



Research Article

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# Public Health Importance and Risk Factor Associated Beef Meat Salmonellosis in Ethiopia



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## Abstract

Many species of Salmonella are responsible for occurrence of acute gastroenteritis infection in in which it remains as an important public health concern of worldwide, particularly in the developing countries such as Ethiopia. Salmonella is the leading cause of common food-borne infection in many countries in the world. It is more widespread in young children, elderly citizens frequently affected with underlying chronic diseases, and immuno-suppressed individuals. Consumption of raw or unsafe food, cross-contamination, improper food storage, poor personal hygiene practices, inadequate cooling and reheating of food items, and a prolonged time lapse between preparing and consuming food items were mentioned as contributing factors to an outbreak of salmonellosis in humans. Salmonella contamination of animals and animal products in farms and organs and carcasses in abattoir is a key cause of the pathogen's spread. In Ethiopia however, the probability expose to the salmonella from beef is high, the habit of consuming raw or medium-cooked. renowned custom of raw meat consumption favorable among the community. These trends expose the Ethiopian to risk of antibiotic resistant and pathogenic Salmonella that indicate the likely occurrence of public health hazards due to Salmonella. The risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene among others. So that the stakeholder should establish standard meat safety requirements and provision of training for meat handlers is mandatory, apply and maintain the basic hygienic slaughtering practices to prevent hazards which may affect the public health, Preventing the trend of eating raw/mid-cooked beef meat and improving the community knowledge, skills and practice through public training

**Keywords:** Food, Hygiene; Meat; Salmonella and public health

## Introduction

Microbial food safety is an increasing public health concern worldwide and the importance of food as a vehicle for the transmission of many diseases has been documented for a long time, especially in developing countries where hygienic standards are not strictly enforced and followed. These microorganisms have led to foodborne outbreaks and several countries have seen dramatic and steady increases in human outbreaks of salmonellosis, caused by infections in animals [1]. Salmonella is one of the top causes of foodborne bacterial illnesses in humans. The primary sources of human Salmonella infection are food producing animals such as cattle, poultry, and swine [2]. Salmonella species are the most important causes of acute gastroenteritis in several countries and salmonellosis remains an important public health problem worldwide, particularly in the developing countries [3]. Consumption of raw or unsafe food, cross-contamination, improper food storage, poor personal

hygiene practices, inadequate cooling and reheating of food items, and a prolonged time lapse between preparing and consuming food items were mentioned as contributing factors to an outbreak of salmonellosis in humans [4]. With estimates of 22 million cases and 200,000 fatalities from typhoid fever and 93.8 million episodes of gastroenteritis and 155,000 deaths from non-typhoidal Salmonellae (NTS), salmonellosis is one of the most common zoonotic illnesses in the world [5].

Salmonella is a genus of the family Enterobacteriaceae. It is a Gram-negative, non-spore-forming, rod-shaped and facultative anaerobic bacterium. Salmonella cells move by means of a peritrichous flagellum. They are 2-5 µm long by 0.5-1.5 µm wide and, depending on the serotype, the Salmonella genome ranges from 4460 to 4857 kb [5]. Salmonella belongs to the Enterobacteriaceae family which also includes pathogens such as Escherichia coli, Shigella, and Klebsiella. Members of the genus

Salmonella are ubiquitous pathogens that infect a wide variety of mammals, birds, fish, and reptiles, as well as humans [2].

**Table 1:** Prevalence of Salmonella on Beef carcass in Ethiopia

No.	Study location	Prevalence	Publisher and year
1	Jimma	14.29%	[24]
2	Ambo and Holeta	5.70%	[17]
3	Addis Ababa	2.50%	[2]
4	Dukem Town	12.70%	[4]
5	Hawasa	2.30%	[26]
6	Bishoftu,	8.60%	[9]
7	Adama	3.70%	[12]

**Table 2:** Distribution of Salmonella in abattoir and butcher

No.	Origin	Prevalence	Publisher and year
1	abattoir	26.30%	[21]
		7.90%	[22]
		11.40%	[24]
		4.20%	[17]
2	Butcher	6.52%	[24]
		8.50%	[21]
		4.10%	[26]

Most of these food products, for example, beef, mutton and poultry, are contaminated during slaughter and processing, from the gut contents of healthy excreting animals. In the same way, all food that is produced or processed in a contaminated environment may become contaminated with Salmonella and be responsible for outbreaks or separate cases of disease because of faults in transport, storage or preparation [6]. Salmonella has been detected in several locations within dairy farms and slaughterhouses, both before and after sacrifice; the same Salmonella clone has been recovered in a dairy herd and in ground meat products following processing. Consequently, the presence of Salmonella in cattle at slaughter and the consequent cross contamination of edible carcass tissue presents a significant food safety hazard. Salmonella is the leading cause of common food-borne infection in many countries in the world. It is more widespread in young children, elderly citizens frequently affected with underlying chronic diseases, and immuno-suppressed individuals in a study made by Bangui [7].

Even though the restaurant industry plays an important role in the safety of the food supply chain, the proportion of illnesses that result from the consumption of food from restaurants is still unknown [1]. As far as microbial load level of Ethiopian meat is concerned there is limited information on the microbial quality of Ethiopian beef that is being retailed in different outlets. Plus, the need for assuring safety cannot be underestimated in this modern world [8]. Consumption of contaminated beef and beef products is one of the transmission routes of Salmonella to humans [9]. Salmonella frequently contaminates raw foods of animal origin

through faecal contact during production and slaughter. Humans generally become infected by eating undercooked or contaminated food [10], hence, the Ethiopian food culture includes eating raw beef "Kurt" or minced raw beef "Kitfo," which increases people's exposure to pathogens [11]. Also, the public understanding toward the meat borne contamination along the entire meat supply chain is low and needed to identify targets for interventions to reduce the number of meats borne bacterial outbreaks. Therefore, the aim of this review is to insight the public health importance of Salmonella and associated risk factors in case of Ethiopia

## Literature Review

Salmonella species occur widely in natural environments and in different sectors of the global food chain. The ability of these microorganisms to survive under adverse conditions and to grow in the presence of low level of nutrients and at sub optimal temperatures and pH values presents a formidable challenge to the agriculture and food processing industries in marketing safe products. The continued prominence of raw meats, eggs, dairy products, vegetables sprouts, fresh fruits, and fruit juices as the principal vehicle of human food borne salmonellosis arises from major difficulties to coordinate sectarian control efforts within each industry [12]. Salmonella is the most important disease-causing bacteria in persons as well as in animals. Antimicrobial-resistant Salmonella can be transmitted from animals to humans through consumption of contaminated food and food products [13]. At the slaughterhouses, stunning, de-hiding and evisceration in vertical position, carcass washing, and separate storage of offal were the identified good practices. Lack of hot water baths, absence of a chilling room, infrequent hand washing, insufficiently trained staff and irregular medical check-up were practices that lead to unhygienic handling of carcasses [14].

Salmonella is primarily intestinal bacteria that is widespread in the environment and commonly found in farm effluents, human sewage and in any material subject to fecal contamination. Salmonellosis has been recognized in all countries but appears to be most prevalent in areas of intensive animal husbandry, especially poultry, dairy and swine production [15]. use of flush water systems, hygienic conditions in farms both for cattle and humans, animal feeds as a source of Salmonella due to contamination like feeding brewers' products [3]. It is a potential cause of acute and chronic diarrhea and death in numerous animal species and human beings. The disease is also considered an important food-borne illness with significant public health ramifications [16]. The epidemiology of has been modified tremendously due to globalization of trade, urbanization, change in consumers' behaviors, increased population, demographic changes, changes in industrial structure, and the capacity of the pathogens to acclimatize to new situations [17].

## Public Health importance of Salmonellosis

Salmonella infections are considered one of the major causes of diarrheal diseases globally, and although most cases

are mild and occasionally self-resolving, life-threatening clinical illness is common [16]. Salmonella is one of the major and important foodborne pathogens of humans and animals causing salmonellosis, which have great medical and economical cost. Salmonella has significant public health implications causing food borne and zoonotic diseases in humans. Foodborne salmonellosis often follows consumption of contaminated animal products, which usually results from infected animals used in food production or from contamination of the carcasses or edible organs (Yalew, 2020). The emergence and spread of antimicrobial-resistant Salmonella originating from food animals or retail meats have grown to be a serious health hazard worldwide, especially in growing countries. The emergence of antibiotic-resistant foodborne pathogens has raised the concern of the public as these pathogens are more virulent, causing an increase in the mortality rate of infected patients [18].

They are often concerned due to the disease of cattle and the potential to infect humans that meet cattle or consume dairy products or bovine meat products. Thus, dairy cattle infected with non-typhoidal Salmonella spp. can pose a substantial risk to public health. It is a popular and essential food borne pathogen that causes salmonellosis (enteric fever, paratyphoid) in humans and animals, resulting in significant medical and economic consequences. Salmonella infections are most typically detected in food animals such as pigs, poultry, and cattle. Salmonella contamination of animals and animal products in farm and organs and carcasses in abattoir is a key cause of the pathogen's spread [19]. Understanding the potential drivers of microbial meat contamination along the entire meat supply chain is needed to identify targets for interventions to reduce the number of meats borne bacterial outbreaks [14]. Food animals such as cattle may carry Salmonella at slaughter and can serve as sources of contamination and provide an opportunity for entry of the pathogen into the food products. This implies that the presence of Salmonella in slaughter cattle and slaughterhouse environments and the potential cross contamination of carcasses and edible organs can pose a significant food-safety hazard [2]. Salmonella strains humans through consumption of contaminated food and food products. However, the sources and transmission routes of Salmonella in growing countries are poorly understood due to the lack of coordinated-country-wide epidemiological surveillance systems [18].

### Status of Salmonella in Ethiopia

According to the report of the Tadesse & Gebremedhin [20] the prevalence of Salmonella contaminated meat was more than twice higher in markets than in slaughterhouses. The Salmonella contamination rate of beef carcasses was the third next to the milk and minced beef were 3.86%, 4.53%, 8.34% and 10.76% respectively. While the report of Hiko et al., [21] indicated the prevalence of salmonella in the abattoir line environment (36.6%) was higher than that in animal-related samples (14.7%). Sometimes the prevalence of salmonella in live animals can be lower than that

of processed carcasses because cross-contamination of carcasses with Salmonella can occur during slaughtering operations at the abattoir. Stress associated with the transport of animals to abattoir augments the shedding of Salmonella by carrier animals and this causes spreading of the organism to other animals in the slaughter plant. During slaughter, fecal contamination of edible organs with subsequent contamination of the carcass may occur. This can be carried out through all slaughter procedures up to the processing of the raw products, which are important sources of Salmonella in the human food chain [22]. In Ethiopia, the prevalence of NTS from cattle, carcasses, and hide of slaughtered bovine ranges from 2.75% to 31%, and the incidence of foodborne Salmonella infections has expanded dramatically during the past few years. Studies conducted in different parts of the country have demonstrated the presence of Salmonella in human beings [18].

In Ethiopia, several factors including unhygienic living circumstances and tradition of raw meat consumption may substantially contribute to the occurrence of Salmonellosis [22]. Failure to carefully clean work surfaces used to prepare raw meat and other foods in the restaurants can also be a source of Salmonella. Moreover, in Ethiopia, minced beef is usually used for the preparation of a popular traditional Ethiopian dish known as "Kitfo" (minced raw beef mixed with a chili powder-based spice blend and a clarified butter infused with herbs and spices), and most of the time, it is consumed raw or medium-cooked. renowned custom of raw meat consumption, the presence of Salmonella in minced beef, and the inadequate hygienic standards in food handling indicate the likely occurrence of public health hazards due to Salmonella [17].

### Risk factor associated Salmonella

Microbial food safety is an increasing public health concern worldwide and the importance of food as a vehicle for the transmission of many diseases has been documented for a long time, especially in developing countries where hygienic standards are not strictly enforced and followed [1]. In fact, food products may become contaminated at different stages along the food chain, which might happen during production, processing, distribution, preparation, and/or final consumption. The risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene among others [23]. The source of beef contamination by salmonella can be contaminated feeds, transportation of animals to the abattoir, the slaughtering operation, and edible organs being contaminated by fecal storage, distribution, and preparation for consumption may contribute to Salmonella contamination of raw meat.8 Uncleanliness of equipment, utensils, and personal hygiene of food handlers aid in the spread of Salmonella [24].

limitations in hygienic practices were determined as the main sources of carcasses contamination on the slaughter procedures [22]. The report of Mekonnen [4] showed that materials which were not cleaned and people who didn't know contamination as

risk were the major risk factors for the occurrence of Salmonella among abattoir and butcher houses in the study area. Besides, the knowledge, attitude and practices of beef meat handlers were found to be poor. Contamination of meat by Salmonella could occur at abattoir from the excretion of asymptomatic animals, unclean abattoir tools, floor, and workers. pathogens enter the meat at any stage during slaughtering. Cross-contamination of carcasses and meat products could continue during successive handling, processing, preparation, and delivery [17]. Lack of hot water baths, absence of a chilling room, infrequent hand washing, insufficiently trained staff and irregular medical check-up were practices that lead to unhygienic handling of carcasses [9].

Unhygienic practices both at the slaughterhouses and retail shops is a predispose factors to circulate salmonella between the beef and beef consumers in Ethiopia [14].

### Conclusion and Recommendation

Salmonella is one of the top causes of foodborne bacterial illnesses in humans as food products may become contaminated at different stages along the food chain, which might happen during production, processing, distribution, preparation, and/or final consumption. Cross-contamination of carcasses and meat products could continue during successive handling, processing, preparation, and delivery. In Ethiopia however the probability expose to the salmonella from beef is high, the habit of consuming raw or medium-cooked. renowned custom of raw meat consumption favorable among the community. These trends expose the Ethiopian to risk of antibiotic resistant and pathogenic Salmonella that indicate the likely occurrence of public health hazards due to Salmonella. The risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene among others.

Based the above conclusion, the following recommendation was forwarded:

- Establishing standard meat safety requirements and provision of training for meat handlers is mandatory
- Relevant authorities apply and maintain the basic hygienic slaughtering practices to prevent hazards which may affect public health.
- Preventing the trend of eating raw/midcooked beef meat.
- Improving community knowledge, skills and practice through public training.

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