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# Status of food safety research in Sudan with special reference to milk and meat hygiene

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## Abstract

Protection against animal diseases and pests and against food safety threats and preventing their spread is one of the keys to fighting hunger, malnutrition and poverty. However, the most reported outbreaks of food borne disease are due to contamination of foods with zoonotic agents, often during primary production. Moreover, the obvious benefit of food Safety is to reduce food illnesses and fatalities. The aim of this paper is to discuss the status of food safety research in Sudan with special reference to milk and meat hygiene. Zoonotic diseases such as brucellosis and tuberculosis can be transmitted by using unhygienic milk or milk products. This article is reviews the above mentioned zoonotic diseases as well as the major pathogens of bovine mastitis such as *Staphylococcus areus*, *Streptococcus pyogenes*, and *E. coli* which have a great impact on public health and poor hygiene in dairy farms responsible for spreading these pathogens. On the other hand, the presence of antibiotic residues using the strain *Bacillus subtilis* British type ATCC-bb33 as the test organism is reviewed. An attempt was made in Sudan in order to apply Hazard Analysis Critical Control point (HACCP). Fore instance, poor building construction, poor water supply, poor farms hygiene as well as milkers and accumulation of dung and animal waste that induced insect spread are also reviewed. Furthermore, there were two critical control points were assigned for milk distribution chain, the first critical control point was to control raw milk production hygiene before distribution. While, the second critical control point was controlling of milk temperature.

HACCP is the main issue of meat safety. Therefore, it has been reported that the isolated bacteria during assessment of meat hygiene practices in slaughter houses were *Staph. aureus*, *Staph. xylosus*, *Staph. lentus*, *Staph. auricularis*, *Staph. hominis*, *Bacillus cereus*, *Micrococcus spp* and *Escherichia.. Furthermore*. These isolated bacteria were either non-pathogenic or opportunistic pathogens, and it is unlikely that these bacteria were from infected organs at postmortem examination, but from pitfalls in application of hygienic measures during skinning and handling of organs and carcasses. Moreover, the hygienic quality of mutton intended for export on basis of surface bacterial contamination which depends on critical contamination levels is also reviewed.

On the other hand, the paper reviews the pathological conditions, causing liver condemnations. Fore instance, parasitic infections particularly food borne parasites such as fascioliasis, cysticercosis have been recognized. Specific bacterial causes were limited in hepatic necrosis and abscesses and *Staphylococcus spp.*, *Streptococcus spp.*, *Corynebacterium spp*, *Enterobacteria* species and *Pasteurella spp.* were the main isolates. The whole carcasses were mainly condemned due to tuberculosis, cysticercosis, jaundice, pyeamia and septicemia, while abscesses were the main causes of partial condemnations of carcasses. Based on all studies, it is important that milk and meat distribution chain should be monitored by heath and Veterinary authorities to ensure safe food to consumers.

Salmonella and other pathogens in poultry carcasses, livers, spleens, intestinal contents and related environments are also reviewed. The following isolates were recognized: *Salmonella spp.*, *Escherichia coli*, *Citrobacter spp.*, *Klebsiella spp.*, *Enterobacter hafni*, *Proteus spp.*, *Acinetobacter spp.*, *Edwardsiella tarda*, *Erwina herbicola*, *Yersinia spp.*, *Serratia spp.*, *Morganella spp.*, *Hafnia alvei* and *Shigella spp*. Overall, there is an urgent need for better monitoring and control food borne disease using new technologies.

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**Keywords:** Food safety, Zoonotic diseases, Milk hygiene, Meat Hygiene, Sudan

## Introduction

Animal resources in the Sudan comprise of sheep, goat, cattle, camel, poultry and wild-game. Most of the animals in the Sudan are raised on natural pastures by nomadic tribes. In irrigated projects and the area of mechanized farming animals feed on crops byproducts. So, Sudanese animals are almost free from feed additives, hormonal and chemical residues, which give special preference to the Sudanese animal products (Ibrahim et al, 2011). Sudan has one of the harshest climates in the world, with one-third of the total land area being desert, about 40% suitable for grazing and less than one-quarter potentially arable (FAO 1997). Of the total livestock population of the Arab world—the main market for Sudanese livestock—Sudan accounts for about 70% of cattle, 31% of sheep, 49% of goats and 25% of camels. Sudan also accounts for some 43% of the Arab world's red meat production. The main livestock production sites are located far from the major

consumption centers and export outlets. Economically valuable livestock populations are concentrated in northern, western and southern Kordofan and Darfur accounting for 36% of cattle, 40% of sheep, 36% of goats and 33% of camel populations.

Protection against animal diseases and pests and against food safety threats and preventing their spread is one of the keys to fighting hunger, malnutrition and poverty. However, the most reported outbreaks of food borne disease are due to contamination of foods with zoonotic agents, often during primary production. The Veterinary Services play a key role in the investigation of such outbreaks all the way back to the farm and in formulating and implementing remedial measures once the source of the outbreak has been identified. This work should be carried out in close collaboration with human and environmental health professionals, analysts, epidemiologists, food producers, processors and traders and others involved. In addition, veterinarians are well equipped to assume important roles in ensuring food safety in other parts of the food chain, for example through the application of HACCP-based controls and other quality assurance systems during food processing and distribution. The Veterinary Services also play an important role in raising the awareness of food producers, processors and other stakeholders of the measures required to assure food safety.

Historically, the Veterinary Services were set up to control livestock diseases at the farm level. There was an emphasis on prevention and control of the major epizootic diseases of livestock and of diseases that could affect man (zoonotic diseases). As countries begin to bring the serious diseases under control, the scope of official animal health services normally increases to address production diseases of livestock, where control leads to more efficient production and/or better quality animal products.

The role of the Veterinary Services has traditionally extended from the farm to the slaughterhouse, where veterinarians have a dual responsibility – epidemiological surveillance of animal diseases and ensuring the safety and suitability of meat. The education and training of veterinarians, which includes both animal health (including zoonoses) and food hygiene components, makes them uniquely equipped to play a central role in ensuring food safety, especially the safety of foods of animal origin. In many countries the role of the Veterinary Services has been extended to include subsequent stages of the food chain in the “farm to fork” continuum Terrestrial Animal Health Code, (2012).

**Status of food safety research in Sudan with special reference to milk and meat hygiene:**

The obvious benefit of food Safety is to reduce food illnesses and fatalities. The health and hygiene of the Cow, The environment in which the cow housed and milked and hygiene during milking and storage equipments , all influence microbial numbers consider milk .Furthermore , milk is consider as good medium for bacteria including pathogenic or non-pathogenic organisms which have a great impact on public health (Ibtisam and Mohboba ,2007). Zoonotic diseases such as brucellosis and tuberculosis can be transmitted by using unhygienic milk or milk products .These diseases have been reported from different parts of Sudan. Fore instance, Khalid (2006) reported that the prevalence rate of brucellosis in Khartoum state was 23.2% using Rose Bengal Test. Similarly, a study by Mahmoud (2010) showed that the prevalence of the disease was 24.6% , 23.6, 23% and 5% by Rose Bengal Plate Test, Serum Agglutination Test, ELISA and Milk Ring Test, respectively in West Kordofan State .The disease was also reported in other species (camel, sheep and goat) by Yousif (2010) , Rasa (2000) , El Sayed Rias (2005), Hatim (2005) and Hayfa (2001). Nahid and Ibtisam (2007) found a higher counts of bacteria in milk samples collected from supermarket in Khartoum State and they confirmed the presence of brucellosis. On the other hand, a research work by Naglaa (2007) confirmed the Presence of tuberculosis in both cattle and man in Khartoum state using Single Intradermal Comparative Tuberculin Test (SICTT), bacteriological procedures and Nested Polymerase Chain Reaction (nPCR ). Some Pathogens such as *Staphylococcus areus*, *Streptococcus pyogenes* and *E. coli* are considered to be one of the major pathogens that cause mastitis as well as are Known as public health concern . A number of researchers have been isolated the above mentioned pathogens from the raw milk in different parts of the country (Abubaker, 2005; Ahmed Elias, 2007; IKhtyar, 2010; Nuha, 2000; Rofaida, 2010 and Salah Eldin, 1996).

Regarding , the detection of antibiotics in milk, Abdel Rahman (2001) stated that minimum detectable concentration for Oxyteracycline was 2 µg/ml milk, 48 µg/ml milk for Benzyl penicillin and 25 µg/ml milk for Tylosin. He also explained that all the milk samples collected from bulk milk of the farms and supermarket were free of antibacterial residues, whereas 76. 6% of the samples collected from treated cows with intramammary infusion were positive for antibiotic residues. In contrast, Manal (2005) found that 25%milk samples which collected from the central market in Khartoum State in summer were positive for antibiotic residues using the strain *Bacillus subtilis* British type ATCC-bb33 as the test organism as well as her results revealed a high positive samples (73.9%) of antibiotic residues in winter .

An attempt was made in Sudan in order to apply Hazard Analysis Criticl Control point (HACCP). Fore instance, a study by Nuha (2009) revealed poor building construction, poor water Supply, poor farms hygiene as

well as milkers and accumulation of dung and animal waste that induced insect spread. The above mentioned results were obtained by means of questionnaire. In the same Study, 38 milk Samples were collected from dairy farms and subsequent different stage of distribution, the results revealed that the *Staph. areus* count was between $8.70X10^2$ cfu/ml and $1.98X10^6$ cfu/ml as well as the aerobic bacteria and gram positive and negative bacteria were isolated. Moreover, the author stated that there were two critical control points were assigned for milk distribution chain in the study area, the first critical control point was to control raw milk production hygiene before distribution. While, the second critical control point was controlling of milk temperature. Based on all studies, it is important that milk distribution chain should be monitored by heath and Veterinary authorities to ensure safe milk to consumers.

HACCP is the main issue of meat safety. Therefore, Ahmed (2004) carried out a study in a slaughterhouse in Khartoum State to assess meat hygiene practices in ten critical control points in the cattle slaughter line. The isolated bacteria were *Staph. aureus*, *Staph. xylosus*, *Staph. lentus*, *Staph. auricularis*, *Staph. hominis*, *Bacillus cereus*, *Micrococcus spp* and *Escherichia coli*. The most predominant organisms isolated in the study were *Staphylococcus* species. Moreover, Gihan (2010) studied other ten critical control points in a cattle slaughter line. The isolates were *Staphylococcus caseolyticus* (38.4%), *Staph. caprae* (4.2%), *Staph. epidermidis* (4.9%), *Staph. cohnii* (0.22%), *Staph. schleiferi* (0.11%), *Streptococcus pyogenens* (3.99%), *Micrococcus kristinae* (11.09%), *Mic. varians* (8.65%), *Bacillus cereus* (4.99%), *B. firmus* (0.22%), *Corynebacterium pseudotuberculosis* (0.89%), *Aerococcus* (22.51%), Anaerobic cocci (0.44%), *Kurthia gibsonii* (0.11%). The most predominant organism isolated was the *Staphylococcus spp*. In the two studies *E. coli* or *Salmonella* were not isolated in the critical control points. Not far from this, Amel (2009) evaluated the status of meat hygiene in Assabaloga slaughterhouses in Khartoum State and found that isolated bacteria were either non-pathogenic or opportunistic pathogens, and it is unlikely that these bacteria were from infected organs at postmortem examination, but from pitfalls in application of hygienic measures during skinning and handling of organs and carcasses. Ibrahim (2006) evaluated the hygienic quality of mutton intended for export at Elkadaro slaughterhouse on basis of surface bacterial contamination. He found that the results of the bacterial count revealed higher counts but no critical contamination levels were recorded.

On the other hand, pathological conditions, causing liver condemnations were determined by Khalid (2008). He found that fascioliasis, cysticercosis and hydatidosis represent 6% of the liver condemnations. Specific bacterial causes were limited in hepatic necrosis and abscesses which represented 85% of liver condemnations. *Staphylococcus spp.*, *Streptococcus spp.*, *Corynebacterium spp*, *Enterobacteria* species and *Pasteurella spp.* were the main isolates. Abdalla (1994) investigated the cattle liver condemnation in Khartoum State slaughter houses for four years and found that the main causes of condemnation were non-specific causes (2.33%),

fascioliasis (2.29%), schistosomiasis (0.36%), abscesses (0.34%), *Cysticercus bovis* (0.33%) and watery cysts (0.05%). He recommended that the prevention of illegal slaughtering will help in the control of hydatid cystsand *Cysticercus tenuicollis*. Furthermore, Darien (2008) determined the major causes of condemnations of meat intended for human consumption and found that Fascioliasis was the major cause of condemnation of livers followed by cysticercosis. However, the major causes of bovine hearts condemnetions mainly due to adhesions, and cysticercosis, while head condemnations were due to abscesses and cysticercosis. The whole carcasses were mainly condemned due to tuberculosis, cysticercosis, jaundice, pyeamia and septicemia, while abscesses were the main causes of partial condemnations of carcasses. On the other hand, Izdihar (1996) studied the prevalence of Salmonella in poultry carcasses, livers, spleens, intestinal contents and related environments in some of ElObeid poultry farms, market and local breeds in El Obied. The samples belonged to the breeds Bovane, Fiowmy, Hisex, Cross-15, Kuku-1 and Balady. The following 14 bacterial genera were isolated: *Salmonella spp.*, *Escherichia coli*, *Citrobacter spp.*, *Klebsiella spp.*, *Enterobacter hafni*, *Proteus spp.*, *Acinetobacter spp.*, *Edwardsiella tarda*, *Erwina herbicola*, *Yersinia spp.*, *Serratia spp.*, *Morganella spp.*, *Hafnia alvei* and *Shigella spp.* A total of 45 *Salmonella* strains were isolated.

**Recommendation**

1. In Sudan most of important milk and meat producing areas have no rigid systems of inspection on the farms or slaughterhouses and are not complying with sanitary standards. Thus, there is a need for up – to date sound information based on scientific data on the quality, health and safety measures at milk and meat.

2. Although the responsibility lies with the manufacturer for ensuring that the foods manufactured are safe and suitable, there is a continuum of effective effort or controls needed by other parties, including milk and meat producers, to assure the safety and suitability of milk and meat products. It is important to recognize that distributors, competent authorities and consumers also have a role in ensuring the safety and suitability of milk and meat and their products.

3. All food businesses should implement a documented food safety management system based on Hazard Analysis Critical Control Point (HACCP) principles. This means food businesses should be aware of all the food safety hazards in their food operations and have system in place to control them.

4. Competent authorities should have in place legislative framework (e.g., acts, regulations, guidelines and requirements), an adequate infrastructure and properly trained inspectors and personnel. For food import and export control systems, reference should be made to the Guidelines for the Design, Operation, Assessment and Accreditation of Food Import and Export Inspection and Certification Systems (CAC/GL 26-1997). Control programmes should focus on auditing relevant documentation that shows that each participant along the chain has met their individual responsibilities to ensure that the end products meet established food safety objectives and/or related objectives and criteria.

5. Many developing countries are poorly equipped to respond to existing and emerging food safety problems. They lack technical and financial resources, an effective institutional framework, trained manpower and sufficient information about the hazards and risks involved. Hence, an attention should be made for this issue

**References**


1. Abdalla H. O, (1994): Prevailing causes of cattle liver condemnation in Khartoum State. MVSc thesis, Dep. of Prev. Vet. Med, Fac. Of Vet. Med. U of K. Sudan.

2. Abdel Raman, M.A. (2001): Detection of antibiotics in milk and effect of heating on the antibacterial activity. MSc thesis, Dep. of Micro., Fac. of. Vet. Med., Uof K, Sudan.

3. Abu baker, A.M. (2005): *Staphylococci* associated with bovine mastitis in Khartoum State. MSc thesis, Dep. of Micro., Fac. of Vet. Med., Uof K, Sudan.

4. Ahmed Elias, O.M. (2007): *E. coli* mastitis in dairy farms in Khartoum state. MSc thesis, Fac. of Vet. Med. UofK., Sudan.

5. Ahmed, K. E. (2004): Meat hygiene assessment in a slaughter house in Khartoum State. MVSc thesis, Dep. of Prev. Vet. Med, Fac. Of Vet. Med. U of K. Sudan.

**6.** Amel, B. M. (2009): Assessment of meat hygiene statues at Assabaloga Slaughterhouse in Khartoum State, Sudan. MVSc thesis, Dep. of Prev. Vet. Med, Fac. Of Vet. Med. U of K. Sudan.

7. Darien, K. A. (2008): Ante-mortem and post-mortem causes of condemnation of meat in Ghanawa Slaughterhouse in Khartoum State. MVSc thesis, Dep. of Prev. Vet. Med, Fac. Of Vet. Med. U of K. Sudan.

8. El Sayed Rias, A. R. (2005): On caprice brucellosis in Nyala area, South Darfur State. MSc thesis, Dep. of prev. Med., Fac. of Vet. Med., UofK, Sudan.

9. FAO (Food and Agriculture Organization of the United Nations). (1997): Livestock and red meat export marketing. Volumes I and II. Reports for the Arab Authority for Agricultural Investment and Development, Khartoum, Sudan. FAO, Rome, Italy.

10. Gihan, A. E. (2010): Quality management of meat in a slaughterhouse in Khartoum State. MVSc thesis, Dep. of Prev. Vet. Med, Fac. Of Vet. Med. U of K. Sudan.

11. Hayfa , M. I. (2001): Caprice brucellosis in Khartoum State. MVSc thesis, Dep. of prev. Med., Fac. of Vet. Med., UofK, Sudan.

12. I khtyar, A. H. (2010): Detection of *Staph. aureus* and other coagulase positive staphylococci in bovine raw milk in Khartoum state. MSc. thesis, Dep. of Micro., Fac. Of Vet. Med., UofK, Sudan.

13. Ibtisam, E. M. and Mohboba, I. A. (2007): The hygienic quality of raw milk produced by some dairy farms in Khartoum State, Sudan. Research Journal of Microbiology 2 (12): 988-991.

**14.** Ibrahim, M. E. (2006): Hygienic assessment of mutton intended for export from Elkadaro export slaughterhouse. MVSc thesis, Dep. of Prev. Vet. Med, Fac. Of Vet. Med. U of K. Sudan.

**15.** Izdihar, A. A. (1996): Isolation and characterization of *Salmonella* from domestic fowl and its environment in Kordofan, State. MVSc thesis, Dep. of Prev. Med.,Fac. of Vet. Med., UofK, Sudan.

16. Khalid, H.A. (2006): Sero–diagnosis of brucellosis and differentiation between Vaccinated and infected animals. MSc. thesis, Dep. of Micro. , Fac. Of Vet. Med., Uof K, Sudan.

17. Khalid, A. A. (2008): Prevailing causes of sheep liver condemnations in Nyala North Abattoir. MVSc thesis, Dep. Of Prev. Vet. Med, Fac. Of Vet. Med. U of K. Sudan.

18. Mahmoud, H.A. (2010): Brucellosis in cattle in the former West Kordofan state. MSc. thesis, Dep. of Micro., Fac. of Vet. Med., UofK, Sudan.

19. Manal, B.A. (2005): Residual antibiotic marketable milk in Khartoum State, plasma and milk concentration of gentamicin in goats and ewes. MSc thesis, Dep. of prev. Med., Fac. of Vet. Med., UofK, Sudan.

20. Nahid, N. I. and Ibtisam, E. M. (2007): Evaluation of hygienic quality of market milk of Khartoum State (Sudan). International Journal of Dairy Science 2 (1): 33-41.

21. Nuha, I.E. (2000): Staphylococcal species in normal and mastitis milk of some domestic from animals. MVSc thesis., Dep. of Micro ., Fac. Vet . Med., Uof K, Sudan.

22. Nuha, M.A. (2009): Determination of HACCP prerequisites and critical control point in raw milk post collection processes in Omdurman. MVSC. thesis, Dep. of prev. Med., Fac. of Med., UofK, Sudan

23. Raga, I.O. (2000): Brucellosis in camels and cattle in Darfur states. MVSc thesis, Dep . of Micro., Fac. of Vet. Med., UofK Sudan.

24. Omar, H. D, Mohammad A. J, and Babiker I. B, (2009):.Constraints in the mrarket chains for export of Sudanese sheep and sheep meat to the Middle East. ILRI Publications Unit, Addis Ababa, Ethiopia , p 8.

25. Rofaida, M.E. (2010): Isolation and identification of the bacteria associated with bovine mastitis and detection of their specific antibodies in milk and sera. MSc thesis, Dep. of Micro., Fac. of Vet. Med., UofK, Sudan.

26. Salah, El Din, A.M. (1996): Some studies on ovine mastitis in Eddamer province, Nahred Nil State. MVSc thesis, Dep. of Micro., Fac. of Vet. Med., UofK, Sudan.

27. Terrestrial Animal Health Code (2012): The role of the Veterinary Services in food safety. OIE - *Terrestrial Animal Health Code* Chapter 6.1. Article 6.1.1., Article 6.1.3.

28. Yousif, M.S. (2010): Prevalence of brucellosis in cattle , sheep and goats of West Darfur State, Sudan. MSc thesis, Dep. of Micro., Fac. of Vet. Med., UofK, Sudan.

29. Naglaa, A.A. (2007): Epidemiological and Zoonotic aspect of bovine tuberculosis in Khartoum State, Sudan. MTAH thesis, Dep. of prev. Med., Fac. of Vet. Med., UofK, Sudan.