Journal of the Hellenic Veterinary Medical Society

Vol 71, No 4 (2020)

Chemical quality indices in local and imported beef meat

F. S. HASSANIEN, F. A. SHALTOUT, M. Z. FAHMEY, H. F. ELSUKKARY

doi: 10.12681/jhvms.25935

To cite this article:

HASSANIEN, F. S., SHALTOUT, F. A., FAHMEY, M. Z., & ELSUKKARY, H. F. (2021). Chemical quality indices in local and imported beef meat. *Journal of the Hellenic Veterinary Medical Society*, *71*(4), 2549–2552. https://doi.org/10.12681/jhvms.25935

J HELLENIC VET MED SOC 2020, 71(4): 2549-2552
ΠΕΚΕ 2020, 71(4): 2549-2552

Research article
Ερευνητικό άρθρο

Chemical quality indices in local and imported beef meat

F.S. Hassanien, F.A. Shaltout, M.Z. Fahmey, H.F. Elsukkary

Food Hygiene and Control Department, Faculty of Veterinary Medicine, Benha University

ABSTRACT: Freshness of meat samples can be measured and evaluated by chemical tests based on their protein decomposition, lipid oxidation and/or pH values. A total of 100 random samples of local and imported beef meat (50 of each) were collected from different shops in Cairo governorate for evaluation of their chemical quality. Chemical examination of beef samples revealed that the mean values of pH, TVB/N (mg%) and TBA (mg/Kg) were 5.77 ± 0.32, 11.9±1.63 &0.58± 0.10 for local meat samples respectively , while they were 6.6 ± 0.12, 21.5 ± 1.95 & 0.95 ± 0.11 for imported samples respectively. Overall results obtained were considered important meat quality indicators. It is clear that there is a significant difference between fresh and frozen meat samples, which could be attributed to storage time and other conditions, particularly for frozen samples.

Keywords: beef, local, imported, chemical, evaluation.

Corresponding Author:
Hassan Fehr Abdelkader Elsukkary, Narges 3 City Towers, El- Bushy, El- Waha District, Nasr City, Cairo, Egypt.
E-mail address: hassanfehr@gmail.com

Date of initial submission: 17-02-2020
Date of revised submission: 05-04-2020
Date of acceptance: 27-04-2020

INTRODUCTION

Meat is one from the most nutrient-dense food that provides ideal conditions for microbes to grow and defines its perishable nature (Saucier, 2016). Freshness of any meat samples can be measured chemically based on protein decomposition and lipid oxidation. For example, thebreakdownofproteinleads to ammoniaproductiondue toamino acid deamination, which is reflected as liberation of volatile basic nitrogen (VBN) content (Min et al., 2007). Onthe other hand, lipid oxidation could be measured as a thiobarbituric acid value (Kruk et al., 2011). The increase in TVB/N value in the meat might be attributed to the destruction of proteinas a result of different microorganisms activity and their proteolytic enzymes (Hassan and Omama , 2011).It isimportantto mention that TBA values is a useful quality indicator for the assessment of rancidity during the storage of lipid rich food substance. Therefore, the present study was planned out to throw light on the chemicalexamination of meat samples .There is a significant effect of storage time. Beef samples are more susceptible than chicken and tuna to lipid oxidation changes, and by day 7 of storage, TBA values in beef reached above 1 mg /kg of meat samples (Khan, 2014). The TVB-N content of chilled beef increased rapidly with prolonged storage time, indicating that beef spoilage was accelerated. The average TVB-N contents increased from 9.42 mg/100g to 19.57 mg/100g at Days 1 and 13 of storage at4°C, respectively. This increase might be attributed to ammonia produced due to proteolysis of protein inthe chilled beef during storage (Li et al., 2019). pH values of meat under any kind of conditions must not exceed 6.4, otherwiseit should be considered as unfit for human consumption (Gracey and Collins, 1992) .The variation of pH values of the examined samples of meat could be attributed to the water holding capacity of the muscle proteins and storage life of the meat (Kadim et. al., 2006).

MATERIALS AND METHODS

A grand total of 100 random fresh and frozen meat samples (50 0f each) were collected from different shops in Cairo governorate. The imported meat samples were collected from raw frozen imported meat stored at a storage temperature -18°C to -20°C which were collected during its claimed shelf-life time, while the local fresh meat samples were collected from raw chilled meat stored at 4°C to 8°C, collected during the claimed shelf-life time then all samples were transferred directly to the laboratory, in an ice-box under complete aseptic conditions without any delay. Then they were subjected to following examinations to evaluate chemical quality.

Determination of pH value (ES 63/11, 2006)

Approximately 10 grams of the examined sample were homogenized with 25 ml of neutral distilled water in stomacher, and left to stand for 10 min at room temperature with continuous shaking and filtered. The pH was determined by using electrical pH meter (ACTWA-AD1200-1034678) calibrated by using two buffer solutions of exactly known pH (Alkaline pH 7.01, acidic pH 4.01) therefore, pH electrode was washed with neutralized water and then introduced into the homogenate.

Determination of Total Volatile Basic Nitrogen (TVB/N)"mg" % (ES 63/10, 2006)

A part of 10 grams of sample were minced in a stomacher for 1-2 minutes until homogenization. Then in a distillation flask add 2 grams of magnesium oxide and 300 ml distilled water to the minced sample. Make distillation and receive 100 ml distillate within 30 minute in a beaker contain 25 ml of 2% boric acid. Then titrate against H_2SO_4 0.1M until faint pink color.

$$\text{TVN mg/100g} = R \times 14$$

Where R is the volume of H_2SO_4 exhausted in titration.

Determination of Thiobarbituric Acid (TBA)"mg/Kg" (ES 63/9, 2006)

TBA number is expressed as milligrams of malondialdehyde equivalents per kilogram of sample.

A part of 10 grams of sample were blended with 48 ml of distilled water, to which 2 ml of 4% of ammonium chloride (to bring the pH to 1.5) were added in a stomacher for 2 minutes and left at room temperature for 10 minutes. The mixture was quantitatively transferred into Kjeldahl flasks by washing with additional 50 ml distilled water, followed by an anti-foaming preparation and few glass beads. The Kjeldahl distillation apparatus were assembled and the flask was heated to 50°C.

A part of 50 ml distillate was collected in 10 minutes from the time of boiling commences. The distillate was mixed, and then 5ml was pipette into a glass- Stoppard tube. 5ml of TBA reagent (0.2883g/100ml of 90% glacial acetic acid) were added. The tube was stoppered, shacked and immersed in boiling water bath for 35 minutes. A blank was similarly prepared using 5ml distilled water with 5ml TBA reagent and treated like

the sample.After heating, the tube was cooled under tape water for 10 minutes. A portion was transferred to a curette and the optical density (D) of the sample was read against the blank by means of spectrophotometer (Perkin Elmer, 2380, USA) at a wave length of 538 nm.

TBA value (mg malondialdehyde /kg of sample) = D× 7.8

D: the read of sample against blank.

RESULTS

Results show the chemical evaluation of fresh and frozen samples and revealed that PH values were varied from 4.22 to 6.80 and 6.36 to 7.32 with an average of 5.77±0.32 and average of 6.6± 0.12 for fresh and frozen meat samples respectively with a significance difference between the fresh and frozen samples, TVB/N values were varied from 6.81 to 20.95 and 14.22 to 28.4 with an average of 11.9 ± 1.63 and of 21.5 ± 1.95 for fresh and frozen meat samples respectively, moreover , and finally TBA values were in range of 0.12 to 1.02 and 0.47 to 1.55 with an average of 0.58 ± 1.63 and 0.95 ± 0.11 of fresh and frozen meat samples respectively and also there is a significance differences between the fresh and frozen samples .

DISCUSSION

Results of table (1) discuss the chemical evaluation of fresh and frozen samples and revealed that pH values were varied from 4.22 to 6.80 and 6.36 to 7.32 with an average of 5.77±0.32 and average of 6.6± 0.12 for fresh and frozen meat samples respectively with a significance difference between the fresh and frozen samples, TVB/N values were varied from 6.81 to 20.95 and 14.22 to 28.4 with an average of 11.9 ± 1.63 and of 21.5 ± 1.95 for fresh and frozen meat samples respectively, moreover, and finally TBA values were in range of 0.12 to 1.02 and 0.47 to 1.55 with an average of 0.58 ± 1.63 and 0.95 ± 0.11 of fresh and frozen meat samples respectively and also there is a significance differences between the fresh and frozen samples.

Results obtained in table (2) concluded the acceptance of samples accordingto Egyptian standard specification (ES 1522/ 2005) and revealed that 30% of fresh meat samples and 60 % of frozen meat were unfit for human consumption due to their unaccepted pH value according to ES (1522/ 2005). These findings of freshmeat samples were nearly similar to those reported by Edris et al. (2013**)** with mean values 5.69 ± 0.01, for Elbagour abattoir, 5.62 ± 0.01, for Menouf abattoir and 5.54 ± 0.01, for Shibin Elkom abattoir and Suleimenova (2016**)** when pH values ranged from 5.63±0.06 for Aberdeen Angus to 5.83±0.19 for Northern Finn cattle, low pH of meat is an indication of high quality and it is associated with a bright red colour, increased tenderness, increased flavor and increased shelf life and this may be attributed to the presence of lactic acid production during the postmortem phase as said by (Pethick et al.,1995**).** 10% of fresh meat samples and 40 % of frozen meat samples were unacceptable for human consumption due to high TVB/N content according to ES (1522/ 2005). Lower results have been reported by Edris et al. (2013) where mean values of TVB/N (mg%) were 7.63 ± 0.49 for Elbagour abattoir and 4.15 ± 0.32 for Shibin Elkom abattoir.

Table 1: Chemical evaluation of examined fresh and frozen meat samples (n = 50 each)

	Fresh meat			Frozen meat		
	Min.	Max.	Mean ±S.E.M*	Min.	Max.	Mean ±S.E.M*
pH	4.22	6.80	5.77 ± 0.32**	6.36	7.32	6.6 ± 0.12**
TVB/N	6.81	20.95	11.9±1.63	14.22	28.4	21.5 ± 1.95
TBA	0.12	1.02	0.58± 0.10**	0.47	1.55	0.95 ± 0.11**

*S. E.M = Standard error of mean

** significant difference (P<0.05).

N.B: No Significant difference in TVB/N (P>0.05)

Table 2: Chemical acceptability of examined fresh and frozen meat samples (n = 50 each)

	MPL[1]	Accepted fresh		Unaccepted fresh		Accepted frozen		Un accepted frozen	
		No.	%	No.	%	No.	%	No.	%
PH	5.6 – 6.5	35	70	15	30	20	40	30	60
TVN	< 20 mg%	45	90	5	10	30	60	20	40
TBA	< 0.9 mg/kg	40	80	10	20	25	50	25	50

MPL[1] = Maximum permissible limit according to ES (1522/ 2005).

Results obtained by Li et al. (2019) showed rapidly increase of content of TVB-N of chilled beef samples with prolonged storage time, indicating that beef spoilage was an accelerated process. The average TVB-N contents increased from 9.42 mg/100g to 19.57 mg/100g at Days1and 13 of storage at 4°C, respectively. This increase might be an indication to ammonia produced in the chilled beef during long storage and decomposition of meat.

Total volatile basic nitrogen (TVB-N) content in meat samples is a physicochemical indication in the judgment of meat freshness (Ma et al., 2013**).** According to Chinese National Standard GB2707-2016, TVB-N content is the vital direct measurement indicator form at freshness. TVB-N is an alkaline nitrogen-containing substance produced by meat protein decomposition under the action of enzymatic degradation and microbial action during the spoilage of animal-based foods (Leroi et al., 2001).

As the results of TBA, there was found that 20% of fresh meat samples 50 % of frozen meat samples were unacceptable for human consumption due to their increase of TBA value *according to ES (1522/ 2005).*, Khan (2014) recorded almost the same results of fresh samples with average (1.06 mg/kg) due to effect of storage time. While Edris et al. (2013**)** have got much lower results with mean values of TBA (mg/ Kg) were 0.18 ± 0.01 for Elbagour abattoir, 0.11± 0.01 for Menouf abattoir and 0.06 ± 0.01 for Shibin Elkom abattoir. Lipid oxidation primarily results in alkyl, alkoxyl and peroxy radicals which later result in secondary oxidation products such as aldehydes, ketones, alcohols, hydrocarbons, esters, furans, epoxides, and cyclic peroxides (Faustman et al., 2010).

The thiobarbituric acid (TBA) test is used for lipid oxidation measurements (Fernandez et. al., 1997**).** Overall, results of table (1) and Table (2) concluded that there is a significant difference between fresh and frozen meat samples.

CONCLUSIONS

Chemical examination of beef samples revealed that the mean values of pH, TVB/N(mg%) and TBA (mg/Kg) were 5.77 ± 0.32, 11.9±1.63 &0.58± 0.10 for local meat samples respectively , while they were 6.6 ± 0.12, 21.5 ± 1.95 & 0.95 ± 0.11 for imported samples respectively. Overall results which obtained were considered important meat quality indicators. It is clear that there is a significant difference between fresh local and imported frozen meat samples, which could be attributed to storage time and other handling and transportation conditions, particularly for frozen samples.

CONFLICT OF INTEREST

The authors declared no conflict of interest in this article.

REFERENCES

Edris A, Hassan M, Saltout F, El-Hosseny S(2013) Chemical evaluation of cattle and camel meat. BVMJ, 25, 145-150.

E.S (Egyptian Standards) , 63/9" (2006) Egyptian Organization For Standardization and quality control. Egyptian Standards for meat products treated with heat.

E.S (Egyptian Standards), 63/10" (2006) Egyptian Organization For Standardization and quality control. Egyptian Standards for meat products treated with heat.

E.S (Egyptian Standards), 63/11" (2006): Egyptian Organization For Standardization and quality control. Egyptian Standards for meat products treated with heat.

E.S. (Egyptian standards), 1522"(2005) Egyptian standards specification for frozenmeat. Egyptian Organization for Standardization and Quality Control.

Faustman C, Sun Q, Mancini R, Suman SP (2010) Myoglobin and lipid oxidation interactions: Mechanistic bases and control. Meat Science, 86(1), 86-94.

Fernández J, Pérez-Álvarez JA, Fernández-López JA (1997)Thiobarbituric acid test for monitoring lipid oxidation in meat. Food Chem, 59(3), 345-353.

Gill CO (1998) Microbiological contamination of meat during slaughter and butchering of cattle, sheep and pigs. In: Davies, A.R., Board, R.G (Eds.),The Microbiology of Meat and Poultry. Blackie Academic, London, pp.118–157

Gracey JF, Collins DS (1992) Meat Hygiene. 9th Ed., Baillier, Tindall, England.

Hassan AA, Omama A (2011) Chemical evaluation of meat and meat products. Assuit Vet. Med. J., 57(130), 62-71.

Kadim TI, Mahgoub O, Almarzooqi W, Alzadjali S, Annamalai K, Mansour MH (2006) Effect of age on composition and quality of muscle longissimus thoracis of the omani Arabian camel Camelus dromedaries. Meat Sci., 73(4), 619-625.

Kruk ZA, Yun H, Rutley DL, Lee EJ, Kim YJ, Jo C (2011) The effect of high pressure on microbial population, meat quality and sensory characteristics of chicken breast fillet. Food Control, 22(1), 6-12.

Khan A. (2014): Effects of Processing and packaging modifications on the quality and shelf life in meats.

Leroi F, Joffraud JF, Cardinal M (2001) Research of quality indices for cold- smoked salmon using a stepwise multiple regression of microbiological counts and physico-chemical parameters. J Appl Microbiol, 90(4), 578–587.

Li, Y.; Tang, X.; Shen, Z. and Dong, J., (2019): Prediction of total volatile basic nitrogen (TVB-N) contentof chilled beef for freshness evaluation by using viscoelasticity based on airflow and laser technique. **Food C**hem, 287, 126-132.

Ma SB, Peng YK, Xu Y, Tang XY, Tian XY (2013) Detection of beef TVB-N by visible and near-infrared spectroscopy combined with variables election method. J Jiangsu Univ (Natural Science Edition), 34(1), 44–48.

Lee SO, Jang A, Jo C, Park CS, Lee M (2007) Relationship between the concentration of biogenic amines and volatile basic nitrogen infresh beef, pork, and chicken meat. As Austral J An Sci, 20(8), 278-1284.

Saucier L (2016) Microbial spoilage, quality and safety within the context of meat sustainability. Meat Sci 120, 78-84.

Suleimenova A (2016) Biochemical And Sensory Profile Of Meat From Dairy And Beef Cattle, MSc Thesis Green Biotechnology and Food Security University of Eastern Finland, Faculty of Science and Forestry.