Contamination of poultry carcasses with *Staphylococcus* species at slaughterhouses of three companies in Khartoum

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DEDICATION

To *Soul of my mother*
To my uncle.
To sincerely my *Father,*
To my *sister and brother*
*For their tremendous support encouragement and patience.*
KNOWLEDGEMENTS

First of all thanks and praise to Almighty Allah for giving me strength and health to do this work.

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ABSTRACT

This study was carried out to identify staphylococci bacteria which contaminate poultry carcasses which may cause food poisoning.

Fresh poultry carcass samples were collected from slaughterhouses of three companies in Khartoum State. The total number of samples was 100 (30 intestine, 35 liver and 35 skin). They were cultured onto Baird Parker and manitol salt agar. After being purified, they were identified according to their morphological and biochemical properties. The highest frequency of isolation of staphylococci was from the liver, followed by skin and intestine. *S. capitis* subsp. *ureolyticus*, *S. warneri* were found in the three organs (liver, skin and intestine). While *S. kloosi*, *S. epidermidis*, *S. hyicus* and *S. capitis* were only present in liver and skin. *S. caseolyticus*, *S. pulveri* and *S. haemolyticus* were present in the liver only and *S. chromogen* and *S. lentus* on the skin only.
Staphylococcus capitis subsp. ureolyticus and S. warneri
S. kloosi, S. epidermidis, S. hyicus and S. capitis
S. caseolyticus, S. pulveri and S. haemolyticus
S. chromogen and S. lentus.
INTRODUCTION

Contamination of food can occur from either human or animal sources, such contamination results in staphylococcal food poisoning (Wood et al., 1992). Banwart (1981) reported that so as to control contamination, keep microbial load on the food as low as possible.

Bacterial food poisoning was first described by Graether in (1888) (Jay, 1970). Denys (1895) was the first associate *staphylococcus* with food poisoning which an intoxication is caused by enterotoxins produced by strains of *Staph aureus* in food prior to ingestion (Dayne and Wood, 1979). Strains of human origin are more frequently enterotoxic that strains isolated from other sources (Bergctoll, 1979). Strains of staphylococcus produce sufficient enterotoxin in food resulting in food poisoning (Peterid et al., 1991).

Staphylococcal food – poisoning follows the consumption of the food heavily contaminated with certain *Staphylococci*, that produce poisonous or toxic substance in the food which when ingested by man after 4 – 6 hrs results in severe vomiting, diarrhea, abdominal pain and cramps some times followed by collapse but recovery is rapid (Hobbs and Gilbert, 1979; Jay, 1986). Common type of food poisoning caused by heat – stable staphylococcal enteratoxin (Jawes and Adel, 1990).

Staphylococcal food poisoning disease is not ordinarily fatal, and it is considered that death from this disease happens only when the patient is already weakened or in a seriously sick condition when the poisoning occurs (John and Anthony, 1974).
*Staphylococcus* exists in air, dust, sewage, water, milk, food or food equipment, environment surface, human and animals; some of Staphylococci are saprophytic.

**Objectives**

The objective of this work is to Isolate and identify staphylococci from poultry carcasses.
CHAPTER ONE
LITERATURE REVIEW

Staphylococcus:

Genus staphylococcus was first discovered by Sir Alexander Ogesten (1880) who introduced the name *Staphylococcus*.

Staphylococci are Gram-positive cocci that tend to be arranged in irregular clusters or bunches of grapes. The average diameters of the cocci is 1 µ. They are facultative anaerobes, fermentative, catalase positive, oxidaze- negative and nonmotile. They grow readily on a variety of media and are metabolically active, fermenting many carbohydrates and producing pigments that vary from white to deep yellow.

Pathogenic Staphylococci hemolyse blood and coagulate plasma (Quin *et al.*, 1999).

1.1 Scientific classification

Kingdom: Bacteria  
Phylum : Firmicutes  
Class : Bacilli  
Order : Bacillales  
Family : Staphylococcaceae  
Genus : Staphylococcus

1.2 Species

*S. afermentans*  
*S. aureus*  
*S. auricularis*  
*S. capitis*  
*S. caprae*  
*S. cohnii*  
*S. epidermidis*
S. felis  
S. haemolyticus  
S. hominis  
S. intermedius  
S. lugdunensis  
S. pettenkoferi  
S. saprophyticus  
S. schleiferi  
S. simulans  
S. vitulus  
S. warneri  
S. xylosus

1.3 Classification of Staphylococci

The standard method on taxonomy of Staphylococci and Micrococi in 1965 used modification of Baird Parker's modified V.P. test (Baird Parker, 1963). The first separation between them was based on their oxidation – fermentation ability in glucose metabolism. Separation on thioglycolate (shake medium) was based on different behaviour under anaerobic condition (Evan and Kloos, 1972). Sensitivity to lysozyme to which staphylococci are resistant and micrococci are sensitive (Fleming, 1922) and lysostaphin to which Staphylococci are sensitive and micrococci are resistant are useful criteria (Schindler and Schuhard, 1964).

Schleifer and Kloos (1975) found that Staphylococci have sensitivity to erythromycin of 0.4 m/ml than micrococci. Similarly Falk and Guerin, (1983) reported sensitivity of Staphylococci to bactracin.

Serological tests have been used to distinguish micrococci from coagulase – negative Staphylococci (Nakhla, 1973).
1.4 Morphological and cultural characteristics

Colony size has been used as differential character to separate them into greater or lesser than 5 mm. Isolated colonies of Staphylococci are usually circular, smooth, raised and opaque within 24 hours and encapsulated strains produce more convex and smaller colonies with wet ghistening appearance (Bergey's manual 1988).

1.5 Biological and biochemical characteristics

1.5.1 Pigmentation

Pigment production is variable and wide range of pigmentation can be produced. D' Connor and Smith (1966) found that cream agar enhances pigmentation. Pykan and Krvasctrein (1987) recommended agar media at temperature of 20° - 25°C.

1.5.2 Coagulase

Historically Staphylococci have been divided in two major groups on the bases of their ability to clot plasma by the action of staphylocoagulose (Kloos, 1990). Any coagulase – positive species was regulated as *S. aureus* but this changed after Hajek (1976) described *S. intermedia*. Dervrries (1977) reported coagulase variable *S. hyicus* Varledo *et al.* (1988) reported coagulase *S. dolphin*.

Cruickshank *et al.* (1937) published their paper that coagulase positive Staphylococci are potentially pathogenic. Human or rabbit plasma are coagulated by strains of *S. aureus* of human origin. Where as, bovine or ovine plasma are less equally clotted by that (Shaw* et al.*, 1951).

1.5.3 Catalase and oxidase

Since early 1950 there has been a general agreement that Staphylococci are catalase positive *S. aureus ssp anaerobius* has
been found by Fuente et al. (1985) as being catalase and oxidase negative.

The detection of cytochromic in the oxidase test (Faller and Schleiper, 19981) is a characteristic of Micrococi also *S. caseolyticus* which has been transferred to micrococcus (Schleifer et al., 1982).

**1.5.4 VP test**

The production of a cation from glucose in VP test has been used as valuable character for separating *staphylococcus* from *micrococcus* (Occur and Martinee, 1962). In addition it is one of the characters that can identify Staphylococci species that infect man (Cown and Steel, 1993). All Spp of staphylococci positive under standard conditions except *S. intermedius* *S. hyicus* and *S. simulans* which are usually associated with animals while micrococi are negative except *Micrococcus kistinae* (Barrow and Feltham, 1993).

**1.6 Staphylococci toxins, antigen and enzymes**

Some of the substance thought to be involved in the production of staphylococci infection for the most part their effects have been demonstrated experimentally in rabbits and mice (Carter, 1986).

**1.6.1 Leukocidin**

Kills leukocytes, antigenic, non hemolytic, associated with alpha and delta toxins (Carter, 1986).

**1.6.2 Dermonecrotic**

Necrotizing associated with alpha Toxin (Carter, 1986).

**1.6.3 Lethal toxin**

Rapidly lethal for mice and rabbits associated with alpha and beta hemolysin (Carter, 1986).
1.6.4 Peptidoglycan

Polysaccharides polymer containing linked subunits provides the rigid exoskeleton of the cell wall. It elicits production of interleukin-endogenous pyrogen) and opsonic antibodies and it can be a chemo attractant for polymer phonuclear leukocytes. It has endotoxin – like activity and activate complement (Jawerz et al., 2001). Protein A: protein is a cell wall component of many S. aureus strain that bind to Fe protein 0C IgG.

1.6.5 Capsules

Some of S. aureus strains have capsules which inhibit phagocytosis by polymer phonuclear leukocytes and less specific antibodies are present.

1.6.6 Lipase

Lipase positive strains tend to cause abscesses of the skin and subcuits; lipase destroys protective fatty acids on skin. Staphylococci causing generalized infection are usually lipase negative (Carter, 1986).

1.6.7 Hyaluronidase

Spreading factor that may be involved in virulence.

1.6.8 Staphylokinase

A weak fibrinolysin

1.6.9 Nuclease

Most cultures of S. aureus produce thermostable

1.6.10 Dnase

It’s role in disease is not clear.
1.6.11 Hemolysins (Hemotoxins)

All are antigenically distinct. Erthrocytes from various animals' species differ in susceptibility.

1.6.12 Alpha hemolysin

Inner clear zone.

1.6.13 Beta hemolysin

Outer partial zone.

1.6.14 Gamma and delta hemolysin

Poorly characterized. Double zone hemolysis on blood agar is characteristic of many *S. aureus*.

Exofoliatative toxins (Exofoliatin): Some strains of *S. aureus* produce a soluble protein that induces exfoliation or intraepidermal separation in newborn mice after parental inoculation. Skin changes in staphylococcal epidermal infections in humans, especially children, are attributed to this toxin.

1.6.15 Enterotoxin

About one third of coagulase positive strains of *S. aureus* produce enterotoxin. There are six antigenically distinct types, which are coded by plasmids (Carter, 1986). *S. aureus* produces an enterotoxin which causes acute food poisoning in man (Wilson and Miles, 1961). The enterotoxins are not destroyed by 100°C for 30 minutes but can be destroyed by N/100 NaOH and HCl (Merchant and Parker, 1969).

1.6.16 Coagulases

Clotting of plasma, its role in virulence has been questioned (Carter, 1986).
Protease: This enzyme has the ability to hydrolyse protein. It is produced by some S. aureus strains (Gillespie and Timoney, 1981). Fatty acids modifying enzyme (FAME).

Some strains of S. aureus produce enzyme which is capable to inactivate the bacteriocidial fatty acids produced staphylococcal abscesses by esterification of various alcohols. The enzyme has an optimum pH between 5.5 and 6, and temperature optimum of about 40°C. FAME production is correlated with the ability of strains to grow and survive within the tissue (Mortenson et al., 1992).

1.7 Staphylococcus diseases in animals and man

1.7.1 Animals

Staphylococcus aureus causes chronic granulomatus lesion involving the udder of the mare, cow, sow and spermatic cord of horses. It also causes mastitis in cow, sow and ewe, suppurative wound infection and septicemia in all animals (Smith and Esman, 1989). Pyoderma, in dog, horses and lambs commonly caused by staphylococcus intermedius.

1.7.2 Man

Staphylococcus aureus causes a variety of suppurative infection, toxins in human and superficial skin lesions. Also it causes pneumonia, mastitis, phlebitis, meningitis and urinary infection, and deep – seated infection such as Osteomyelitis and endocarditic (Smith and Esman, 1989).

1.8 Staphylococcus in Sudan

1.8.1 Staphylococcus caseolyticus

Staphylococcus caseolyticus was isolated from human axilla, groin, eye, mouth, nose, throat and abscess by Ali (1997) Mohamed

1.8.2 *Staphylococcus epidermidis*


1.8.3 *Staphylococcus warneri*

It is human pathogen. It causes prosthetic heart valves, prosthetic joint and neuro surgical ventricular shunt (Usha *et al*., 1992).


1.8.4 *Staphylococcus chromogens*

It is common a pathogenic of animals. It was isolated from hospital wound infection (Beno, 1994). Also it was isolated by

1.8.5 *Staphylococcus capitis*

It is part of normal human flora, it causes native valves endocarditis Theodore *et al.* (1976), pathogenic for human and isolated from hospital wound infection (Bone, 1994).


1.8.6 *Staphylococcus capitis sub sp ureolytieus*


1.8.7 *Staphylococcus kloosi*


1.8.8 *Staphylococcus lentus*

1.8.9 *Staphylococcus hyicus*


1.8.10 *Staphylococcus haemolyticus*

*Staphylococcus haemolyticus* was isolated by Saeed (1995) from skin and Ali (1997) from human axilla, groin, hand, nose and urine.

1.8.11 *Staphylococcus aureus*


1.8.12 *Staphylococcus aureus ssp anaerobius*


1.8.13 *Staphylococcus gallinarum*


1.8.14 *Staphylococcus cohnii sub sp ureolyticus*

1.8.15 *Staphylococcus simians*


1.8.16 *Staphylococcus hominis*


1.8.17 *Staphylococcus schleiferi*


1.8.18 *Staphylococcus simulans*


1.8.19 *Staphylococcus carnosus*

These *Staphylococcus* was isolated by Gasem (1997) from human nose and abscess, Saeed (1995), Mohamed (1997) from medical laboratories environment.

1.8.20 *Staphylococcus lugdunensis*

*Staphylococcus lugdunensis* was isolated by Mohamed (1997) from medical laboratories environment, Gasem (1997) from human

1.8.21 *Staphylococcus saccharolyticus*


1.8.22 *Staphylococcus auricularis*


1.8.23 *Staphylococcus intermedius*


1.8.24 *Staphylococcus delphini*


1.8.25 *Staphylococcus sciuri*

It is coagulase – negative. It was isolated by Saeed (1995) from eye, ear, nose and feces, Salih (1997) from abscess, Mohamed (1997) from beef burger, ice – cream, Mohamed (1997) from medical

1.8.26 *Staphylococcus equorum*

It was isolated by Mohamed (1997) from medical laboratories environments.

1.8.27 *Staphylococcus xylosus*


1.8.28 *Staphylococcus cohnii ssp ureolyticus*


1.8.29 *Staphylococcus arlettae*

*Staphylococcus arlettae* was isolated by Mohamed (1997) from dandorma.

1.8.30 *Staphylococcus saprophyticus*

It was isolated by Saeed (1995) from skin, Mohamed (1997) from medical laboratories environment, Mohamed (1997) from dandorma and Abdalla (2005), from Maternal Hospital and Omdurman Hospital.

1.8.31 *Staphylococcus caprae*

It was isolated by Saeed (1995) from skin and Ali (1997) from human ear and eye.
1.8.32 *Staphylococcus cohnii*


Spoilage of food involves any change which renders food unacceptable for consumption (Forsyth and Hayes, 1998). Meat provides a suitable environment for bacterial growth which results in degradation of food stuffs.

Adams and Moss (2000) illustrated the primary reasons why poultry spoilage was mainly restricted to meat surfaces. They state that the inner portion of poultry tissues were generally sterile or contained relatively few organisms, which do not generally grow at low temperatures.

Meat contaminated by contact with skin, feet, stomach and intestinal contents, hand and clothing of personnel, water used for washing carcasses and equipment and even air in the processing and storage areas (Haines 1993, Empery and Scott, 1939; and Wamger, 2000).

1.9 Bacteria associated with poultry meat

Stephenj (2000) reported that poultry skin carry a range of spoilage organisms such as, *Morerella SPP, Enterobacter SPP.*

Forythy and Hayes (1998) indicated that large numbers of micro organism were brought into the processing plant on the feather and feet and faeces of the live birds. Mohamed (1998) investigated aerobic bacteria in poultry at different areas at processing plants. She found in post – defeathering these species of bacteria – *Citrobacter, Salmonella, Micrococcus, Streptococcus, Staphylococcus, Bacillus,*
Corynbacterium and at post evisceration citrobacter, Micrococcus, Salmonella, staphylococcus, Streptococcus, Bacillus, Cory bacterium.

1.9.1 Staphylococcus

Staphylococcus aureus is common causes of bacterial food borne disease world wide. Symptoms include vomiting and diarrhea that shortly after ingestion of S. aureus contaminated food. The symptoms arise from ingestion of preformed entertoxin, which accounts for short incubation time.

Staphylococci in poultry meat may originate from handlers. Equipment and environmental surfaces are also sources of contamination with S. aureus (Wanger, 2000).

Mohamed (1998) isolated staphylococcus from previscerated and post viscerated poultry carcasses.

Devriese et al. (2008) isolated coagulase–negative Staphylococci from the skin and nares of cattle, pigs poultry, goats and sheep. They were novobiocin sensitive, Staphylococcus hyicus, Staph. simulans, Staph.epidermidis, Staph.haemolyticus and Staph. warneri. Novobiocin resistant species were Staph. sciuri, Staph. lentus, Staph. xylosus, Staph. cohnii, Staph. saprophyticus and Staph gallinarum.

Tracheas, livers and hock joints of some market-age turkeys were naturally colonized with Staph. aureus, and various species of coagulase-negative Staphylococci (Jensen et al., 1987).

Srdjan stevanovic et al. (2005) isolated members of Staphylococcus sciuri from a variety of farm animals, pets and wild animals, as well as from various food products of animal origin. This group consisted of Staphylococcus sciuri sub spp carnaticus, Staphylococcus
sciuri sub spp sciuri, Staphylococcus lentus and Staphylococcus vitulinus.

Mead and Scott (2008) isolated coagulase negative Staphylococci and coliform bacteria were isolated from defeathering machines and carcasses at a commercial poultry processing plant, the predominant Staphylococci on carcasses were Staphylococcus xylosus and Staphylococcus simulans but during defeathering, these organisms were replaced by Staphylococcus sciuri.

Since Staph sciuri predominated in the defeathering machines, the machinery appeared to responsible for contaminating carcasses.

1.9.2 Micrococcus

Thomas and MC Meekin (1980) reported that Micrococcus spp was found in poultry as skin microflora and during scalding and plucking, the skin epidermal, exposed dermal tissues, was contaminated by microorganisms from mechanical subsequent stages of processing. Major sources of contamination by microorganism were washing and chilling water.

1.9.3 Streptococcus

Abdalla (1993) isolated streptococcus from liver of poultry. The recovery of this organism may be due to infection from live birds (Gillies and Dodds 1984).

1.9.4 Enterococcus

Gram-positive cocci in pairs or short chains. Non spore, aerobic, facultative anaerobe. catalase and oxidase negative, Fermentative. Enterococcus was present in very large numbers in
poultry meat due to direct or indirect fecal contamination, especially when meat was held between 10 - 45°C (Monica, 1984).

1.9.5 *Bacillus*

The genus belongs to the family Bacillaceae they are rods, motile, produce heat resistance spores under aerobic condition. Oxidase – variable, catalase positive. Wadi (2000) found that *Bacillus spp* were the most common isolates detected in poultry meat. Omer (2005) isolated *Bacillus* from ground poultry product.

1.9.6 *Salmonella*

Belongs to family Enterobacteriaceae, motile, aerobic and facultative anaerobic, catalase-positive, oxidase-negative, attack glucose fermentatively with the production of acids and gas but unable to metabolize lactose and sucrose.

Most of Salmonella are found in intestines of animals especially of poultry.

Mohamed (2007) isolated *Salmonella* from poultry and found that 2-9% of samples were positive. Jay (2000) reported that up to 70% of broiler carcasses have been found to be contaminated with salmonella. The organisms do not appear to be a normal flora of poultry but are acquired from the environment via rodents, feed, other animals and humans.

1.9.7 *Enterobacter*

Abdalla (1993) isolated enterobacter from liver, gizzards, external and internal surface of poultry carcasses.
CHAPTER TWO
MATERIALS AND METHODS

2.1 Collection of sample

Total number of 100 samples were collected from poultry (swab). All samples were transported in an ice cold thermos as soon as possible to the laboratory for immediate processing.

2.2 Preparation of media

2.2.1 Baird Parker’s medium

In a liter of distilled water, 63g of dehydrated (Oxide M275) Baird Parker medium were suspended, mixed and steamed to dissolve. The pH was adjusted to 6.8 before autoclaving at 121°C for 15 minutes. After cooling to about 45°C, 5 ml of egg yolk emulsion and 2 ml of potassium tellurite were added aseptically and mixed well before pouring plates.

2.2.2 Mannitol salt agar

One hundred and eleven grams of (Oxoid CM85) were suspended in 1liter of distilled water, mixed, steamed to dissolve and then the pH was adjusted to 7.5 it was then autoclaved at 121°C for 15 minutes, cooled and poured into Petri dishes.

2.2.3 Nutrient agar

Dehydrated nutrient agar (Oxoid Ltd., England) was prepared according to the manufacturer's instruction. This medium consists of yeast extract, sodium chloride, peptone and agar. Twenty-eight grams of the powder were dissolved in 1 liter of distilled water by boiling. The pH was adjusted to 7.4 and then the medium was sterilized by autoclaving at 121°C for 15 minutes, cooling to 50-55°C and then distributed into sterile Petri dishes 20 ml in each.
Table (1): Distribution of samples according to poultry site on carcass and source

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<td>swab</td>
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<tr>
<td>30</td>
<td>Intestine</td>
<td>Elasal</td>
<td>swab</td>
</tr>
</tbody>
</table>
2.2.4 Blood agar

Hundred ml of fresh defibrinated sheep blood were added aseptically to 900 ml of melted sterile nutrient agar which was cooled to 55°C, mixed and distributed into sterile Petri dishes 20 ml in each dish.

2.2.5 Urea agar

This medium composed of peptone, dextrose, sodium chloride, disodium hydrogen phosphate, potassium dihydrogen phosphate, phenol red and agar.

It was obtained in dehydrated form from Oxoid. The medium was prepared according to manufacturer's instructions by dissolving 2.4 g of the powder in 95 ml distilled water by boiling. After sterilization by autoclaving at 115°C for 20 the base medium was cooled to 50°C and 5 ml of sterile 40% urea solution were added aseptically. The pH was adjusted to 6.8 and distributed as 10 ml aliquots into sterile screw-capped bottles, which were allowed to solidify in slope position.

2.2.6 Milk agar

Fresh bovine milk was boiled in sterile flask and with sterile pipette 10 ml were added to 90 ml of molten and cooled sterile nutrient agar, mixed and poured into plates

2.2.7 Mueller- Hinton agar

This is medium composed of meat infusion, casein hydrolysate, starch and agar.

It was prepared according to Barrow and Feltham (1993) by dissolving 21 g of the medium in 1 litre of distilled water and the pH was adjusted to...... The medium was sterilized by autoclave (121°C
for 15 minutes) cooled to 50-55°C and then distributed into sterile Petri dishes, 20 ml in each dish

2.2.8 Nutrient broth

This medium composed of peptone, yeast extract, and sodium chloride. It was prepared according to Barrow and Feltham (1993) by dissolving 13 g of the medium in 1 litre of distilled water. The pH was adjusted to 7.4 and the medium was distributed into screw capped bottles 5 ml each and sterilized by autoclaving at 121°C for 15 minutes.

2.2.9 Nitrate test reagents

Nitrate reagent was composed of two solutions:
Solution A: 0.8% sulphanilic acid in acetic acid. This was prepared by mixing 0.4 ml of sulphanilic acid in 50 ml of 5 N-acetic acid.
Solution B: 0.5% dimethyl – nephthylamine in 5N-acetic acid

2.2.10 Oxidase test reagent

One percent tetra methyl-p-phenylenediamine aqueous solution was added to one percent ascorbic acid. Filter paper of 5×50millimeter size were impregnated in the above reagent and dried at 50C

2.2.11 Carbohydrate fermentation

This medium was prepared according to Barrow and Feltham (1993). Nine hundred ml of peptone water were prepared and the pH was adjusted to 7.1. Ten ml of Andrades indicator were added and the media was sterilized by autoclaving at 115°C for 20 minutes. Sugar solution was prepared by dissolving 10 g of the appropriate sugar in 90 ml of peptone water. This sugar solution was added aseptically to
the peptone water, distributed into sterile test tubes with inverted Durham's tube 5 ml each and sterilized by autoclaving at 115°C for 10 minutes. The carbohydrates examined were glucose, mannitol, mannose, xylose, raffinose, cellobiose, maltose, sucrose, arabinose, fructose and salicin.

2.2.12 Blood

Defibrinated sheep blood was used in preparing blood agar medium. It was collected from the jugular vein in sterile flask containing glass beads and mixed gently. The blood was distributed in 10 ml amount in sterile screw capped bottles and stored in refrigerator to be used for blood agar medium.

2.3 Sterilization

2.3.1 Sterilization of equipment

Petri dishes, test tubes, forceps, flasks, Pasteur pipettes and graduated pipettes were sterilized in a hot air oven at 160°C for 1 h. Bottle were sterilized by autoclaving at 15 lb./sq. inch for 15 minutes at 121°C.

2.3.2 Sterilization of culture media and solutions

Media and solution were sterilized by autoclaving at 15 lb/sq. inch for 15 minutes at 115°C, but carbohydrate media was sterilized by autoclaving at 5lb/sq. inch for minutes at 110°C.

2.4 Culture methods

Primary inoculation on to Baird Parker Swabs were directly streaked on Baird Parker and the inoculated plate was incubated at 37°C.
2.5 Subculture of primary isolates

This was done by picking up single colony with sterilized wire loop from primary isolate and then strikes into nutrient agar to obtain pure culture.

2.6 Incubation of cultures

All inoculated solid and liquid media were incubated aerobically at 37°C for 24 h and except for urease and sugar which were incubated for up to 7 days.

2.7 Examination of cultures

Visual examination of all cultures on solid media was performed for the detection of growth, colonial morphology and changes in the media. The liquid media were similarly examined for turbidity, colour changes, formation of sediment.

2.8 Identification of isolated bacteria

2.8.1 Primary identification

This was done microscopically by examining the smear stained by Gram's stain, to identify the shape, arrangement and Gram's reaction.

2.8.2 Preparation of smears

Smears were prepared as follows: A small inoculums of bacteria was emulsified in drop of normal saline and spread on a clean slide. The smears were allowed to dry in air and then fixed by gentle flaming.

2.8.3 Gram staining

This was done according to the method described by Barrow and Feltham (1993).
2.8.4 Secondary identification of isolated bacteria

This was done by biochemical tests. All biochemical tests were performed according to Barrow and Feltham (1993).

2.9 Oxidase test

The organism was grown on nutrient agar. A piece of filter paper approximately 7 cm in diameter was soaked in oxidase test reagent and dried in an oven at 50°C. The tested organism was picked with a sterile clean bent glass rod and rubbed on the filter paper. When a dark purple colour that developed in 5 – 10 seconds, the test was considered positive.

2.10 Catalase test

According to Barrows and Feltham (1993) a drop of hydrogen peroxide (H2Os2) was placed on a clean slide. Using a sterile wood stick, small part of an isolated colony was taken and emulsified in the hydrogen peroxide drop, the production of gas bubbles was considered positive reaction.

2.11 Sugar fermentation test

The sugar medium was inoculated with bacteria grown on peptone water, incubated and then examined daily for up to 7 days. Acid production was indicated by the development of pink colour in the medium.

2.12 Urease test

A slope of urea agar medium was inoculated with the test organism and incubated at 37°C. Change in colour to red indicates positive reaction.
2.13 Novobiocin sensitivity test

Standard disc diffusion method was used to carry out the sensitivity of the test organism. A plate of Muller and Hinton agar was inoculated, then on the surface of plate the antibiotic disc was gently applied on the plate by using sterile forceps, and incubated at 37°C for 24 h. The zone of growth inhibition was measured in millimeters and reported as sensitive.

2.14 Tube coagulase test

Fresh plasma was diluted 1:10 in physiological saline. 0.5ml of diluted plasma was placed in a sterile agglutination test tube and 0.5 of overnight broth culture of the test organism was added. The inoculated tube was then incubated at 37°C. The tube was examined for coagulation after 1,3 and 24 h. A positive test was indicated by coagulation of the tube contents. Negative result was considered after further incubation for overnight, positive and negative controls were included.

2.15 Nitrate reduction

To test the ability of the organism to reduce nitrate to nitrite. The test culture was inoculated into nitrate broth, and then inoculated at 37°C for two days; 1 ml of solution A acid was added to the test culture followed by 1 ml of solution B. A positive reaction was indicated by development of red colour. If the result was negative Zinc dust was added. A red colour indicated the presence of nitrate which was reduced by zinc to nitrite.

Staphylococci were identified according to Scheme of Staphylococcus species (El Sanousi and Saeed, 1996).
CHAPTER THREE
RESULT

Samples were hundred collected from poultry carcasses (35 liver, 35 skin, 30 intestine).

The general isolates:

From hundred samples tested for bacterial isolates 51 (51%) were positive for staphylococcal growth as shown in table (1).

Identification of isolates:

According to microscopic appearance, the cultural and biochemical activities, the isolates were identified as:

1. Coagulase-negative Staphylococcus novobiocin resistant.
   This group was represented by: *S. koolsi*, *S. pluveri* and *S. lentus*.

2. Coagulase-negative Staphylococcal novobiocin sensitive.
   This group were represented by: *S. capitis*, *Scapitis sub spp ureolyticus*, *S.chromogen*, *S. warneri*, *S. epidermidis*, *S. hycius*, *S. caseolyticus* and *S. haemolyti*
Table (2): The sample and percentage (positive for Staphylococcus)

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<tr>
<th>No of samples</th>
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<th>Percentage</th>
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<tbody>
<tr>
<td>100</td>
<td>51</td>
<td>51%</td>
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Table (3): Distribution of isolates according to poultry site on carcass and source

<table>
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<th>No: of Isolates</th>
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<td>Skin</td>
<td>Taiba Elhasanab</td>
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<td>30</td>
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Table (4): The prevalence of *Staphylococcus* species in poultry

<table>
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<tr>
<th>Staphylococcus species</th>
<th>No: of samples examined</th>
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<tbody>
<tr>
<td>S. capitis sub spp ureolyticus</td>
<td>100</td>
<td>17</td>
<td>17</td>
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<tr>
<td>S. warneri</td>
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<td>11</td>
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<td>S. caseolyticus</td>
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<td>S. kloosi</td>
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Fig. (1): The prevalence of Staphylococcus species isolated from poultry

*s.ca.sub spp – S.capitis sub spp ureolyticus*
Table (5): The prevalence of Staphylococcus species isolated from (liver) poultry

<table>
<thead>
<tr>
<th>Staphylococcus species</th>
<th>No: of samples examined</th>
<th>No: of isolates</th>
<th>Percentage</th>
</tr>
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<td><em>S</em>.hycius</td>
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<td><em>S</em>.epidermidis</td>
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<td><em>S</em>.pluveri</td>
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<td><em>S</em>.capitis</td>
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Fig. (2): The prevalence of Staphylococcus species isolated from (liver) poultry

*s.ca.sub spp – S.capitis sub spp ureolyticus
Table (6): The prevalence of *Staphylococcus* species isolated from (skin) poultry

<table>
<thead>
<tr>
<th><em>Staphylococcus</em> species</th>
<th>No: of samples examined</th>
<th>No: of isolates</th>
<th>Frequency of isolation (%)</th>
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<td><em>S. capitis sub spp ureolyticus</em></td>
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<td><em>S. warneri</em></td>
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<td><em>S. kloosi</em></td>
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Fig. (3): The prevalence of Staphylococcus species isolated from (skin) poultry

*S.ca.sub spp – S.capitis sub spp ureolyticus
Table (7): The prevalence of *Staphylococcus* species isolated from (intestine) poultry

<table>
<thead>
<tr>
<th><em>Staphylococcus</em> species</th>
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<th>Percentage (%)</th>
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<td><em>S. capitis sub spp ureolyticus</em></td>
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<td><em>S. warneri</em></td>
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<td>2</td>
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Fig. (4): The prevalence of various Staphylococcus species isolated from (intestine) poultry.

*s.ca.sub spp – S.capitis sub spp ureolyticus*
Table (8): Biochemical properties of *staphylococcus* species.

<table>
<thead>
<tr>
<th>Species</th>
<th>S. capitis sub spp ureolyticus</th>
<th>S. capitis</th>
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<th>S. caseoliticus</th>
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<th>S. haemolyticus</th>
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<th>S. pluveri</th>
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</table>
CHAPTER FOUR
DISCUSSION

Although *Staphylococci* are normal flora of different parts of man and animal body, some of them have been associated with many disease problems. They might cause disease in their presence in the animal body or by contamination of food.

Gimour and Harvey (1990) reported that the enterotoxin producing *Staphylococcae* species in food, particularly *Staphylococcus aureus* are probable cause of food borne illness throughout the world.

Poultry carcasses were examined for the presence of *staphylococcus* species. From hundred samples, fifty one samples were positive for *staphylococci*. Eleven species were identified and all were coagulase –negative.

Our results are similar to the result of Mohamed (1998) who isolated *Staphylococcus capitis* from poultry. Also the result of Abdella (1993), who isolated *Staphylococcus epidermis* from gizzard, liver and external surface are similar to our result.

Microbial food safety and food-borne infections are important public health concern world wide. There have been a number of food –borne illness resulting from ingestion of contaminated foods such as chicken meats. Most of the pathogens that play a role in food – borne disease have a zoonotic origin (Busani *et al.*, 2006).

The result of Saikia *et al.* (2010) who isolated *Staphylococcus epidermis* from poultry meat (wings and gizzard) agrees with the result of this study.
The contamination with staphylococci in this study may be due to handler, equipment defeathering machine and environment.

This result agrees with Devries, et al. (2008) who isolated coagulase – negative, *Staphylococcus hyicus, Staphylococcus warneri, Staphylococcus xylosus, Staphylococcus haemolyticus and Staphylococcus epidermis* from poultry.

The isolates in this study were similar to those isolated by Jensen et al. (1997) who isolated coagulase – negative *taphylococcus* species from liver and tracheas of turkeys. Also Mead and Scoot (2008) isolated coagulase – negative form defeathering machines and carcasses at commercial poultry processing plant.

In this study *Staphylococcus arueus* was not isolated such a result disagree with Foryythe and Hayes (1998) who isolated *Staphylococcus arueus* from poultry.

Ahmed (2000) isolated *Staphylococcus. hyicus* and *Staphylococcus. xylosus* from poultry (Intestine) and in this study they were also isolated. *Staphylococcus warneri, Staphylococcus capitis sub spp ureolyticus* from intestines were also isolated in this study.

The result of Valeria and Cleber (2010) who isolated *Staphylococcus* from poultry carcass before chilling disagrees with the result of this study because they isolated coagulase positive *Staphylococcus*

Furthermore our result disagrees with Mead et al. (1989) and Bystron et al. (2005) who isolated *Staphylococcus* from slaughterhouse of poultry.

Cross contamination is a particular problem and several recommendations have been published to control pathogen through
the chain from hatcheries to the preparation in the home (Dincer and Basyo, 2004).

In addition, this result is similar to Abdalla (2008) who isolated *Staphylococcus* species from poultry carcasses. Poultry carcasses and their parts are frequently contaminated with pathogens, which reach the carcasses. They may be brought from the intestinal tract or from faecal material on feet and feather.

The contamination with Staphylococcus in this result may be due to the use of one knife in slaughtering, staffs personal hygiene and transport of chicken from farm to slaughterhouse.
CONCLUSION AND RECOMMENDATIONS

Conclusion

From the results this investigation can be concluded that:-
1. This study revealed that staphylococci contaminated poultry carcasses is one major problems which may contribute food borne disease.
2. In this study staphylococci species is most contaminated liver.
3. The intestine is lesser than contaminated by staphylococci.
4. *S. capitis ssp ureolyticus* is found in the liver, intestine and skin.

Recommendation

Based on the results obtained in this study, the flowing is recommended so as to avoid contamination with staphylococcus.
1. The staff worker must be wear face mask and gloves during processing from slaughter to packing.
2. Clean the flour of slaughter house with detol or other antiseptic.
3. The staff worker must wear lab coat and boots during processing.
4. Wash the towel of work before processing.
REFERENCES


Cleber Rabelo da Roza (2010). The university of Queensland School of Land, Crop and Food Sciences St Lucia Campus QLD 4072-Australia – e-mail; c.daroza@uq.edu.au


Jawetz, Melinck and Adelersgs' (2001). Medical Microbiology, 22nd U.S.A.


Valeria Castro Cardoso Guerra (2010). Hygiene and Food Processing UERGS/UCS Rua Getulio Vargas, 1130 Bairro Petropolis CEP 95070-560 Caxias do sul Brasil e-mail; valeriaccg@ibest.com.br


