as hurdle heat processing with keeping materials such as nitrites add to canned meat very high for limited allowance [16, 17, 18] Nitrites affect the growth of microorganisms in food through several reactions including: reacting with alpha-amino groups of the amino acids at low pH levels, blocking sulfhydryl groups which interferes with sulfur nutrition of the organism, [19, 20]. The possible reason for decrease in colour scores during refrigerated storage at 4°C might be due to surface drying or lipid oxidation causing non - enzymatic browning. The juiciness scores decreased with increasing storage periods [21, 22 & 23].

2. MATERIALS AND METHODS

2.1. Samples of Corned Beef Meat: The samples of corned beef, (4x5) divided four origins from Brazil (A) (B) Lebanon (C) and Jordan (D) were collected from super market of Baghdad city.

2.2. Storage of Corned Beef: The cans of beef opened and storage in refrigerator under cooling 4°C for (0, 3, 5) days

2.3. pH meat: Five grams of meat samples were homogenized and diluted decimally in 45 mL of phosphate buffered saline using a grinder (SFM1500NM, Shinil Co. China) for 1 min. Sample

solutions were centrifuged for 15 min at 2,000 g, and the pH was measured using a pH meter, marked Hunna, Malesia [24].

2.4. Sample Dilution and Plating: Ten grams of meat were extracted aseptically and added to 90ml of buffered peptone water (0.1%) (wt/v) and homogenized for 5 minutes in a stomacher, then 1ml mix was taken and serially tenfold diluted to 10⁻⁶ in a sterile 0.1% buffered peptone in autoclave 121 C° for 15minutes.and plated in duplicates by pour plating method using sterile nutrient agar and then incubated aerobically at 37C°for 48hours before enumeration. Each experimental condition was conducted for five replications [25].

2.5. Bacteriological Tests: Total bacterial count or total plate count (T.P.C.) described by [26] the colony of culture of bacteria ranges (30 – 300) in which Count of bacteria (cfu/g) meat= mean colony culture x dilute factor⁻¹

Total coliform count: Described by [26] similar to total bacterial count but different that plating method using sterile violet red bile agar and the colony count standards for culture of bacteria ranges (50 – 150). Count of coliform (CFU)/gr meat= mean colony culture x dilute factor⁻¹

2.6. Sensory Evaluation [27]: Was carried out by a nine-member semi trained panel. Panel members with ages ranging from 40 to 50 were from faculty members of public health Department of College of Veterinary Medicine / University of Baghdad, Panelists were asked to evaluate the samples of each brand for tenderness, juiciness, flavor, color and palatability as described in Table (1).

Table 1: Evaluation for descriptions of sensory properties for all trademarks of corned beef.

COLOR	FLAVOR	PALATABILITY	JUICINESS	TENDERNESS
(5) Very dark	(5) Very good	(5) Very palatability	(5)Very juice	(5) Very soft
(4) Dark	(4) Good	(4) palatability	(4) Juice	(4) Soft
(3) Acceptable	(3) Middle	(3) Middle	(3) Middle	(3) Middle
(2) Light	(2) Weak	(2) Unpalatability	(2) Dry	(2) Hard
(1) Very light	(1) Very weak	(1) Rejected	(1) Very dry	(1) Very hard

2.7. Statistical Analysis: The results were analyzed statistically, determining using completely randomized design (CRD). The significance of differences between groups was verified by the Duncan multiple range test; Levels of significance: p < 0.05 = non-significant (ns), using SAS program [28].

3. RESULTS AND DISCUSSION

The microbiological evaluation of the four trademarks of corned beef (A, B, C and D) were shown in table 2 in

which, a significant difference (p<0.05) in the means of Total anaerobic bacteria were found in ranges (0.56 – 0.65) cfu/gm, but non-significant differences (p<0.05) were found in the means of total coliform bacteria counted ranges (0.45 – 0.51) cfu/gram, *Staphylococcus aureus* was not found in all corned beef samples. This rate was situated within the limits allowed in the standard specification of Iraq. The Central Agency for Standardization and Quality Control (1992) identified between 10¹ to 10⁴ / gram microbial log count in meat

[11, 16]. 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 [16, 17]. According to

these results, the process of canning was properly occurs with handling and transporting were correctly guaranteed to insure not any contamination or changes in health parameters.

Table 2: Means of total anaerobic bacterial counts and total coliforms and *staphylococcus aureus* with standard error (SE \pm)

Number of Samples	Origin of Marks	Frequency Number	Means of <i>Staphylococcus aureus</i> cfu/g meat	Means of total coliform cfu/ g meat	Means of total anaerobic bacterial count Cfug/g meat
1	Brazil (A)	4	ND	0.51 ^a \pm 0.02	0.56 ^b \pm 0.08
2	Brazil (B)	4	ND	0.45 ^a \pm 0.03	0.64 ^b \pm 0.01
3	Lebanon (C)	4	ND	0.48 ^a \pm 0.01	0.57 ^b \pm 0.01
4	Jorden (D)	4	ND	0.45 ^a \pm 0.02	0.65 ^a \pm 0.04

Inspects count shown in Table (3) revealed non-significant deference in the periods storage (0) to (3) days but, significant differences ($p < 0.05$) among the trades marks was indicated. Aerobic contamination not

found at day zero but, growth of total aerobic log increased during storage periods to reach ranges (0.58 -0.65) cfu/g and (1.27 - 1.45) cfu/g in opened canned meat at (3) & (5) day respectively [16].

Table 3: Means of total bacterial counts cfu/g meats and storage in refrigerator for periods (0, 3 and 5) days with standard error (SE \pm)

Number of Samples	Origins of Marks	Frequency Number	Means of total bacterial counts cfu/g meat for periods (0,3,5)		
			0 Day	3 Day	5 Day
1	Brazil (A)	4	0.0 ^a \pm 0.0	0.63 ^a \pm 0.02	1.35 ^{ab} \pm 0.02
2	Brazil (B)	4	0.0 ^a \pm 0.0	0.64 ^a \pm 0.04	1.27 ^b \pm 0.04
3	Lebanon (c)	4	0.0 ^a \pm 0.0	0.65 ^a \pm 0.02	1.35 ^a \pm 0.02
4	Jorden (D)	4	0.0 ^a \pm 0.0	0.58 ^a \pm 0.02	1.45 ^a \pm 0.02

The means of concentration of pH of corned beef samples at storages periods (0, 3 and 5) days were shown in Table (3) in which, were increased from 0 to 5 days from 4.9 - 5.9. No significant difference was observed in the periods storage (0-3) days but, there were significant difference ($p < 0.05$) in periods storage at day (5) with increased in means of concentration of

pH were ranges 5.8 - 5.9. The concentration of pH were changes from acidity 4.9 in period (0) day to 5.9 in period (5) day, these results were similar and agreed with the studied results according to which the pH increased due to storages in refrigerator 4°C [21,22 ,23].

Table 4: Means of concentration of pH of corned beef samples storages periods (0, 3 and 5) days with standard error (SE \pm)

Number of Samples	Origins of Marks	Frequency Number	Means of concentration of pH of corned beef samples storages at (0,3,5) days		
			0 Day	3 Day	5 Day
1	Brazil (A)	4	4.9 ^a \pm 0.47	5.1 ^a \pm 0.04	5.8 ^b \pm 0.02
2	Brazil (B)	4	4.9 ^a \pm 0.12	5.1 ^a \pm 0.04	5.9 ^a \pm 0.02
3	Lebanon (c)	4	5.0 ^a \pm 0.05	5.1 ^a \pm 0.04	5.8 ^c \pm 0.0
4	Jorden (D)	4	5.0 ^a \pm 0.0	5.2 ^a \pm 0.04	5.8 ^{abc} \pm 0.02

The results in table (5) show No significant differences in the sensory properties (juiciness and color) among the four trademarks of corned beef, while significant differences ($p < 0.05$) in the tenderness, palatability and flavor were detected in corned beef by panel test consumers study. Trademark scored between 3.7 to 4.7 for tenderness, 3.5 to 4.25 for juiciness, 3.5 to 4.7 for flavor, 2.0 to 2.7 for color and 3.5 to 4.5 for palatability.

The scores of trademarks character middle for juiciness and flavor character tenderness and middle for tenderness and palatability for palatability but light color. Al-Rubeii et al. (2000) observed significant differences for the effect of genetics on the tenderness, color, palatability, flavor and juiciness that agree with the studied results according to the different companies with different meat samples [19,21,22].

Table 5: Sensory evaluation of corned beef samples storages of periods (0) day with standard error (SE \pm).

Number of Samples	Origins of Marks	Frequency Number	Sensory Evaluation				
			Color	Flavor	Palatability	Juiciness	Tenderness
1	Brazil (A)	4	2.5 ^a \pm 0.28	4.7 ^a \pm 0.25	4.5 ^a \pm 0.28	3.7 ^a \pm 0.25	4.25 ^{ab} \pm 0.25
2	Brazil (B)	4	2.0 ^a \pm 0.0	3.5 ^b \pm 0.25	3.5 ^b \pm 0.28	3.5 ^a \pm 0.28	4.5 ^{ab} \pm 0.28
3	Lebanon (c)	4	2.7 ^a \pm 0.25	3.7 ^b \pm 0.25	3.7 ^{ab} \pm 0.25	3.7 ^a \pm 0.25	4.7 ^a \pm 0.25
4	Jorden (D)	4	2.7 ^a \pm 0.25	4.25 ^{ab} \pm 0.25	4.0 ^{ab} \pm 0.0	4.25 ^a \pm 0.4	3.7 ^b \pm 0.25

P<0.05 =a,ab,b NS=aa

Table (6) show the sensory evaluation of corned beef samples during storages period (3) day. No significant differences in the sensory properties (juiciness and flavor) among the four trademarks of corned beef, while significant differences ($p < 0.05$) in the tenderness, palatability and color were noticed in corned beef by panel test consumers study. Trademark scored between 3.5 to 4.5 for tenderness, 3.5 to 4.25 for

juiciness, 3.5 to 4.25 for flavor, 2.25 to 3.25 for color and 3.25 to 4.5 for palatability. The scores of trademarks character middle for juiciness color, and flavor character tenderness for tenderness and palatability for palatability. The studied results according to the different companies with different meat samples [19, 21, 22].

Table 6: Sensory evaluation of corned beef samples storages of periods (3) day with standard error (SE \pm).

Number of Samples	Origins of Marks	Frequency Number	Sensory Evaluation				
			Color	Flavor	Palatability	Juiciness	Tenderness
1	Brazil (A)	4	2.75 ^{ab} \pm 0.25	3.75 ^a \pm 0.25	4.5 ^a \pm 0.28	3.5 ^a \pm 0.28	3.5 ^b \pm 0.28
2	Brazil (B)	4	2.25 ^b \pm 0.25	4.25 ^a \pm 0.25	3.25 ^b \pm 0.25	3.75 ^a \pm 0.25	4.5 ^a \pm 0.28
3	Lebanon (c)	4	2.25 ^b \pm 0.25	3.75 ^a \pm 0.25	4.0 ^{ab} \pm 0.4	3.75 ^a \pm 0.25	3.75 ^{ab} \pm 0.25
4	Jorden (D)	4	3.25 ^a \pm 0.25	3.5 ^a \pm 0.25	3.75 ^{ab} \pm 0.25	3.75 ^a \pm 0.25	4.25 ^{ab} \pm 0.25

P<0.05 =a,ab,b NS=aa

Table (7) show the sensory evaluation of corned beef samples during storage period 5 days. No significant differences in the sensory properties (tenderness, palatability, color, juiciness and flavor) among the four trademarks of corned beef were noticed in corned beef by panel test consumers study. Trademark scored between 3.7 to 4.0 for tenderness, 3.37 to 3.62 for

juiciness, 3.5 to 4.25 for flavor, 1.75 to 2.12 for color and 3.75 to 4.37 for palatability. The scores of trademarks character middle for juiciness, tenderness and very light color, character palatability, good for palatability and flavor respectively. The studied results according to the different companies with different meat samples [6, 19, 21, and 22].

Table 7: Sensory evaluation of corned beef samples storages of periods (5) day with standard error (SE ±)

Number of Samples	Origins of Marks	Frequency Number	Sensory Evaluation				
			Color	Flavor	Palatability	Juiciness	Tenderness
1	Brazil (A)	4	2.12 ^a ± 0.21	4.12 ^a ± 0.36	4.37 ^a ± 0.28	3.50 ^a ± 0.31	3.75 ^a ± 0.36
2	Brazil (B)	4	1.75 ^a ± 0.21	4.25 ^a ± 0.36	4.25 ^a ± 0.28	3.37 ^a ± 0.31	3.87 ^a ± 0.36
3	Lebanon (c)	4	1.85 ^a ± 0.21	4.25 ^a ± 0.36	3.75 ^a ± 0.28	3.62 ^a ± 0.31	3.75 ^a ± 0.36
4	Jorden (D)	4	2.0 ^a ± 0.21	4.25 ^a ± 0.36	4.25 ^a ± 0.28	3.50 ^a ± 0.31	4.0 ^a ± 0.36

P<0.05 =a,ab,b NS=aa

4. CONCLUSION

The storage conditions affect dramatically on microbial log count, organoleptic criteria tested by induced panel consumers test and quality assurance of opened canned corned meat cans during refrigeration periods from time zero to day (5). The bacteriological evaluation of the four trademarks of corned beef by the means of total anaerobic bacteria were ranges (0.56 – 0.65) cfu/g, but no significant differences (p<0.05) were found the means of total coliform bacteria counted ranges (0.45 – 0.51) cfu/g, *Staphylococcus aureus* were not found in all corned beef (table 2), the counts of aerobic total bacterial (table 3) not indicate any colony contamination at time zero storage but, increased growth of total aerobic bacterial were noticed in ongoing periods of storage. 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 [16, 17]. According to observed results, the process of canning was scientifically occurs and the handling and transporting were correctly insured so no indices of any aerobic contamination were detected [11, 13]. The mean values for sensory attributes of restructured corned beef during refrigerated storages (tables 5, 6, 7) were reduction during storage might be due to microbial growth and lipid oxidation .The juiciness and color scores decreased with increasing storage period. Dehydration and moisture reduction of the product with advancement of refrigerated storage could be the reason for lower juiciness, color scores [20, 21].

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