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*Research Article*

# **Occupational Hazards and Health Risks Among Abattoir Workers: A Narrative Review**

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## **ABSTRACT**

The purpose of the review is to provide an informed discussion on the health and safety of workers in slaughterhouses and/or abattoirs where animals are slaughtered for human consumption and different processes and activities are performed on daily basis. Primarily, this review provides knowledge on health and safety within slaughterhouses and/or abattoirs and subsequently to identify occupational hazards and health risks associated thereon. Abattoir work can be connected to the health hazards that might result in occupational diseases and/or may exacerbate the existing ill-health of non-occupational origin. Several studies have been completed on the health and safety of workers in abattoirs and studies indicated that workers in animal-related occupations have an average knowledge to adequate knowledge of zoonotic diseases but poor knowledge of preventive measures and that employer responsibilities towards prevention and control of occupational hazards are inadequate. South Africa has enacted legislation to deal with occupational health and safety, this includes the Occupational Health and Safety Act, 85 of 1993. However, information on the development of National Guidelines on health and safety in the meat industry is still lacking. This legislation covers occupational health and safety in all workplaces and ensures that employers and workers comply with the requirements stipulated to protect the workers from hazards in the workplace. Therefore, this review recognizes that there is limited literature on the health and safety of workers and poor knowledge on identifying the types of injuries experienced and the associated risk factors, and as well as the management of these injuries in the facilities.

**Keywords:** *Abattoirs; occupational hazards; health risks; infections; zoonosis.*

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## **INTRODUCTION**

Slaughterhouse is a facility where animals are slaughtered for consumption as food (Stevenson, 2023). The first public slaughterhouse became operational in France and the French word abattoir was acquainted with allude to a specific place where animals are slaughtered for human consumption (Fitzgerald, 2010). In meat production industries, accidents result from animals, machines, knives, hooks, falling carcasses, manual handling, lifting, slippery wet floors, and many other hazards present in these facilities (British Meat Processors Association, 2014). In the United Kingdom (UK), injury incidence rates per 100,000 employees as reported by the Health and Safety Executive (HSE) in 2011/2012 indicates that a total of 4,700 injuries were recorded and 17% of these

were major and 83% minor in the meat industry (Nourish, 2012).

Long hours of working and the performance of repetitive motion directly leads to increased risk of injury and predisposes workers to chronic pains in their hands, arms, shoulders, and back pain (National Institute of Occupational Safety and Health, 2012). Data from the Bureau of Labor Statistics (BLS) in the USA (2003-2007) show that the sickness and injury rate of workers in slaughterhouses was more than twice the national average and the sickness rate alone was more than ten times the national average (Lo and Jacobson, 2011).

In the 1880s, the United States became the first mass production industry for slaughtering animals. Directly related to this mass production, the rate of sickness and injury among

slaughterhouse workers increased for much of the last quarter of the 20th century than in any other industry (Fitzgerald, 2010). The number of reported injuries and illnesses in the US was 26.7 per 100 full-time employees in 1999, three times the average for other industries (Fitzgerald, 2010). This incidence rate of injury has been reduced to an average of 7.2 per 100 full-time workers in the year 2012 (American Meat Institute, 2013).

In the Britain, the Health and Safety Act 1974 provides training, updated health and safety guidelines, and safety and health committees, and these measures have helped reduce injury rates in the meat industry (British Meat Processors Association, 2014). New Zealand has enacted Health and Safety in Employment Act, 1992 and this has seen a recent trend of injury rates decreasing resulting from the enactment and implementation of this Act (Meat Industry Association and New Zealand Industry Training Organization, (2013). The Center for Disease Control and Prevention (2010) found that occupational risks have steadily increased over the past few decades, leading to increased occupational exposure to blood-borne diseases and other communicable diseases. This review recognizes that there is no enough information put in place by the government to track occupationally acquired hazards within slaughterhouses and/or abattoirs. Ideally, continuous health monitoring would be essential to identify any diseases and associated health effects that are related to occupational exposure, to ensure that appropriate and effective precautions are taken to protect workers. Subsequently, most of these occupational hazards are not reported and underreporting makes these occupational hazards increase every year.

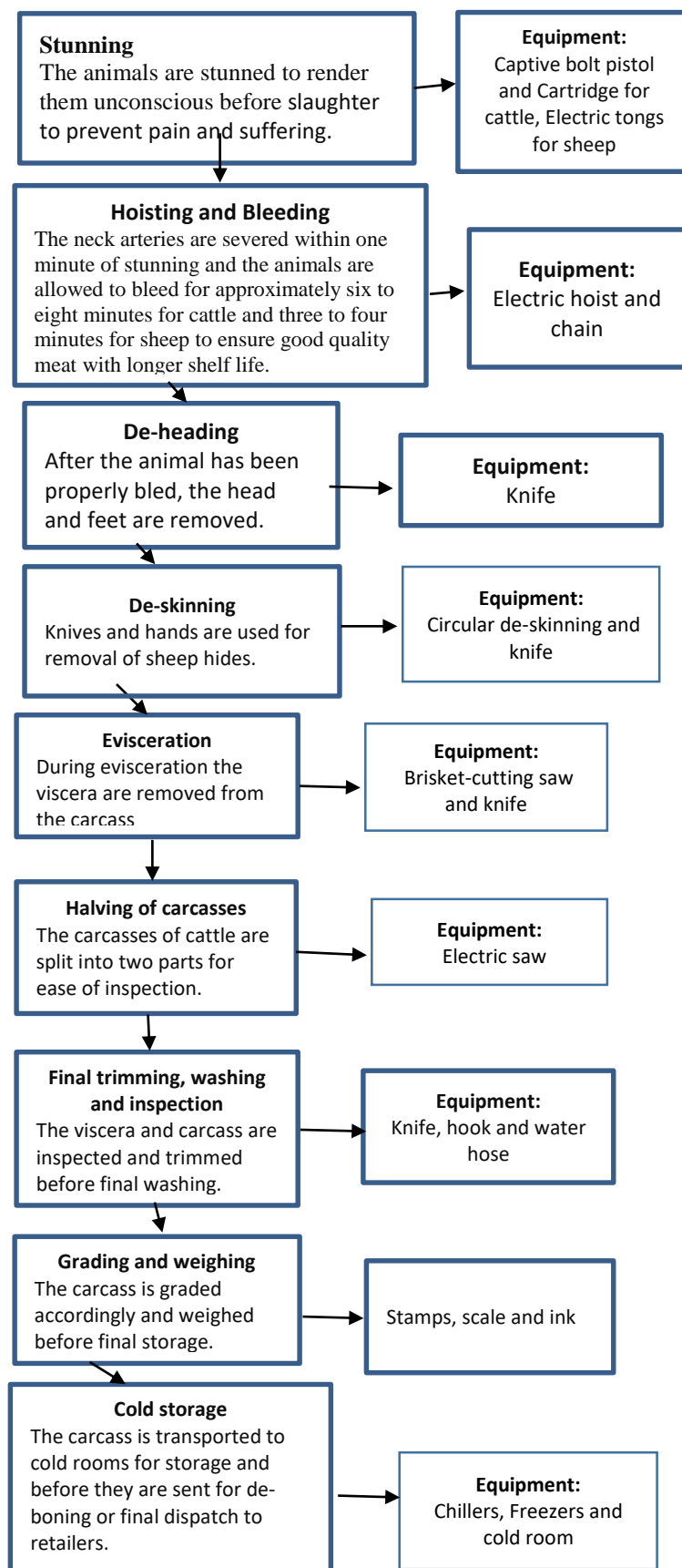
## MATERIALS AND METHODS

A literature search was carried out using the Google Scholar and PubMed databases. The search was limited to articles focused on occupational hazards in abattoirs published from 2010 to 2020. Search terms included “hazards” and “abattoirs”. The subject headings were “Hazards” AND “Abattoirs”. Articles were selected and narratively reviewed. Titles suggestive of occupational hazards in butchers and poultry were selected for abstract review. Articles focusing on zoonotic diseases were included and articles focusing on production, disposal and efficient techniques for separating heavy metals from red meat slaughterhouse effluents were excluded.

A total of 55 articles met the search criteria. Of these, 21 titles appeared to be relevant to occupational hazards in abattoirs; 34 titles were excluded because they were not focused on the occupational hazards and health risks in abattoirs.

## RESULTS AND DISCUSSION

**Types of injuries that the employees are exposed to in the meat industry:** Before this review can highlight on the major injuries experienced in the meat industry, it is important to discuss the abattoir slaughter processes, the hazards existing in this industry, and the risk factors in these facilities which may exposure workers to injuries.



**Figure 1:** Flow diagram for meat processing operations.

**The slaughtering process:** On arrival, the animals are kept in stables where they can rest before slaughter. This makes it easier to conduct an ante-mortem inspection to determine the health condition of the animals [9]. The animals are then stunned to render them unconscious before slaughter to prevent pain and suffering (Figure 1). The captive bolt pistol is used for cattle and electric tongs for sheep (South Africa. Department of Agriculture, 2000; National Department of Agriculture, 2000).

A chain is attached just above the hoof and the animal is then hoisted with an electric hoist. The neck arteries are cut within one minute of stunning and the animals are allowed to bleed for approximately six to eight minutes for cattle and three to four minutes for sheep to ensure good quality meat with longer shelf life (National Department of Agriculture, 2000). The Red Meat Regulations of South Africa prescribe eight minutes for cattle and six minutes for sheep to bleed (South Africa. Department of Agriculture, 2004). After the animal has been adequately bled, the head and feet are removed. In cattle, the skin is removed with circular saw blades. Knives and hands are used to remove sheepskins.

During evisceration, the entrails are removed from the carcass. The carcasses of cattle are split into two parts for ease of inspection, this also allows proper cooling. The viscera and carcass are inspected and trimmed before final washing. By-products, which include blood, bone dust, and marrow, are removed before the carcasses are transported to cold rooms for storage.

Slaughterhouse workers are exposed to physical hazards including noise, vibration, cold, bodily harm and ergonomic hazards such as overexertion, manual and repetitive activities

such as hanging and cutting meat, awkward positions and lifting heavy objects (Table 1). This can lead to musculoskeletal disorders (MSD), which are caused by impairment of muscles, tendons, nerves and joints. Musculoskeletal disorders consist of back and neck pain, nerve entrapment, tendonitis, bursitis, and trigger finger (Harmse et al, 2016).

Based on the above research studies, the safety of workers in abattoirs is neglected and immediate intervention is needed to address all occupational hazards and health risks faced by workers. However, information on the development of National Guidelines on health and safety in the meat industry is still lacking.

## RISK FACTORS IN SLAUGHTERHOUSES

**The risk of contracting zoonotic diseases:** Slaughterhouse workers are at greater risk of developing zoonosis. These are diseases and infections that are naturally transmitted from animals to humans and account for around 70% of the most recently emerging infectious diseases (Mahendra et al, 2014). In the UK, 2009, anthrax was reported countrywide, and 50 cases of leptospirosis and 150 of listeriosis are reported each year. Q fever outbreaks were very common in abattoir workers in UK in the same year. A total of 500,000 cases of salmonellosis were been reported each year in the UK (British Meat Processors Association, 2011). In Uganda, it has been established that the risk of brucellosis was higher (23%) for individuals who do not use protective clothing in abattoirs compared with those who used protective clothing (9%) (Nabukenya et al, 2013).

**Table 1:**

The comparison of studies conducted on common hazards in the slaughterhouses.

Author	Type of the study	Methodology	Study title	Common hazards
Pereira et al. 2020 [12]	A systemic review and meta-analysis	Case-control	Occupational exposure to <i>Brucella</i> spp: A systematic review and meta-analysis	Animal breeders, laboratory technicians and slaughterhouse workers were at higher risk of contracting <i>Brucella</i> spp. than people who had no contact with the possible sources of infection.
Banjo et al. 2013 [13]	Cross sectional study	Quantitative method, and questionnaire	Occupational Health Hazards Among Abattoir Workers In Abeokuta.	Abattoir workers were exposed to tremendous work-related physical and biological hazards which consistently exposed their health status when left unchecked. such various physical hazards ranged from scalds, cuts, wounds to accidents, rashes and smoke, while associated risk factors such as polluted work spaces, slippery floors and animal contact predominated.
Abdullahi et al.2016 [14]	Cross-sectional Survey	Validated structured questionnaire and an observation checklist	Occupational hazards among the abattoir workers associated with non-compliance to the meat processing and waste disposal laws in Malaysia.	Slaughterhouse workers, mostly large animal practices have been exposed to physical and biological hazards while working. Physical hazards included cuts, needle-stick injuries, back injuries, wounds, scalds, accidents, and noise, while the other predisposing factors are contaminated air, animal contact, and slippery surfaces.
Cook, 2014 [15]	Cross-sectional Survey	Interviews	Epidemiology of zoonoses in slaughterhouse workers in Western Kenya.	The study was carried out in Busia in Kenya, and reported that 25% of the abattoir workers were physically injured at work at least once a month and 8% had a wound at the time of interviews.

In Western Kenya, the sero-prevalence of zoonotic diseases in slaughterhouse workers was reported at 13.4% for leptospirosis, 1.2% for Rift Valley Fever, 0.1% for brucellosis, 1.8% for taeniasis, 4.5 for Q fever and 2.6% for cysticercosis and that less than 32% of the workers wore Personal Protective Equipment (Cook, 2014). The same author reported that risk factors for these diseases included open wounds resulting from injuries, washing of the intestines, and smoking at work.

**Inadequate training:** Improper training and poor use of equipment is very common in this industry. OSHA, 2007, Section 99 stipulates that no person may be employed on any machines or processes that can cause illness or personal injury, unless she/he is adequately trained in working on the machine or in the process or is under the supervision of a person who is very familiar and experienced with the machine or process [20]. The training should be undertaken at recruitment, transfer or change of job or introduction of a new machine or equipment. The training must be done when risks change and should be repeated periodically and this is entirely the responsibility of the employer (Occupational Safety and Health Administration, 2007)).

**Causes, types, and body parts affected by the injuries:** Out of 17 food and drink producing industries within the UK, injury rates were highest in the meat production at 28 per 100 in full-time employees (British Meat Processors Association, 2014). On the same report provided, the main causes of injuries were identified as being struck by an object, handling and lifting of heavy weights, slips on wet and greasily floors, machinery like band saws, dehiders, transport including lift trucks, vehicles, and injury by animals.

In Nebraska within the USA, factors resulting to high-risk working conditions of meatpacking plants have been found to be the use of sharp tools, employees working with high-speed machines, confined workplaces, long hours of working, slippery floors, and heavy lifting (Autumn, 2014). The same author found out that fingers, hands, wrists, and forearms were the major body parts injured in the meatpacking industry. In the United States, fingers were discovered to be the most common part of the body to be (Lander, 2010).

In New Zealand, the most commonly reported types of injuries were soft tissue injuries with sprains and strains, cuts or stab wounds, and chronic or slow-onset conditions such as musculoskeletal disorders (MSD) as a result of the use of repetitive forces (Meat Industry Association and New Zealand Industry Training Organization, 2013).

#### **REVIEW OF RELATED STUDIES CONDUCTED ON THE OCCUPATIONAL ZONOSIS ON ABATTOIR WORKERS.**

Ogundeji et al, (2015) conducted a study on bovine tuberculosis. The study was conducted to assess *Mycobacterium bovis* as an occupational risk for slaughterhouse workers in Enugu. Blood samples were collected from 50 individuals at both Artisan and Ogbete slaughterhouses, and 25 samples were taken from each location. Of 50 samples analyzed, 7 (14%) were positive by

the PCR method. After using the Nar 1 digestive enzyme on the positive samples; 3 (6%) of the blood samples were positive for *Mycobacterium tuberculosis* while the remaining 4 (8%) were *Mycobacterium bovis*. There was no statistically significant difference between the positive samples of the pathogen ( $p > 0.05$ ). Age distribution of tuberculosis cases in humans showed that individuals between the age group of 16 to 45 years were significantly affected ( $p < 0.05$ ). The result of the study shows that detection of *Mycobacterium bovis* in abattoir workers confirms that they are exposed to occupational hazard. Moreover, Lord et al, (2015) conducted a study of a Q fever cluster among workers at a slaughterhouse in southwest Sydney. The 8 cases met the case definition, with 7 confirmed, including one deceased, and one suspected case. The 8 cases were all men who were employed in a slaughterhouse in south-west Sydney during their incubation period. The symptoms experienced ranged from November 2014 to September 2015. Research revealed several potential risk factors in the slaughterhouse and around 75% of workers were not vaccinated against Q fever despite this high risk setting. This accumulation of Q fever in a single slaughterhouse confirms the importance of this zoonosis as an occupational hazard for those working in high risk environments.

Similarly, a study by Luwumba et al (2015) on the occupational risks associated with human brucellosis in slaughterhouses found that a total of 452 serum samples; 190, 200 and 62 cattle, goats and humans were collected from animals and workers at the Dodoma slaughterhouse, Tanzania. The samples were screened for brucellosis using the Rose Bengal Plate Test (RBPT) and the indirect enzyme immunoassay (iELISA). The seroprevalence of brucellosis in cattle, goats and slaughterhouse workers was 7.3, 1.5 and 1.6%, respectively, based on the Rose Bengal Plate Test. The seroprevalence was 4.7% in cattle, 1.6% in humans and was not detected in goats when samples were tested by indirect enzyme immunoassay. The study found that slaughterhouse workers have a potential occupational risk of developing brucellosis and that awareness campaigns and appropriate precautions to minimize the risk of zoonoses are urgently needed. All of these studies showed that slaughterhouse workers were significantly exposed to zoonoses in their work environment.

#### **COMPLIANCE WITH THE REQUIREMENTS OF OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS**

The review found a scarceness of resources on compliance with health and safety law in South Africa, and studies on the workplace have mostly pursued to address issues relating to job security and work conditions. Workplace inspections are carried out in many government agencies around the world to facilitate compliance with health and safety laws (Burstyn et al, 2010). The employer is required by law to play a critical role in complying with health and safety regulations to protect employee wellbeing and improve company performance by keeping productive employees (Aliyu and Saidu, 2011).

**LEGISLATIVE COMPLIANCE BY EMPLOYERS**

The employer is required by law to provide and maintain a safe and healthy work environment, as set out in Section 8 (1) of the amended South African Occupational Health and Safety Act (No. 85 Of 1993), while Section 8 (2) (a) prescribes, that the employer provides and maintains work systems and ensures that they are safe and without risk to the health of workers [30]. In addition, Section 8 (2) (b) of the Occupational Safety and Health Act (No. 85 of 1993) provides that the employer must eliminate or mitigate any hazard or potential hazard to the safety and health of workers before resorting to personal protective equipment

In addition, Section 8 (2) (e) of the Occupational Safety and Health Act (No. 85 of 1993) obliges the employer to provide his employees with information, instructions and training as well as supervision to ensure the health and safety of his employees in the workplace as much as possible

Also, Section 13 (a) of the amended OHS Act (No. 85 of 1993) requires employers to inform workers of health and safety risks associated with any work, item or substance they must manufacture, processing, use, handling as well as with the preventive measures that should be taken to protect against the hazards [30]. In order to be compliant, the employer must provide effective leadership in health and safety management; demonstrate management commitment by allocating adequate resources for workplace health and safety

**CONCLUSION**

Studies showed that the majority of workers had injuries from various work equipment, as well as musculoskeletal problems such as pain in the upper limbs, neck, and back. Some of these injuries could be attributed to neglected personal protective equipment (PPE) and lifting heavy loads that are beyond the individual's capacity. Occupational health remains a neglected issue in a majority of developing around the world and they only focus on the adequate supply of clinical care and treatment while placing less importance on the appropriate preventive measures. Continuous routine medical surveillance and/or diagnostic investigation for potential occupational health hazards is critical disease control measures of value for safe slaughterhouse practices. Animal owners and workers need to be educated about the importance of vaccination, especially for those who are at risk of deep cuts in their work.

Furthermore, enforcement of laws, as well as penalties as regulatory tools in the operation of abattoirs, should be enforced. Similar studies should be encouraged in the country to allow a viable government policy that would assist in restructuring and removing abattoirs of all occupationally acquired zoonosis, hence ensuring a safe environmentally friendly, and healthy society.

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