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Bacterial contamination of beef carcasses in slaughter houses Khartoum State, Sudan

Awatif A. Ahmed[1], Yahia A. Sabiel[1] and Huyam K. Fadolelgaleel[1]

1 Veterinary Research Institute, Animal Resources Research Corporation. P. O. Box 8067 (Al Amarat), Khartoum, Sudan.

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ABSTRACT

This study was conducted to isolate bacteria contaminating beef carcasses and to determine the antimicrobial sensitivity test of the most frequent isolated Gram negative bacteria against selected antibiotics. Sixty swab samples were collected randomly from posterior and anterior surfaces of beef carcasses from slaughterhouses at Khartoum State. The collected Samples were transported to the Department of Bacteriology, Veterinary Research Institute for microbiological examinations. The most frequent isolated Gram positive bacteria were *Bacillus lechiniformis* 15.4. %, *Streptococcus* spp. 8.7%, *Micrococcus kristinae* 5.8%, S*taphylococcus aureus* 2.9%, while the most frequent isolated Gram negative bacteria were *Proteus mirabilis* 13.5%, *Klebsiella pneumonia* 6.7%, *Citrobacter* spp. 1.9%, and *Vibrio* spp. 1.9%. Antibiotics sensitivity testing was carried out for 7 Gram negative isolates. The isolates showed variable reaction to the tested antibiotics. From the result it could be concluded that these Gram negative organisms reduce quality of meat and could play public health hazard.

INTRODUCTION

Food security is a complex issue, where animal proteins such as meats, meat products, fish and fishery products are generally regarded as high risk commodity with pathogenic microganisms (Yousuf *et al*., 2008), food-borne diseases are diseases resulting from ingestion of bacteria, toxins and cells produced by microganisms present in food (Clarence *et al*., 2009). In the developing countries many children suffer from cases of food-borne infection lead to the death where as in the industrialized world, the interaction causes considerable illness and heavily affecting healthcare system (Adak *et al*., 2005).

Meat is considered as the most nutritive source of protein consumed by humans, and characterized by a high water content which is suitable for microbial growth (Rao *et al*., 2009). Hide and skin have been described as the main sources of contamination of the slaughtered animals (Wagner, 2000). The slaughter of cattle with excessively dirty hides resulted in increasing bacterial contamination on the carcass (McEvoy *et al*., 2000).

Hands and clothes of the workers, water used for washing carcasses, equipments, even air in the processing and storage area may contaminate the meat (Wagner, 2000). Certain *Streptococcus* spp. including those of lancefield group A and D and the *Viridan* types are usually isolated from suspected food samples (Dolman, 1997). *Staphylococcus* strains particularly those of *S. aureus* may produce a number of extracellular protein leading food poisoning (Jawetiz *et al*., 2001 and Cheesbrough, 2000).

An early report of associating with *Bacillus* spp. food poisoning was recorded for Sanatorium outbreak (Adam and Moss, 2000). *Klebsiella pneumoniae* was the most predominant bacterial isolates found in beef carcasses, followed by *Enterobacter* spp. *Citrobacter frendii*, *Escherichia coli*, *Salmonella* spp. *Serratia marcescens*, *Pseudomonas* spp. and *Proteus vulgaris* are the less predominant (Okonko *et al*., 2010). From raw foods, *Klebsiella pneumoniae* was prevalence among *Klebsiella* strains (Cheesbrough, 2000).

In addition, pathogens like *Staphylococcus aureus*, *Bacillus cereus*, *Corynebacterium pseudotuberculosis, Escherichia coli, Salmonella* spp and *Klebsiella pneumoniae* were isolated from fresh beef meat before and after processing (Wafa, 2004). In Pakistan, Nafissa *et al*., (2010) isolated *E. coli* 0 157:H7*, Listeria* spp, *Salmonella enteritidis* and *Shigella* spp. from meat samples. Moreover *Proteus* spp. isolated from spoiled meat, and fresh meat (Mohammed *et al*., 2011). *Acinetobacter* spp. may be found in many foods especially refrigerated fresh beef (Jawetiz *et al*., 2001). In the susceptibility test from raw meat were found, resistance to antimicrobial agents, the *Enterococcus* spp were resistance to vancomycin, a higher resistance to ampicillin was observed in *Y. enterocolitica*, and all *Campylobacter jejuni* were resistance to ampicillin, cephalothin and cefuroxime (Gousia *et al*., 2011).

The objectives of this study were to isolate and to identify bacteria contaminating beef carcasses in Khartoum State by conventional methods and to determine the antibiotics sensitivity reactions of the isolated Gram negative bacteria.

MATERIALS and METHODS

A total of 60 swab samples, were collected randomly from posterior and interior surfaces of beef carcasses from the slaughterhouses at Khartoum State (Khartoum, Omdurman and Bahry) during the period from October 2011 to August 2012.

The swabs were transferred into test tubes containing 5 ml nutrient broth media (Oxoid, 2013) and placed into thermo flasks containing ice bags then transported to the Department of Bacteriology laboratory at Veterinary Research Institute for isolation and identification of the organisms contaminating beef carcasses. The impregnated swab samples were incubated at 37°C for 24 hours, and then cultured onto bood agar plates, incubated at 37°C for 24 hours.

Representative colonies of the growth were selected and further sub culture onto blood agar and nutrient agar plates for purification. The purified isolates were identified by conventional methods as described by Barrow and Feltham (1993) and Quinn *et al*. (1994). Ciprofloxacin, Gentamycin, Amoxyclave, Norflxacin, Furazolidone, Tetracycline, Streptomycin, Cefalexin were used for antibiotics sensitivity testing against Gram negative isolates by using the method described by Benson (1980).

RESULTS and DISCUSSION

One hundred and four bacterial strains were isolated and identified through this study (Table 1). *Bacillus lechiniformis* (16, 15.4%) were the most prevalent organisms isolated from the cultured samples and among the genus *Bacillus*, followed by *Proteus mirabilis* (14, 13.5%), *Enterobacter* spp (10, 9.6%), *Streptococcus* spp (9, 8.7%), *Klebsiella pneumonia* (7, 6.7%), *Micrococcus kristinae* (6, 5.8%) and *Aerococcus* spp. (5, 4.8%). *Staph*. *aureus* were (3, 2.9%) *Staph*. *chromogenes* were (3, 2.9%) , whereas *Staph*. *zylosis* (2, 1.9%), finally each of *Haemophillus* spp and *Moraxella lacunata* were (1, 1%) (Table 1).

Most of the Gram negative isolates were sensitive to gentamycin and tetracycline except *Pseudomonas orizihibitans* and *Proteus mirabilis.*

Ciproflaxacin was found effective to the most of the tested organisms whereas cefalexin was less effective to the most of the tested organisms (Table 2). The results showed that, *Bacillus* spp., *Proteus* spp. and *Staph*. spp were isolated from pre and post washed carcasses. No differences was observed between the pre and post washed isolates, this is in agreement with Gill (1991) who noted that the washing may only redistribute the contamination from the posterior to anterior region of the carcass.

Thirty two (32.8%) of *Bacillus* spp. were isolated from the pre and post washed carcasses. This could be due to the presence of large number of house flies (*Musca domestica*) in the three slaughterhouses and may have a role in the organisms from one carcass to another, or could be due to improper cutting off the hooves and lossening the skin of the legs.

This finding is in agreement with Stalle (1981). *Staph*. *aureus*, *Klebsiella pneumonia, Enterobacter* spp. and *Proteus* spp. were isolated in study, this is similar to the finding reported by Okonko *et al*. (2010). McEvoy *et al*. (2000) found that the slaughter of cattle with excessively dirty skin could increase bacterial contamination on the carcasses.

The presence of the *Staph*. spp, *Enterobacter* spp and *Vibrio* spp., could be due to poor environmental conditions during slaughtering, these findings are in an agreement with Wanger, (2000) who noted that hands and clothes of the worker, water used for washing carcass, equipments, even air in the processing and storage area may contaminate the meat.

All tested Gram negative bacteria were observed higher resistance to ciprofloxacin. *Pseudomonas orizihibitans* and *Proteus mirabilis* were resistance to tetracycline and gentamycin. Gousia *et a*l. (2011) found that the *Enterococcus* spp were resistant to vancomycin, higher resistance to ampicillin was observed with *Y. enterocolitica*.

Table 1: Bacteria isolated from 60 swabs samples of pre and post washed carcasses in Khartoum State.

No	Isolates	B		O		K		Total	Percentage (%)
		Pre	After	Pre	After	Pre	After		
1	*Bacillus lechiniformis*	2	-	2	-	7	5	16	15.4%
2	*Proteus mirabili*	-	-	4	4	3	3	14	13.5%
3	*Enterobacter* spp.	3	3	-	-	3	1	10	9.6%
4	*Streptococcus* spp.	3	1	2	1	1	1	9	8.7%
5	*Klebsiella pneumonia*	2	2	1	-	1	1	7	6.7%
6	*Micrococcus kristinae*	-	-	3	1	1	1	6	5.8%
7	*Bacillus pantothenticus*	2	1	1	-	1	1	6	5.8%
8	*Legionella* spp.	1	-	1	-	2	1	5	4.8%
9	*Aerococcus* spp.	1	1	2	1	-	-	5	4.8%
10	*Bacillus sterothermophilus*	2	1	-	-	1	1	5	4.8%
11	*Bacillus furmus*	2	1	-	-	-	-	3	2.9%
12	*Staph. aureus*	-	-	1	1	1	-	3	2.9%
13	*Staph. Chromogenes*	1	1	1	-	-	-	3	2.9%
14	*Staph. zylosis*	1	-	1	-	-	-	2	1.9%
15	*Bacillus megatarium*	1	-	1	-	-	-	2	1.9%
16	*Citrobacter* spp.	-	-	-	-	2	-	2	1.9%
17	*Stomatococcus* spp.	-	-	1	-	1	-	2	1.9%
18	*Vibrio* spp.	-	-	-	-	1	1	2	1.9%
19	*Haemophillus* spp.	1	-	-	-	-	-	1	1%
20	*Moraxella lacunata*	1	-	-	-	-	-	1	1%
	Total	23	11	21	8	25	16	104	100%

Key: **B**: Bahri **O**: Omdurman **K**: Khartoum

Table 2: Antimicrobial sensitivity test of Gram negative isolates

Isolate no	CIP	GEN	AMC	NOR	FR	TE	S	CN
1	S	S	R	S	S	S	I	R
2	S	S	R	S	R	S	S	R
3	S	S	I	S	R	R	S	R
4	S	S	R	S	S	S	S	R
5	S	S	R	S	I	S	S	R
6	I	R	R	I	R	S	I	R
7	I	S	S	I	S	S	S	R

Key:
S: Sensitive. **R**: Resistant. **I**: Intermediate.
1**:** *Citrobacter* spp **2:** *Acinobacter* spp **3:** *Proteus mirabilis*, **4:** *Klebsiella pneumoniae* **5:** *Enterobacter cloacae* **6:** *Pseudomonas orizihibitans*, **7:** *Vibrio*
CIP: Ciprofloxacin **GEN:** Gentamycin **AMC:** Amoxyclau **NOR:** Norfloxacin **FR:** Furazolidone **TE:** Tetracycline **S:** Streptomycin **CN:** Cefalexin.

CONCLUSION

The presence of micorganisms like *Staph. aureus*, *Klebsiella pneumoniae*, and *Proteus mirabilis* in meat foods raised a public health hazards. So practicing good hygienic measure during handling of meat

and meat product may reduce the contamination of carcasses. Moreover control of house fly (Musca domestica) in the slaughterhouses may minimize the distribution of the contaminants between the carcasses.

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