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Bacteriological Evaluation of Cattle Carcasses at Qaliubiya Abattoirs

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Abstract

A total of 60 random samples of cattle carcasses were collected from the different abattoirs located in Qaliubiya governorate. The samples taken from each carcass were represented meat, spleen, liver and kidneys (15 samples of each), the samples were collected directly after slaughtering and evisceration. The collected samples were subjected to bacteriological examination. The results of microbiological examination in examined samples of meat, spleen, liver and kidneys revealed that the mean of total APC were $2.26\times10^4\pm 0.51\times10^4$, $4.09\times10^4\pm 0.63\times10^4$, $1.95\times10^5\pm 0.27\times10^5$, $6.48\times10^5\pm 1.89\times10^5$, respectively. While the mean of coliform count with the mean of $5.54\times10^2\pm 1.02\times10^2$, $8.92\times10^2\pm 2.14\times10^{2,}$ $9.17\times10^3\pm 2.35\times10^3$, $2.38\times10^4\pm 0.61\times10^4$, respectively, total Staphylococci count with the mean of $1.28\times10^3\pm 0.33\times10^3$, $2.69\times10^3\pm 0.47\times10^3$, $4.49\times10^3\pm$ 1.-06×10^3, $1.10\times10^4\pm 0.25\times10^4$ respectively. The incidence of Staphylococcus aureus was 6.67%, 13.33%, 13.33%, 26.67% in meat, spleen, liver and kidneys, respectively. The public health importance of isolated bacteria and the possible sources of contamination of cattle carcasses with such bacteria as well as suggestive hygienic measures to improve the quality of carcasses were discussed.

Keywords: Abattoirs, kidney, Liver, Meat, Microbiological examination cattle, Microbiological examinationcattle , Spleen.

1. Introduction

Fresh meat is highly perishable due to its biological composition. The slaughter of animals yields many edible products other than carcass meat (such as red offal), which are fit for human consumption. They are used either as prepared items (e.g. slices of liver) or used as ingredients in meat products. The market for 'edible by-products' differs with country (even region) and culture [10]. The microbiological contamination of carcasses occurs mainly during processing and manipulation, such as skinning, evisceration, storage and distribution at slaughterhouses and retail establishments, they found that carcass dressing and evisceration processes constitute critical points in the microbial contamination of muscle. Moreover, fecal matter was a major source of contamination could reach carcasses through direct deposition, as well as by indirect contact through contamination with clean carcasses, equipment, workers, installations and air [1]. Slaughtering procedures potentially involve many risks of both direct and cross-contamination of carcasses and meat surfaces. During slaughter, faecal contamination of edible organs with subsequent contamination of the carcass may occur. This can be carried through all slaughter procedures up to the processing of the raw products, [14]. Bacteria presented on the carcasses can attach to wet equipment surfaces, form biofilms, and provide a source of cross-contamination for subsequent carcasses [6]. Staphylococci exist in air, dust, sewage and food or on food equipment, environmental surfaces, humans and animals. Humans and animals are the primary reservoirs. Staphylococci are present in the nasal passages and throats and on the hair and skin of 50 % or more of healthy individuals. Although food handlers are usually the main source of food contamination in food poisoning outbreaks, equipment and environmental surfaces can also be sources of contamination with Staph. aureus [33]. Foodborne pathogens are the leading causes of illness and death in developing countries costing billions of dollars in medical care, medical and social costs [18].

2. Materials and methods

2.1 Collection of samples

A total of 60 random samples of cattle carcasses were collected from the different abattoirs located in Qaliubiya governorate. The samples taken from each carcass were represented meat, spleen, liver, and kidneys (15 samples of each). Each sample was kept in a separated sterile plastic bag and preserved in an ice box then transferred to the laboratory under complete aseptic conditions without undue delay and examined as quickly as possible. The collected samples were subjected to bacteriological examination.

2.2 Preparation of samples [20]

Twenty five gm were taken aseptically from the examined meat, spleen, liver and kidney samples and transferred aseptically to a sterile homogenizer bag containing 225 ml of sterile peptone water (1%) and homogenized for 2.5 minute at 3000 r.p.m. to provide a dilution 101, then decimal serial dilutions were prepared.

2.3 Bacteriological examination

2.3.1 Determination of APC, coliform and total staphylococci counts [21]

2.3.2 Isolation and identification of staphylococci [21]

2.3.2.1 Morphological examination [9]

Gram positive cocci resembling grape like clusters.

2.3.2.2 Biochemical identification

- Catalase activity test [25].
- Detection of hemolysis.
- Mannitol test [7].
- Coagulase test [3].
- Thermostable nuclease test "D-Nase activity" [23].

2.4 Statistical analysis

Data were analyzed by one-way ANOVA. Means with different alphabetical superscripts in the same columns are significantly different at $P \leq 0.01$. according to [17].

3. Results

It is evident from the results recorded in Table (1) that APC(/gm) of the examined samples of cattle were ranged from 4.5×10^3 to 7.3×10^4 with an average $2.26\times10^4\pm 0.51\times10^4$ for meat, 6.9×10^3 to $1.7\times10^{\circ}$ with an average $4.09\times10^4\pm 0.63\times10^4$ for spleen, 7.8×10^3 to 9.2×10^5 with an average $1.95\times10^5\pm 0.27\times10^5$ for liver, 1.1×10^4 to 2.5×10^6 with an average $6.48\times10^5\pm 1.89\times10^5$ for Kidney. High significant differences ($P < 0.01$) were appeared between examined samples of meat, spleen, liver and kidney of cattle**.**

Table (1) Aerobic plate counts/g (APC) in the examined samples of meat and offal of slaughtered cattle and camel (n=15)

Species	Cattle		
Tissues	**Min**	**Max**	**Mean ± S.E***
Meat	4.5×10^3	7.3×10^4	$2.26\times10^4\pm 0.51\times10^{4++}$
Spleen	6.9×10^3	1.7×10^5	$4.09\times10^4\pm 0.63\times10^{4++}$
Liver	7.8×10^3	9.2×10^5	$1.95\times10^5\pm 0.27\times10^{5++}$
Kidneys	1.1×10^4	2.5×10^6	$6.48\times10^5\pm 1.89\times10^{5++}$

S.E* = standard error of mean. ++ means high significant differences ($P < 0.01$) in APC values of the examined samples.

From the results achieved in Table (2), it is obvious that the mean values of total coliform counts in the examined samples of cattle were 6.0×10 to 1.5×10^3 with an average $5.54\times10^2\pm 1.02\times10^2$ for meat, 9.0×10 to 4.8×10^3 with an average $8.92\times10^2\pm 2.14\times10^2$ for spleen, 1.0×10^2 to 2.2×10^4 with an average $9.17\times10^3\pm 2.35\times10^3$ for liver, 3.0×10^2 to 5.7×10^4 with an average $2.38\times10^4\pm 0.61\times10^4$ for kidney. High significant differences ($P < 0.01$) were appeared between examined samples of meat, spleen, liver and kidney either of cattle**.**

Table (2) Total coliform counts/g in the examined samples of meat and offal of slaughtered cattle and camel (n=15)

Species	Cattle		
Tissues	**Min**	**Max**	**Mean ± S.E***
Meat	6.0×10	1.5×10^3	$5.54\times10^2\pm 1.02\times10^{2++}$
Spleen	9.0×10	4.8×10^3	$8.92\times10^2\pm 2.14\times10^{2++}$
Liver	1.0×10^2	2.2×10^4	$9.17\times10^3\pm 2.35\times10^{3++}$
Kidneys	3.0×10^2	5.7×10^4	$2.38\times10^4\pm 0.61\times10^{4++}$

S.E* = standard error of mean. ++ means high significant differences ($P < 0.01$) in total coliform counts values of the examined samples.

From the results achieved in Table (3), it is obvious that the mean values of the total Staphylococci count in the examined samples of cattle were 1.0×10^2 to 4.0×10^3 with an average $1.28\times10^3\pm 0.33\times10^3$for meat, $1.0\times10^2$to 6.0×10^3 with an average $2.69\times10^3\pm 0.47\times10^3$ for spleen, 2.0×10^2 to 7.0×10^3 with an average $4.49\times10^3\pm$ 1.-06×10^3 for liver, 4.0×10^2 to 3.1×10^4 with an average $1.10\times10^4\pm 0.25\times10^4$ for kidney. High significant differences ($P < 0.01$) were appeared between examined samples of meat, spleen, liver and kidney of cattle**.**

Results given in Table (4) declared that Staphylococcus epidermidis (26.67%), Staphylococcus Intermedius (13.33%), Staphylococcus aureus (6.67%), in cattle meat, Staphylococcus epidermidis (46.67%), Staphylococcus saprophyticus (20%), Staphylococcus aureus (13.33%), in cattle spleen, Staphylococcus epidermidis (53.33%), Staphylococcus aureus (13.33%), Staphylococcus saprophyticus (6.67%), in cattle liver, Staphylococcus epidermidis (73.33%), Staphylococcus saprophyticus (55%), Staphylococcus aureus (26.67%), Staphylococcus capitis (13.33%), Staphylococcus Intermedius (6.67%) in cattle kidney.

Table (3) Total Staphylococci counts/g in the examined samples of meat and offal of slaughtered cattle and camel (n=15)

Species	Cattle		
Tissues	**Min**	**Max**	**Mean ± S.E***
Meat	1.0×10^2	4.0×10^3	$1.28\times10^3\pm 0.33\times10^{3++}$
Spleen	1.0×10^2	6.0×10^3	$2.69\times10^3\pm 0.47\times10^{3++}$
Liver	2.0×10^2	7.0×10^3	$4.49\times10^3\pm 1.-06\times10^{3++}$
Kidneys	4.0×10^2	3.1×10^4	$1.10\times10^4\pm 0.25\times10^{4++}$

S.E* = standard error of mean. ++ means high significant differences ($P < 0.01$) in total Staphylococci counts values of the examined samples.

Table (4) Incidence of Gram positive cocci isolated from the examined samples of cattle meat and offal (n=15)

Gram + ve cocci	Meat		Spleen		Liver		Kidney	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Staphylococcus aureus	1	6.67	2	13.33	2	13.33	4	26.67
Staphylococcus capitis	-	-	-	-	-	-	2	13.33
Staphylococcus epidermidis	4	26.67	7	46.67	8	53.33	11	73.33
Staphylococcus intermedius	2	13.33	-	-	-	-	1	6.67
Staphylococcus saprophyticus	-	-	3	20	1	6.67	5	55

4. Discussion

The microbiological contamination of carcasses occurs mainly during processing and manipulation, such as skinning, evisceration, storage and distribution at slaughterhouses and retail establishments, they found that carcass dressing and evisceration processes constitute critical points in the microbial contamination of muscle. Moreover, fecal matter was a major source of contamination could reach carcasses through direct deposition, as well as by indirect contact through contamination with clean carcasses, equipment, workers, installations and air [1].

The current results (Table 1) come in accordance with those reported by [22,15,13,26,29]. While, higher results were obtained by [36] found that the mean value of aerobic plate count was 1.82×10^7 and [27] found that the mean value of in fresh beef was $4.6\ x10^6$ furthermore, lower APC obtained by [30] recorded that the mean value of total aerobic plate count of excised neck samples from cattle 1.58×10^2 .

Although the APC of any food articles are not a sure indicative of their safety for consumption, yet it is of supreme importance in judging the hygienic condition under which food has been produced, handled and stored [24]. Accordingly, the level of the APC is generally accepted as a criterion for microbial contamination of carcasses and a useful indicator of hygiene [38]

The obtained results (Table 2) were nearly similar to those reported by [2,35,28,29,4] While, higher results were obtained by [27] found that the mean value of total coliform count in fresh beef were $6.9\ x10^5$cfu/g, furthermore, lower coliform count obtained by [37] found that the total coliform count in beef shoulder after washing of carcass was 0.22×10cfu/cm^2 and [11] examined 30 cattle liver samples coliform detected as 30.8 ± 15.52cell/gm .

Contamination of meat with coliform may occur during slaughtering, cutting and dressing of the carcasses as well as soiled hands and by the butcher's own clothing when no protective clothing is used. Both the knives used for slaughtering and cutting or contaminated water are important sources of coliform in meat. Moreover, high number of bacteria could be transferred from the fleece/skin of the animal to the carcass surface during hide/skin removal [8].

The achieved results (table3) Nearly similar to results obtained by [22,16]. Higher results were obtained by [19] found that the mean values of Staphylococcal count (cfu/g) were $1.09x10^5$, $9.14x10^4$ in the examined liver, kidney. While lower result was obtained by [12] the microbiological quality of fresh edible offal and processed meat products, pathogenic staphylococci at the level of 4.79 log CFU per g and 2.74 log 10 CFU per g, respectively.

The total Staphylococci count can be taken as index of sanitary conditions under which meat and

its products are manufactured and handled. Staphylococci can be carried on hands, nasal passage or throats. Most food borne illness out breaks is originated as a result of contamination from meat handlers and production of heat stable toxins in meat [31].

The incidence of gram positive cocci isolated from examined samples of cattle meat and offal (table 4) were previously isolated from fresh meat and offal, low frequency of contamination with strains of staph. aureus (7.5%) of 70 swabs taken from neck and caudal areas of beef carcasses by [32]. Staphylococcus aureus was isolated from 26.6% of examined raw meat samples by [16,5]staph. aureus was isolated from 4% and 4% of the examined bovine liver and kidney samples [19].

Staphylococcal food poisoning is the result of performed enterotoxins that are produced by certain strains of Staphylococcus aureus resulting in symptoms of intoxication, not an infection. The most common symptoms appear approximately 3-8 hrs after ingestion and include abdominal cramps, nausea, vomiting sometimes followed by diarrhea. Generally, the symptoms are short in duration "24 – 48 hours" [34].

References

[1] M.A.Abdallah, S.E.Suliman, D.E. Ahmed, and A.O.Bakhiet, Estimation of bacterial contamination of indigenous bovine carcasses in Khartoum (Sudan). Afri. J. Microbio. Res., vol.3(12), pp.882-886, 2009.

[2] Ahmed, M.Fatms. Microbial Statues of Bufallo´s Meat Slaughtered at Cairo Abattoir. M. V. Sc., Thesis, Fac. Vet. Med., Zagazig University (Benha Branch), 2003.

[3] APHA, American Public Health Association. Compendium of methods for the microbiological examination of foods, Speck, H.L. (ed.). Washington D.C. APHA, 2nd Ed., 1984.

[4] S.A.Ammar, A.A.Ibrahim, M.A.Nossair, and I.A.Samaha, Microbial quality of beef liver and kidneys in Kafr-El Sheikh province, 6th conference of Fac. Vet. Med., Alexandria, Research no. 41, 2012.

[5] W.S.S.Arab, Quality improvement of meat meals provided by a University Student Restaurant, Ph. D. Thesis, Meat Hygiene, Fac. Vet. Med., Benha. Univ., 2010.

[6] J.W.Arnold, and S.Silvers, Comparison of poultry processing equipment surfaces for susceptibility to bacterial attachment and biofilm formation. Poul. Sci., vol.79, pp.1215–1221, 2000.

[7] W.Bailey, and E.Scott, Diagnostic Microbiology. A text book for the isolation and identification of pathogenic microorganisms. The C.V. Saint Louis, Washington D. C., USA, 1978.

[8] R.G.Bell, J.C.L.Harrison, and A.R.Roger, Preliminary investigation of the distribution of microbial contamination on lamb and beef carcasses. Hamilton, New Zealand: MIRINZ. Meat Industry Research Institute of New Zealand Technical Report No.927. ISSN 0465-4390, 1993.

[9] R.Cruickshank, J.P.Duguid, B.P.Marino, and R.H.A.Swain, Medical Microbiology, Vol., Churchill Livingston, London and New York, 12th Ed., 1975.

[10] S.Davatkal, S.K.Mendiratta, N.Kondaiah, M.C.Sharma, and A.S.R.Anjaneyulu, 2004. Physiological, functional and microbiological quality of buffalo liver. Meat Sci., vol.68(1), pp.79-86, 2004.

[11] A.S.Dawoud, H.A.Marouf, M.I.M.Abdallah and M.S.Bazalou, Determination of some health significant bacterial contamination of beef liver sold in Damietta City and studying the effect of vinegar to improve quality and safety The 4th In. Sci. Conf., The role of veterinary medicine for community, application of biotechnology in veterinary medicine., 5-7 April 2005, Mansoura, Egypt, 2005.

[12] Domanska-Katarzyna and Rozanska-Hanna. Microbiological quality of polish edible offals processed meat products during storage: influence on N-nitrosamines content Bull. Vet. Inst. Pulawy., vol.47, pp.217-223,2003.

[13] E.A.Duffy, K.E.Belk, J.N.Sofos, S.B.LeValley, M.L.Kain, and J.D.Tatum, Microbial contamination occurring on lamb carcasses processed in the United States. Journal of Food Protection, vol.64, pp.503–508, 2001.

[14] D.S.Edwards, A.M.Johnston, and G.C.Mead, Meat inspection: an overview of present practices and future trends. Vet. J., vol.154, pp.135-147, 1997.

[15] K.M.A.El-Dally, Correlation between parasitism and microbial load and meat quality of the Egyptian food animals. PhD. (Meat Hygiene), Fac. Vet. Med. Moshtohor, Zagzig Univ. Egypt, 1994.

[16] M.El-Taher-Amna, Impact of temperature abuse of safety of food offered in a University Student Restaurant, M.V.Sc. Thesis, Meat Hygiene, Fac. Vet. Med., Benha. Univ., 2009.

[17] D.Feldman, J.Ganon, R.Haffman and J.Simpson, The solution for data analysis and

presentation graphics, Abacus Lancripts, Inc., Berkeley, USA, 2nd Ed., 2003.

[18] P.Fratmico, A. Bhunia and J.Smith, Food borne Pathogens in Microbiology and Molecular Biology, Caister Academic Press, Wymondham, Norfolk, UK, pp.273, 2005.

[19] W.M.Gafer-Rasha, Microbial evaluation of some edible offal in bovine carcasses M.V.Sc. Thesis, Meat Hygiene, Fac. Vet. Med., Benha. Univ. Egypt, 2013.

[20] ICMSF, International Commission on Microbiological Specification for Foods. Microorganisms in Foods, Univ., Tronto Press, Toronto, 2nd Ed., pp.188-192, 1982.

[21] ICMSF, International Commission and Microbiological Specification for Foods. Salmonellae. In: T.A.Roberts, A.C.Baird-Parker and R.B.Tompkin, eds. Microorganisms in foods 5: Microbiological specifications of food pathogens, Blackie Academic & Professional, London, UK, 1st Ed, pp.217-264, 1996.

[22] F.B.Ishak, Sanitary status of cattle livers in Sharkia province M.V.Sc. Thesis, Meat Hygiene, Fac. Vet. Med., Zagazig. Univ., 1992.

[23] R.Lachia, C.Genigeogis and P.Hoeprich, Meta chromatie agar- diffusion methods for detecting Staphylococcal nuclease activity. Appl. Microbiol. vol.21, pp.585:587,1971.

[24] M.M.Levine, Escherichia coli that cause diarrhea: enterotoxigenic, enteropathogenic, enteroinvasive, enterohemorrhagic, and enteroadherent. Journal of Infectious Diseases vol.155, pp.377–389, 1987.

[25] F.MacFaddin, Biochemical tests of identification medical bacteria. Waverly presses Inc. Baltimore Md., 21202 U.S.A, 1976.

[26] B.Martı´nez, M.F.Celda, M.E.Millán, A.Espacio, M.Cano and M.C.López-Mendoz, Assessment of the microbiological conditions of red-meat carcasses from bacterial counts recovered by sampling via excision or swabbing with cotton wool. Inter. J. Food Sci. Technol., vol.44, pp.770–776, 2009.

[27] H.K.Mukhopadhyay, R.M.Pillai, U.K.Pal, and V.JA.J.Kumar, Microbial quality of fresh chevon and beef in retail outlets of Pondicherry. Tamilnadu J. Vet. Ani. Sci., vol.5(1), pp.33-36, 2009.

[28] S.Nouichi, and T.M.Hamdi, Superficial bacterial contamination of ovine and bovine carcasses at El-Harrach slaughterhouse (Algeria). Europ. J. Sci. Res., vol.38(3), pp.474-485, 2009.

[29] I.O.Okonko, I-OE.Ukut, I.S.Ikpoh, A.O.Nkang, A.O.Udeze, T.A.Babalola, O.K.Mejeha, and E.A.Fajobi, Assessment of bacteriological quality of fresh meats sold in Calabar metropolis, Nigeria. Electro. J. Environ. Agri. Chemist., vol.9(1), pp.89-100, 2010.

[30] R.A.Pearce and D.J.Bolton, Excision vs sponge sponge swabbing - a comparison of methods for the microbiological sampling of beef, pork and lamb carcasses. Journal of Applied Microbiology, vol.98, pp.896-900, 2005.

[31] N.N.Potter, Food Science, the AVI Publishing Co. Inc. New York, 3rd Ed., 2001.

[32] J.Schlegelova´, E.Na´ pravnı´kova´, M.Dendisc, R.Horva´ thc, J.Benedı´kc, V.Baba´ka, E.Klı´mova´, P.Navra´ tilova´ and A.S˘ usta´ c˘kova´ Beef carcass contamination in a slaughterhouse and prevalence of resistance to antimicrobial drugs in isolates of selected microbial species. Meat Science vol.66, pp.557–565, 2004.

[33] USFDA, U.S .Food and Drug Administration "Bad Bug Book: Foodborne pathogenic Micro-organisms and Natural Toxins Handbook S.aureus". 10903 New Hampshire Avenue Silver Spring, MD 20993, 2012.

[34] A.H.Varnam, and M.G.Evans, Salmonella. In: Foodborne pathogens. An illustrated text. Eds: Varnam A.H. and Evans M.G. Wolfe Publishing Ltd, Aylesbury, England, 1991.

[35] A.K.A.Wahba, Surface microbial contamination of calf buffalo carcasses slaughtered in an abattoir in Giza Governorate. PhD.V.Sc. Thesis Vet. Med., Moshtohor, Benha University. Egypt, 2006.

[36] M.M.Yadav, S.Tale, R.Sharda, V.Sharma, S.Tiwari, and U.K.Garg, Bacteriological quality of sheep meat in Mhow town of India. Inter. J. Food Sci. Technol., vol.41, pp.1234–1238, 2006.

[37] S.Yalçin, M.Nizamlioglu and U.Gurbuz, Fecal coliform contamination of beef carcasses during the slaughtering process. Journal of Food Safety. vol.21, pp.225-231, 2001.

[38] C.Zweifel and R.Stephan, Microbiological Monitoring of sheep carcass contamination in three Swiss abattoirs. Journal of Food Protection. vol.66, pp.946- 952, 2003.