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Chemical evaluation of cattle and camel meat

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A B S T R A C T

A total of 120 random samples of beef and camel meat (60 0f each) were collected from 3 different abattoirs namely Elbagour, Menouf and Shibin-Elkom (40 0f each) located in Menofia governorate. for evaluation of their chemical quality. The chemical examination of beef samples revealed that the mean values of pH, TVN (mg%) and TBA (mg/ Kg) were 5.69 ± 0.01, 7.63 ± 0.49 & 0.18 ± 0.01 for Elbagour abattoir, 5.62 ± 0.01, 5.89 ± 0.40 & 0.11± 0.01 for Menouf abattoir and 5.54 ± 0.01, 4.15 ± 0.32 and 0.06 ± 0.01 for Shibin Elkom abattoir, respectively. While, the mean values of pH, TVN (mg%) and TBA (mg/ Kg) in the examined samples of camel meat were 5.75 ± 0.01, 9.35 ± 0.57 & 0.13 ±0.01for Elbagour abattoir, 5.67 ± 0.01, 6.48 ± 0.39 & 0.07 ±0.01 for Menouf abattoir and 5.61 ± 0.01, 4.97 ± 0.25 and 0.04 ±0.01for Shibin Elkom abattoir, respectively.

KEY WORDS: meat, beef, camel, TVN, TBA.

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1. I N T R O D U C T I O N

Meat is considered an important source of proteins and essential amino acids. Due to this rich composition, it offers a highly favorable environment for the growth of pathogenic bacteria.The microbiological contamination of carcasses occurs mainly during processing and handling, such as skinning, evisceration, storage and distribution at slaughterhouses and retail establishments [9]. Beef constitutes about 36.88 % of the total red meat produced in Egypt compared to 6.63 % for camel meat, [19].

The growing demand for meat was challenged the live stocks and meat producers to seek ways for minimizing the gap between the production and consumption of meat by paying more attention toward meat animals other than cattle e.g. buffalo and camel.At the same time, the national government enables the consumers to receive maximal palatability benefits at the lowest cost **[7].** pH values of meat under any condition should not exceed 6.4, otherwise it must be considered unfit for human [10]. Meat with a pH below 5.8 has a pale color, however, the color of meat with higher pH is too dark and has a great risk on human health. Therefore, the ideal pH for meat is between 5.3 and 5.8 and the meat is marginally spoiled at pH 6.6 after which it is markedly spoiled [18].

The increase in TVN value in the meat might be attributed to the breakdown of protein as a result of activity of different microorganisms and their proteolytic enzymes [12]. It is of great importance to mention that TBA values could be a useful quality index for the assessment of rancidity during the storage of lipid rich food.Therefore, the present study was planned out to throw light on the chemical quality of cattle and camel meat through measuring their pH,TVN and TBA values .

2. MATERIALS AND METHODS

A total of 120 random samples of beef and camel meat (60 0f each) were collected from 3 different abattoirs namely Elbagour, Menouf and Shibin-Elkom (40 0f each) located in Menofia governorate for determination of their chemical quality.

2.1. Measurement of pH value (15)

In a blender, approximately 10 gm of the sample were blended in 10 ml of distillated water. The homogenate was left at room temperature for 10 minutes with continuous shaking. The pH value was determined by using an electric pH meter (Bayer Model 6020, USA).

2.2. Measurement of Total Volatile Nitrogen "TVN"[7].

Twenty five grams of the examined samples were added to 75 ml of distillated water then thoroughly mixed by a blender for 2 minutes and then 2 drops of (2N)HCL were added to bring the pH value to 5.2. The homogenate was slowly heated to 70°C and then be cooled to 30°C and then filtered. Into the inner compartment of Conway dish, 2ml of (0.01 N) Hcl were added. Whereas, the outer ring was filled with 2 ml of the extract and 1 ml of saturated potassium carbonate (KCO3). The Conway unit was rotated as gently as possible. The dish was covered with air tight glass plate and incubated at 36°C for 2 hours. The HCL in the inner ring was titrated against NaOH (0.01N) by using methyl red indicator.
TVBN mg/100 gm = 26.88 X (2-T1) mg.
Where T1 = volume of NaOH consumed in the titration.

2. 3. Measurment of Thiobarbituric Acid Number "TBA[7].

In a clean blender, about 20 gm of the examined sample were blended with 100 ml of 7.5% trichloroacetic acid solution for 2 minutes, and the homogenate was filtered. Five ml of TBA reagent (0.02 M thiobarbituric acid) (0.29 g/100 ml 90% glacial acid) were added to 5 ml of the filtrate in a screw capped test tubes.
The tubes were heating in a water bath for 40 minutes, and the absorbance of the resulting color was measured by using of a spectrophotometer (Spectronic21 Germany) at wave length 538 nm.
The TBA values were recorded as mg malonaldehyde /100 gm of the samples.

Concentration of malonaldehyde =

$$\frac{0.016\ S + 2.872}{10}\ \text{mg/100gm}$$

Where S = the absorbance

2.4. Statistical Analysis

The obtained results were statistically evaluated by application of Analysis of Variance (ANOVA) test according to [5].

3.RESULTS

Table (1) indicated that the mean values of pH values in the examined cattle meat samples taken from Elbagour, Menouf and Shibin Elkom abattoirs were 5.69 ± 0.01, 5.62 ± 0.01 and 5.54 ± 0.01, respectively. However, the pH values in the examined samples of camel meat were ranged 5.63 to 5.84 with an average of 5.75 ± 0.01 for Elbagour abattoir, 5.58 to 5.77 with an average of 5.67 ± 0.01 for Menouf abattoir and 5.53 to 5.68 with an average of 5.61 ± 0.01 for Shibin Elkom abattoir.

Table(2) indicated that TVN values (mg %) in the examined samples of beef varied from 3.93 to 10.74 with a mean value of 7.63 ± 0.49for Elbagour abattoir, 3.05 to 8.87 with a mean value of 5.89 ± 0.40 for Menouf abattoir and 2.26 to 5.96

with a mean value of 4.15 ± 0.32 for Shibin Elkom abattoir. Furthermore, TVN values in the examined samples of camel meat ranged 6.34 to 13.18 with an average of 9.35 ± 0.57 for Elbagour abattoir, 4.59to 9.71 with an average of 6.48 ± 0.39for Menouf abattoir and 3.01 to 6.83 with an average of 4.97 ± 0.25 for Shibin Elkom abattoir.

Table (3) revealed that the TBA values (mg/Kg)in the examined samples of beef ranged from 0.10 to 0.27 with an average of 0.18 ± 0.01for Elbagour abattoir, 0.06 to 0.19 with an average of 0.11± 0.01for Menouf abattoir and 0.02 to 0.13 with an average of 0.06 ± 0.01 for Shibin Elkom abattoir. On the other hand, the mean values of TBA (mg/Kg) in the examined samples of camel meat taken from Elbagour, Menouf and Shibin Elkom abattoirs were 0.13 ±0.01, 0.07 ±0.01 and 0.04 ±0.01, respectively.

4. DISCUSSION

The differences in pH values associated with the examined samples of meat were high significant ($P < 0.01$) as a result of animal species. Such findings come in accordance with those recorded by [3], [20], [13] and [7] who found that the mean values of pH in the examined samples of fresh beef was 5.56± 0.09.The decrease in pH value in meat may be attributed to the break down of glycogen with the formation of lactic acid and the increase of pH may be due to the partial proteolysis leading to the increase of free alkaline groups depending on the condition of such changes[17].The variation of pH values of the examined samples of meat could be attributed to the water holding capacity of the muscle proteins, color, appearance and storage life of the meat [14].In this respect, the pH value of meat under any condition should not exceed 6.4, otherwise it must be considered unfit for human [10]. Meat with a pH below 5.8 has a pale color, however, the color of meat with higher pH is too dark and it has a great risk on human health. Therefore, the ideal pH for meat is between 5.3 and 5.8 and the meat is marginally spoiled at pH value of 6.6 after which it is markedly spoiled [18].

Table (2)pointed out that the TVN values (mg %)in the examined samples of beef were varied from 3.93 to 10.74 with a mean value of 7.63 ± 0.49for Elbagour abattoir, 3.05 to 8.87 with a mean value of 5.89 ± 0.40for Menouf abattoir and 2.26 to 5.96 with a mean value of 4.15 ± 0.32 forShibin Elkom abattoir. Further, the TVN valuesin the examined samples of camel meat were ranged 6.34 to 13.18 with an average of 9.35 ± 0.57 for Elbagour abattoir, 4.59to 9.71 with an average of 6.48 ± 0.39for Menouf abattoir and 3.01 to 6.83 with an average of 4.97 ± 0.25 for Shibin Elkom abattoir.The differences associated with the examined samples of cattle and camel meat of various Menofia abattoirs were high significant ($P < 0.01$) as a result of TVN nearly similar results were obtained by [2], [1] and [12] who recorded that the mean value of TVN in the examined samples of fresh meat was of 12.5 mg %. Concerning the examined samples, the camel meat samples had the highest proportion of TVN mg% than beef ones, this means that the protein of camel meat samples are most rapid for degradation. In general, all the examined beef and camel meat samples were accepted and fit for consumption where their TVN contents did not exceed the accepted limit (not more than 20mg % stipulated by [6]. Ammonia is one of the most spoilage end products in spoiled meat which is directly responsible for spoilage odors and flavors, it is considered as an indicator for amino acid degradation by bacteria and it can be measured as total volatile basic nitrogen [22].

From the results reported in table (3)it is clear that the TBA values (mg/Kg)in the examined samples of beef were ranged from 0.10 to 0.27 with an average of 0.18 ± 0.01for Elbagour abattoir, 0.06 to 0.19 with an average of 0.11± 0.01for Menouf abattoir and 0.02 to 0.13 with an average

of 0.06 ± 0.01 for Shibin Elkom abattoir. On the other hand, the mean values of TBA (mg/Kg) in the examined samples of camel meat taken from Elbagour, Menouf and Shibin Elkom abattoirs were 0.13 ±0.01, 0.07 ±0.01 and 0.04 ±0.01, respectively. Results achieved in table (3) indicated high significant differences (P .0.01) between the examined samples of cattle and camel meat of different Menofia abattoirs as a result of TBA.The present results agree, quite well, with those reported by [1] and [12]. According to [6]. which recommended that TBA of fresh meat should not exceed 0.9 mg/Kg, all the examined cattle and camel meat samples were accepted and fit for consumption where their TBA contents did not exceed this accepted limit.It is of great importance to mention that TBA values could be a useful quality index for the assessment of rancidity during the storage of lipid rich food. Also, TBA test is a sensitive test for the spoiled meat of high unsaturated fatty acids which do not appear clear in determination In other words, when the ratio of fat content increased in meat, the TBA value will be increased indicating probable lipids oxidation [21]. Generally, TBA value is routinely used as index of lipid oxidation in meat and its products and the rancid flavor is initially detected in meat when TBA values lies between 0.5 and 2.0 mg/Kg [11]. Finally we concluded that application and implementation of Hazard Analysis and Critical Control Point (HACCP) system may be the appropriate solution to ensure quality and safety of fast food especially during preparation and serving.

Table (1): Statistical analytical results of pH values in the examined samples of beef and camel meats at Menofia abattoirs (n=20).

Species	Cattle meat			Camel meat		
Abattoir	Min	Max	Mean ± S.E*	Min	Max	Mean ± S.E*
Elbagour	5.57	5.78	5.69 ± 0.01	5.63	5.84	5.75 ± 0.01++
Menouf	5.53	5.69	5.62 ± 0.01	5.58	5.77	5.67 ± 0.01
ShibinElkom	5.46	5.62	5.54 ± 0.01	5.53	5.68	5.61 ± 0.01

S.E* = standard error of mean ++ = High significant differences (P<0.01)

Table (2): Statistical analytical results of Total Volatile Nitrogen (TVN) values "mg %" in the examined samples of cattle and camel meats at Menofia abattoirs (n=20).

Species	Cattle meat			Camel meat		
Abattoir	Min	Max	Mean ± S.E*	Min	Max	Mean ± S.E*
Elbagour	3.93	10.74	7.63 ± 0.49	6.34	13.18	9.35 ± 0.57++
Menouf	3.05	8.87	5.89 ± 0.40	4.59	9.71	6.48 ± 0.39
ShibinElkom	2.26	5.96	4.15 ± 0.32	3.01	6.83	4.97 ± 0.25

S.E* = standard error of mean ++ = High significant differences (P<0.01)

Table (3): Statistical analytical results of Thiobarbituric acid (TBA) values "mg/kg" in the examined samples of cattle and camel meats at

Species	Cattle meat			Camel meat		
Abattoir	Min	Max	Mean ± S.E*	Min	Max	Mean ± S.E*
Elbagour	0.10	0.27	0.18 ± 0.01	0.07	0.21	0.13 ± 0.01
Menouf	0.06	0.19	0.11 ± 0.01	0.03	0.15	0.07 ± 0.01
ShibinElkom	0.02	0.13	0.06 ± 0.01	0.01	0.08	0.04 ± 0.01

S.E* = standard error of mean

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الحالة الكيميائية لذبائح الماشية والجمال فى مجازر محافظة المنوفية

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الملخص العربى

الهدف من هذه الدراسة هو الوقوف على الحالة الكيميائية للحوم داخل المجازر فى محافظة المنوفية وعليه تم تجميع العينات من ثلاثة مجازر وهم مجزر شبين الكوم و مجزر الباجور ومجزر منوف وكان عدد العينات هو 120 عينة تم تجميع 40 عينة من كل مجزر عشرون منهم للابقار وعشرون منهم للجمال واجرى عليهم الاختبارات والكيميائية.
بالنسبة الى الاختبارات الكميائية فى عينات الابقار كان متوسط القمية العددية لكل من pH, TVN (mg%) and TBA (mg/ Kg)كان فى مجزر الباجور 0.01 ± 0.18 &0.49 ± 7.63 , 0.01 ± 5.69 ، كان فى مجزر منوف ±0.11 0.01&0.40 ± 5.89 , 0.01 ± 5.62 , كان فى مجزر شبين الكوم 0.01 ± 0.06و 0.32 ± 4.15 , 0.01 ± 5.54،
بالنسبة الى الاختبارات الكميائية فى عينات الجمال كان متوسط القمية العددية لكل من فى مجزر الباجور
TBA,TVN,pH 0.57 ± 9.35 , 0.01 ±و0.01± 0.13
كان فى مجزر منوف 0.01± 0.07 &0.39 ± 6.48 , 0.01 ± 5.67
و فى مجزر شبين الكوم على الترتيب 0.01± 0.04و 0.25 ± 4.97 , 0.01 ± 5.61
فى النهاية للحصول على لحوم جيدة وصالحة للاستهلاك الادمى يوصى البحث بمراعاة تطبيق نظام المخاطر المحتملة فى المجازر المصرية .

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