

# **CHRONICITY OF MULTIDRUG RESISTANT LIVESTOCK ASSOCIATED STAPHYLOCOCCUS AUREUS SECLUDED FROM THE NOSTRIL OF A LIVELY CATTLE-Fredrick Odney Ondiek.**

## **CHAPTER ONE.**

### **INTRODUCTION**

#### **1.1 Background to the Study**

Cattle are large-bodied ruminants that feed on pastures and forages or fodder and largely domesticated for meat and milk. In Kenya, cattle are reared primarily for meat which is a veritable source of protein for humans, and for milk. However, some communities like the Maasai do for prestige. Cattle rearing in Kenya is an old occupation that is traditionally practiced by Maasai and Pokot both from the Rift valley part of Kenya.

*Staphylococcus aureus* is a facultative anaerobic gram-positive coccal bacterium and as a result of combination of numerous bacteria immune-evasive strategies which it uses, it is rendered a successful pathogen. The nasal passages are considered to be the major habitat (Kluytmans *et al.*, 1997; Lowy, 1998; Lowy, 2003) and the hughest supply of *S. aureus* in human beings, although many more body locales can harbor this bacterium (Vandenbergh & Verbrugh, 1999). *S. aureus* is a typical tenant of the skin (Lowy, 2003; Williams, 1963), and perineum and can likewise be found in the axillae (Ridley, 1959), vagina (Guinan *et al.*, 1982), and the gastrointestinal tract (Williams, 1963). *S. aureus* strains are noteworthy human pathogens and are conceivably ready in contaminating any human body tissue, bringing on everything from skin contaminations to life-debilitating sicknesses. In people, the diseases brought on by *S. aureus* can be subdivided into these three sorts in general; shallow sores, (for example, surgical site and wound contaminations), life and systemic undermining factors, (for example, osteomyelitis, endocarditis, pneumonia, mind abscesses/wounds, bacteremia, and meningitis), then toxinoses, (for example, poisonous stun disorder, sustenance harming and singed skin disorder (Alo *et al.*, 2013; Aires de Sousa *et al.*, 2004; Lowy, 2003). The sign of staphylococcal contamination is the boils that contain discharge which is made up of dead neutrophils, dead and living microbes, tissue (necrotic), the lysed host substance and bacterial cells. The immunocompetent hosts, as a rule, effectively clear the disease and exhaust the ulcer, though for the immunocompromised and sporadically for a sound individual, the contamination might advance to more profound tissue and turn into a foreseeably lethal intrusive contamination (Novick, 2006). It is still one of the five most often causes of healthcare associated

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infections, commonly causing postsurgical wound infections (Bowersox, 1999). *S. aureus* is similarly known to colonize and contaminate both pets and animals, including pooches, felines, rabbits, stallions, steers, and pigs (Morgan, 2008). A noteworthy concern is the nearness of methicillin-safe *S. aureus* (MRSA) in pets and domesticated animals, as these may fill in as repositories for human colonization, an illustration is MRSA ST398 from pigs (Weese, 2010).

The unnecessary utilization of antibiotics has prompted to the rise of different medication safe strains of *S. aureus* (Lowy, 1998). The Penicillin was presented for curing infections caused by *S. aureus* in the 1940s, and adequately diminished mortality and bleakness. Be that as it may, in late 1940s, its resistance because of the nearness of penicillin's developed (Eickhoff, 1972). The staphylococci are extremely fit for advancing imperviousness to the regularly utilized antimicrobials, just to mention a few, erythromycin (Walmark & Finland, 1961), ampicillin (Klein and Finland, 1963), and antibiotic medication (Eickhoff, 1972). More often than not, imperviousness to antimicrobial agents is coded for by qualities carried on plasmids, representing the quick spread of resistant microscopic organisms (Morris *et al.*, 1998). One purpose behind proceeding with the essential part of *S. aureus* in illness is its inclination and propensity to wind up distinctly impervious to antimicrobials (Waldvogel, 2000). *S. aureus* is presently the main general reason for nosocomial diseases and, as more patients are dealt with outside the healing center setting, is an expanding worry in the group (CDC NNIS System, 2001; Diekema, 2001).

The time of medication development and its execution in human and creature well-being and horticulture that was started with the revelation of anti-infection agents over 70 years prior. These disclosures were powerful against organisms and consequently were viewed as effective against pathogenic microorganisms however this achievement was fleeting as they were tempered in all cases by the rise of resistant microorganisms (D'Costa *et al.*, 2011). A standout amongst the most relentless issues confronted by human services benefits far and wide is the expanding pervasiveness of antimicrobial resistance. This resistance is broadly perceived as a noteworthy general well-being danger and this issue is aggravated by a consistent reduction of the number of new specialists (antimicrobials) getting in the clinical practice (D.H, 2000). There is an expanding worry that some less-alarming infections which were effortlessly treated are currently turning out to

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be progressively hard to treat and ailments created by microscopic organisms which are impervious to antimicrobial agents may set aside a more drawn out time of opportunity to treat successfully (Butler *et al.*, 2006). In spite of the fact that the issue of multidrug resistance has pulled in the consideration of medicinal services administrations and the overall population, rates of antimicrobial resistance among health care center and group pathogens have expanded alarmingly amid the previous decade (NNIS, 2001).

## **1.2 Statement of the Problem**

In Kenya, cattle are reared primarily as a source of meat. According to Kuehnert *et al.* (2008), Lowy (1998, 2003), Onanuga & Temedie (2011), Vandenberg & Verbrugh (1999), Williams (1963), the nares and the skin of humans and animals may be considered as ecological niche for *S. aureus* colonization but this colonization does not frequently result into infection thereby tagging the bacterium a normal flora of these body parts. *S. aureus* colonizes the nares and the skin but if there is an abrasion, lesion or wound in these parts, *S. aureus* may migrate into the body or blood and cause infections. These infections are called opportunistic (staphylococcal) infections. Compared to other pathogens, *S. aureus* has a likelihood and proneness to become resistant to antimicrobials (Weese, 2010). This fact, coupled with the constant abuse of drugs and lack of control over the sales of antibiotics contributes to the increasing problem in multidrug resistance of *S. aureus* including methicillin and vancomycin which is considered as the first line of treatment against methicillin resistant *Staphylococcus aureus* (MRSA). Cuny *et al.* (2015), Fluit (2012), Johnson (2011) and Morgan (2008) found that methicillin-resistant *S. aureus* (a multidrug-resistant organism) may not only be a nosocomial and community-acquired infection but it could also be a zoonotic infection as it can be transmitted from animal to human. The presence of multidrug-resistant *S. aureus* in the nares of cattle poses a threat to cattle herders, butchers, beef retailers/handlers, and consumers as these cattle are frequently asymptomatic carriers and thus are considered 'healthy'. This study may evaluate the prevalence of multiple antibiotic-resistant livestock-associated *S. aureus* and suggest possible control for diseases caused by multi-antibiotic-resistant livestock-associated *St. aureus*.

## **1.3 Objective of the Study:**

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The general objectives of the study were to evaluate the prevalence of multidrug-resistant livestock-associated *S. aureus* and suggest possible control of staphylococcal infections in humans caused by livestock-associated *S. aureus* using the antibiogram of the isolates. The major aims are therefore to:

1. segregate and identify *S. aureus* from the nasal passage of healthy cattle by Gram staining and biochemical tests (catalase test, slide coagulase test, and fermentation of mannitol);
2. determine the antibiogram of the isolates and calculate the Multiple Antibiotic Resistance Index (M.A.R.I) using the antibiogram of the isolates;
3. determine the minimum inhibitory concentration ( $\mu\text{g}/\text{disc}$ ) of the *S. aureus* isolates to vancomycin;
4. Establish the minimum inhibitory concentration ( $\mu\text{g}/\text{ml}$ ) of the isolates to flucloxacillin as a test for methicillin-resistant *S. aureus* (MRSA) and vancomycin.
5. Ascertain the synergistic medication-safe or additive effect of two antibiotics to suggest possible control of staphylococcal infections in humans caused by multidrug-resistant livestock-associated *S. aureus*.

## **1.4 Investigation problems**

1. Can *S. aureus* be isolated and identified from the nasal passage of healthy cattle?
2. How is the antibiogram of *S. aureus* isolates determined and how is the Multiple Antibiotic Resistance Index of the isolates calculated using the antibiogram of the isolates?
3. How is the minimum inhibitory concentration ( $\mu\text{g}/\text{disc}$ ) of *S. aureus* determined?
4. How is the minimum inhibitory concentration ( $\mu\text{g}/\text{ml}$ ) of *S. aureus* isolated from nasal passage of healthy cattle to flucloxacillin and vancomycin determined?
5. Are the effects of the combined antibiotics synergistic, additive, or antagonistic?

## **1.5 Consequences of the Study**

1. This result may create more antimicrobials and the danger of multidrug-resistant *S. aureus* in ruminant flocks.
2. This result may educate the general public on the effect of the negligence of multidrug-resistant *S. aureus* in cattle and its effect on the consumption of undercooked beef.
3. The result may suggest possible control of staphylococcal infections in humans caused by livestock-associated *S. aureus*.

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## **1.6 Rationalization for the Study**

The study may provide more recent data on multiple antibiotic-resistant *S. aureus* and suggest possible control of livestock-associated staphylococcal infections in Kenya and across the globe.

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