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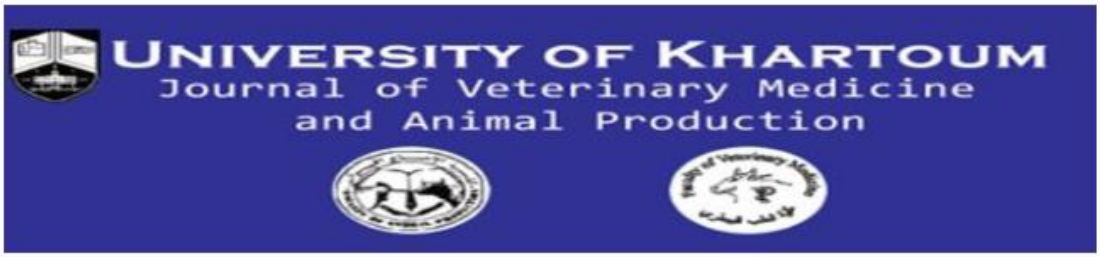

Occurrence of Escherichia species in vended red meat in Khartoum State, Sudan

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Abstract

The aim of this study was to determine the incidence of *Escherichia species* in raw red meat in Khartoum State, Sudan. A total of 75 random samples of raw meat, were collected from different localities in three towns (Khartoum, Omdurman and Khartoum North), Khartoum state, Sudan. These samples were subjected to bacteriological analysis using MacConkey meduim and tentative identification by biochemical tests. The incidence of *Escherichia* spp was 36%. Four types of *Escherichia species* were isolated; *E. coli* (20%), *E. vulneris* (6.6%) followed by *E. albertii* (5.3%) and *E fergusonii* (4%).Considering the fact that *Escherichia species* contribute to the burden of food borne illness, more hygienic measures should be applied to improve the quality of the meat to ensure maximum safety to consumers**.**

الهدف من هذا البحث هو تحديد معدل ظهوربكتريا *Escherichia species* في اللحوم بولاية الخرطوم ، السودان.جمعت 75 عينة عشوائية من ثلاثة مناطق مختلفة من ولاية الخرطوم(امدرمان، الخرطوم والخرطوم بحري) السودان. خضعت العينات للتحليل البكتيري بواسطة البيئة الغذائية آجار المكونكي و التعرف المبدئي بالإختبارات الكيمو حيوية.وكان معدل ظهورها 36%. أربع أنواع عزلت: *E. coli* (20%), *E. vulneris* (6.6%), *E.albertii* (5.3%) and *E. fergusonii* (4%). بما أن في الحقيقة هذه البكتريا تعتبر من مسببات الأمراض المتناقلة بالأغذية ، يجب التدقيق في تطبيق قياسات الصحة وتحسين جودة اللحوم لتأكيد اقصى قياسات السلامة للمستهلك

Introduction

Pathogens are virtually present everywhere, reaching every aspect of life. The potential threat of bacteria in foods, soil and water has historically outrun any detection efforts resulting in unwarranted deaths and illness (Bhunia, 2007). Food animals and poultry are the most important reservoirs for many of the foodborne pathogens (Biswas *et al.*, 2008). The widespread habit of raw beef consumption is a potential cause for foodborne illnesses, besides, the common factors such as overcrowding, poverty, inadequate sanitary, unsafe food storage conditions, and poor general hygiene (Sousa, 2008). Animal food products are available in open-air local retail shops without appropriate temperature control. The presence of even small numbers of pathogens in carcass meat and edible offal may lead to heavy contamination of meat when cut into pieces, as more microorganisms are added to the surfaces of exposed tissue (Ejeta *et al.*, 2009).

Escherichia is the 'type genus 'for the family Enterobacteriaceae many are harmless commensals, however some species are human

pathogens and are known as the most common cause of the urinary tract infection (Ronald, 2003). While, E. coli is responsible for the vast majority of Escherichia related pathogenesis, other members of the genus have also been implicated in human diseases (Pien *et al.*, 1985 and Chaudhury *et al.*, 1999). Until recently, the genus Escherichia was composed of five species, including the type species E. coli and four less frequently encountered members: *E. blattae*, *E. hermannii*, *E. vulneris* and *E. fergusonii* (Farmer, 1999). The species Escherichia adecarboxylata has since been assigned to the genus Lecercia, and a new species, Escherichia albertii, has been described (Abbott *et al.*, 2003). E. coli is the most completely characterized organism and one of the dominant indicator organisms for food and water quality testing (Anderson *et al.*, 2006).

The objectives are to determine the incidence of Escherichia species in vended red meat in Khartoum state (Khartoum, Omdurman and Khartoum North), Sudan.

Materials and methods

Sample collection

Total number of raw meat samples (75) were collected aseptically from different localities in Khartoum city (butcheries) in clean, dry and sterile containers and transferred immediately to the laboratory to be examined.

Isolation of microorganism:

One gram of meat was homogenized in 10 ml Normal saline. Then 0.1ml of the mixture was cultured on MacConke's agar media by spreading method (Aryal, 2016) and incubated at 37°C for 24 h. Then discrete colonies were sub cultured on Nutrient Agar and incubated at 37°C for 24 h. After that Gram stain was carried out.

Identification of isolates

Suspected colonies were identified by Gram's stain, motility test, indole, urease, H_2S production, citrate and sugar fermentation tests (Adonitol, Dulcitol and Sucrose). The identification of isolates was carried out according to (Barrow and Feltham, 1993).

Results

Results presented in Table (1) summarized the biochemical tests that were used to identify Escherichia species, while Figure (1) shows the distribution of *Escherichia spp* in Khartoum state.

Results which are shown in Table (2) revealed that 27 out of 75 meat samples (36%) were positive for Escherichia species. According to these results the highest number of Escherichia species contaminated samples was recorded in Omdurman (14 out of 25 samples) (56%), followed by Khartoum (7 out of 25 samples) (28%). The least number of contaminated samples was detected in Khartoum North (6 out of 25 samples) (24%).

The study revealed four types of Escherichia species together with their frequency and percentage of contamination were shown in Table (3). The highest incidence of Escherichia spp. was *E. coli* (20%), *E. vulneris* (6.6%) followed by *E. albertii* (5.3%) and *E. fergusonii* (4%). However *E. blattae*, *E. hermannii* and E. *adecarboxylata* were not detected.

As shown in Table (4) *E. coli* and *E. vulneris* were isolated from the 3 locations (Khartoum, Omdurman and Khartoum North), *E. fergusonii* was isolated from Khartoum North and Omdurman, while *E. albertii* was isolated from Omdurman only.

Table 1: Biochemical tests used in the identification of *Escherichia* spp.

(A)

***Escherichia* spp**	**Biochemical tests**				
	H_2S production	**Urease**	**Indole**	**Citrate**	**Motility**
E. coli	-ve	-ve	+ve	-ve	d
E. fergusonii	-ve	-ve	+ve	-ve	+ve
E. vulneris	-ve	-ve	-ve	-ve	+ve
E.albertii	-ve	-ve	-ve	+ve	-ve
E.hermannii	-ve	-ve	+ve	-ve	+ve
E.blattae	-ve	-ve	-ve	-ve	-ve
E.adecarboxylate	-ve	-ve	+ve	-ve	+ve

*d: Different reactions given by different strains; positive reactions often delayed

(B) Differentiation between Indole positive *Escherichia* spp by using Sugar fermentation

Adonitol			
(+ve) Dulcitol		**(-ve) Sucrose**	
(+ve) *E. adecarboxylate*	(-ve) *E. fergusonii*	(+ve) *E. coli*	(-ve) *E.hermannii*

Table (2) Incidence of *Escherichia* spp. in the examined raw meat samples

Examined samples	**No. of examined samples**	**Positive samples**	
		No.	%
Khartoum	25	7	28
Omdurman	25	14	56
Khartoum North	25	6	24
Total	75	27	36

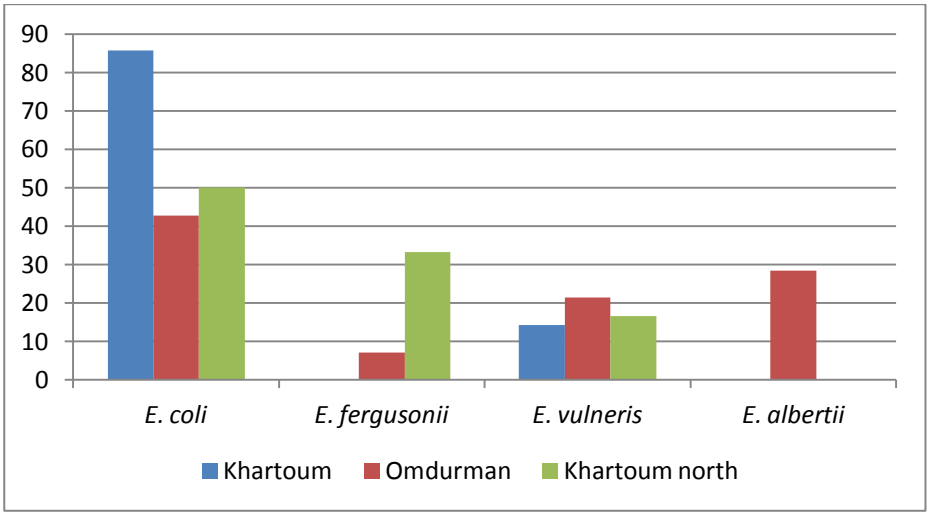
Table (3) Incidence of *Escherichia* spp. in the examined raw meat samples using peptone water sugar

Examinedsamples	*E. coli*		*E.fergusonii*		*E.vulneris*		*E.albertii*		*E.hermannii*		*E.blattae*		*Eadecarboxylate*	
Examined samples	*E. coli*		*E. fergusonii*		*E. vulneris*		*E. albertii*		*E. hermannii*		*E. blattae*		*E. adecarboxylate*	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Khartoum	6	24	-	-	1	4	-	-	-	-	-	-	-	-
Omdurman	6	24	1	4	3	12	4	16	-	-	-	-	-	-
Kh. North	3	12	2	8	1	4	-	-	-	-	-	-	-	-
Total	15	20	3	4	5	6.6	4	5.3	-	-	-	-	-	-

Table (4) Frequency distribution of *Escherichia* spp. in the examined raw meat samples

Examinedsamples	positive	*E. coli*		*E. fergusonii*		*E. vulneris*		*E. albertii*	
		No.	%	No.	%	No.	%	No.	%
Khartoum	7	6	85.7	-	-	1	14.3	-	-
Omdurman	14	6	42.8	1	7.1	3	21.4	4	28.5
Kh.North	6	3	50	2	33.3	1	16.6	-	-

Figure 1: Distribution of *Escherichia spp* in Khartoum State.



Discussion

The results of the present study are summarized in the Table (3) and (4). It was shown in this study that the predominant bacteria isolated were *E. coli, E. vulneris, E. fergusonii* and *E. albertii* Table (3). These microorganisms can be opportunistic pathogens of humans and were reported from human clinical specimens of an outbreak of food poisoning (Gross and Rowe, 1985; Morris *and* Sojka, 1985; Pien *et al.*, 1985; Albert *et al.*, 1992; Farmer *et al.*,1985 and Savini *et al.*, 2009).

According to the data reported in Table (2) the incidence of Escherichia spp. in raw meat reached to 36%. While the highest incidences reported by Nagah *et al.* (2012) 70% on Hugh and Leifson medium and 59.17% on Eosin Methylene Blue in milk and milk products.

Regarding the results in Table (3) the incidence of E. coli in the examined samples of raw red meat reached 20% in contrast to prevalence of 50% of samples previously studied by other authors in Sudan (Mohamed *et al.*, 2012and Ahmed KK., 2004) also E. coli represented the highest contaminants in Khartoum state with prevalence of 34.6% (Egbal, 2014). However, lower incidences were recorded by Aballa *et al.* (2009) 8.86%. The difference between our results and other studies may be attributed to the sampling technique, sources and handling of samples, types of media used. High incidences of *E. coli* in the examined raw meat samples indicated the neglected sanitary control during handling of meat and possibly fecal contamination.

E. albertii was detected as 5.3% (Table 3). These results were not in line with those recorded by Nagah *et al.* (2012). These authors reported 0.83% of *E. albertii* isolated from milk and milk products.

The surface of a beef carcass may carry between 10^2 and 10^4 bacteria/cm² and after butchering, joints and pieces of meat for packing are likely to carry considerably higher numbers (Taylor, 1985).

The presence of bacteria in meat has been widely reported from different parts of the world (Holds *et al.*, 2007 and Kinsella *et al.*, 2008). Some groups recognized the presence of viable bacteria, especially Gram-negative organisms from 10^6 to 10^9 , as an indication of open-air meat spoilage (Eribo and Jay, 1985), while others argued this assertion and considered the presence of a high number of background organisms as a pathogen-reduction strategy due to the organisms' antagonistic effect against pathogenic bacteria and thus safer for meat quality. Therefore, it is considered that fresh meat that contains $10–10^6$ of background organisms are inherently safer than those that contain less bioload; however, this hypothesis applies only to harmless bacteria (Jay, 1996). In order to address the issue in the view of our local scenario, the organisms were identified.

Data recorded in Figure (1) illustrated the distribution of Escherichia spp differ in the three towns.

This may be due to the bad hygienic measures followed during handling and distribution of raw meat in Khartoum State. Hence, obligate strict hygienic measures should be applied to improve its quality and to avoid public health hazards.

The study concluded that four types of Escherichia species were isolated from raw meat in Khartoum State, Sudan; *E. coli*, *E. vulneris*, *E. albertii* and *E. fergusonii*. Neither E.hermannii, E.blattae nor E.adecarboxylate were existed in meat samples.

The presence of foodborne pathogens such as E. coli samples reflects the role of animal's food products as major reservoir for causative pathogenic agents.

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