

Review

Meat quality, nutrition security and public health: a review of beef processing practices in Nigeria

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Animal protein is an important nutritional component which is required in the appropriate quality and quantity towards growth and development of humans and animals. Its shortages constitute a major problem especially in sub-Saharan Africa leading to unwholesome processing and marketing practices. Beef is the red flesh or meat obtained from bovines, especially domestic cattle after slaughter. It is one of the principal meats with wide acceptance in many parts of the World. However, beef is considered a taboo especially in Indian culture. In Nigeria, it has been severally reported that fresh carcasses are exposed to various unhygienic conditions during slaughtering and when leaving the abattoirs. The rate of microbiological contamination under such situation remains a serious health risk to the consuming public, yet this situation continues unabated. This health hazards also occurs during handling, processing, packaging and storage. Therefore, the purpose of the study was to highlight and identify areas that should be addressed to improve the quality of fresh beef at the retail point for human consumption. Then need for public awareness about proper and hygienic handling of meat from the abattoir to the retailer and the consumers were reiterated, bearing in mind the health implications of ingesting microorganism's which could result in some food borne diseases like cancer, tuberculosis, abdominal cramps, nausea, vomiting and diarrhoea among others, the result of which could be fatal. Bacteria enter the blood stream and spread through the body. Therefore it is of importance to maintain strict hygiene from pre-slaughter till the products gets to the consumer. Consumer protection in this review was considered the major priority before any other consideration. Considering the importance of this topic, the authors suggested that Government agencies and other stakeholders involved in meat/food safety regulations like the Veterinary Departments, Public health and hygiene Departments at the three tiers of Government as well as the National Agency for Food and Drugs Administration and Control should use their good offices to enforce strict compliance to standard food safety regulations. Government should ensure the provision of infrastructures and state of the art abattoirs across the Nation since healthy citizens builds a healthy Nation and a healthy Nation is a wealthy Nation.

Keywords: Beef, processing, meat safety, nutrition security, public health.

INTRODUCTION

Meat is animal's flesh that is used as food. Meat is considered as the most important and readily available source of animal protein consumed by humans. However, meat is the most perishable of all staple foods since it contains sufficient nutrient needed to support the growth

of microorganisms (Huda et al., 2010). For highly perishable foodstuffs such as fresh red meat, the threat of food poisoning is particularly high (Nel et al., 2004; Yousuf et al., 2008). Thus, if food is not immediately utilized or preserved after processing, it spoils. Most often, this means the skeletal muscle and associated fat and other tissues, but it may also affect other edible tissues such as organs. The muscle tissue of healthy living animals is free from micro - organisms.

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Table 1.Some Bacteria in meat

Bacteria present on meat	Aerobes	Facultative Anaerobes	Anaerobes
Mesophiles Optimum growth Temperature: 30- 45 °C	<i>Bacillus spp</i>	<i>Salmonella spp</i> <i>Staphylococcus spp</i> <i>Enterobacteriaceae</i>	<i>Cl. sporogenes</i> <i>Cl. botulinum</i> <i>Cl. perfringens</i>
Psychrotrophs (Cold Tolerant) Optimum growth Temperature: 15 - 30 °C	<i>Micrococcus spp</i>	<i>Lactobacillus spp</i> <i>Streptococcus spp</i>	
Psychrophyles Optimum growth Temperature: 5 - 15 °C	<i>Pseudomonas spp</i> <i>Acinetobacterspp</i> <i>Moraxella spp</i>	<i>B. thermosphactum</i>	<i>Cl. putrefaciens</i>

Source: Bekker, (1998), Frazier and Westhoff (1988)

During the slaughtering and associated processing of food animals, contamination of meat occurs from the external surface, such as hair and skin, the gastrointestinal and respiratory tract contents as well as the water being used. Extremely high numbers of micro-organisms are found in meat animals' intestinal tracts, and some of these find their way to the carcass surfaces during slaughter. Furthermore, the equipment used in the slaughtering and dressing operations (knives, saws, cleavers and hooks) make significant contributions to the overall contamination through direct contact with hides and hair as well as by contact with steels, knife scabbards and the clothing of operatives (Grings, 2004).

Food safety hazards are associated with foods from animals (Kivi et al., 2007; Maripandi, and Al-Salamah, 2010). Meat can transmit certain diseases, but complete cooking and avoiding contamination reduces this possibility. In the U.S.A., Australia, Canada, the UK and Germany, grilling, particularly over charcoal, is sometimes known as barbecuing, often shortened to "BBQ". When cooked over charcoal, this method can also be called charbroiling. Beef can be cooked to various degrees, from very rare to well done. The degree of cooking corresponds to the temperature in the approximate center of the meat, which can be measured with a meat thermometer (McMichael, et al., 2007).

The microbiological condition of carcass (meat) is highly dependent in most cases on the health status of the animals prior to slaughtering and processing as well as the hygienic condition of the slaughtering, processing and marketing environment. It is important that only healthy and relatively clean animals are presented for slaughtering, since it is extremely difficult to obtain clean and pathogen free meat from sick and dirty animals. Availability of healthy and clean livestock depends on husbandry (feeding and management), weather and climate, methods of transport and holding conditions before getting to the abattoir. Cattle from feedlots may carry more faecal bacteria and less soil organisms

(Anon, 2005).

Microbiology, Food Safety and Public Health

Food safety is a scientific discipline describing handling, preparation, and storage of food in ways that prevent food-borne illness. This includes a number of routines that should be followed to avoid potentially severe health hazards. Food can transmit disease to person as well as serve as a growth medium for bacteria that can cause food poisoning. Debates on genetic food safety include such issues as impact of genetically modified food on health of further generations and genetic pollution of environment, which can destroy natural biological diversity (Sinha, et al., 2007) (table 1).

In general, the micro-flora of meat will be that of the barnyard or feedlot which are on the external surfaces of the animal contaminating the meat by direct contact through air, water, soil, manure and the hands and tools of the workers. The healthy inner flesh of meat has been reported to contain few or no micro-organisms, although they have been found in lymph nodes, bone marrow, and even flesh. Staphylococci, Streptococci, Clostridia and Salmonella, have been isolated from the lymph nodes of red-meat animals. The important contamination, however, comes from external sources during bleeding, handling and processing. During bleeding, skinning and cutting, the main sources of micro-organisms are the exterior of the animal (hide, hooves and hair) and the intestinal tract (Tannock, 2005).

Approved "humane" methods of slaughtering such as mechanical, chemical and electrical have little effect on contamination, but each method is followed by sticking and bleeding, which can introduce contamination (Bekker, 1998; Frazier and Westhoff, 1988). This heavily contaminated portion is often in the form of lymph nodes, which are generally embedded in fat. These organs have been shown to contain high numbers of micro-organisms

and account in part for hamburger meat having a generally higher total count than ground beef. Psychrotrophic strains of *Achromobacter*, *Micrococcus*, *Flavobacterium* and *Pseudomonas*, were recovered from the carcasses after dressing.

Clostridium perfringens toxins are products of bacteria that infect meat and when taken into the body by an individual it causes various types of illness like crampy stomach pain followed by diarrhoea after 6 – 24 hours of eating the contaminated meat, loss of appetite, nausea, difficulty in breathing, wheezing and coughing. Mouth and throat pain with some blood in the saliva and sputum may be possible, skin burning pain, redness in skin, itching, rash or blisters (Tannock 2005).

According to Charles (2011), Staphylococcal food poisoning is an illness of the bowels that causes nausea, vomiting, diarrhoea, and dehydration. It is caused by eating meats contaminated with toxins produced by *Staphylococcus aureus*. Symptoms usually develop within one to six hours after eating contaminated food. The illness usually lasts for one to three days and resolves on its own. Patients with this illness are not contagious, since toxins are not transmitted from one person to another. *Salmonella* infection can be gotten from eating underdone (half cooked) beef. Consumers are encouraged to cook meat very well to avoid or reduce the incidence of microbial contamination of meat. Some of the discomforts are flu. Meat can transmit certain diseases, but complete cooking and avoiding recontamination reduces this possibility (Jamieson, 2010).

Lean beef is an important part of many common foods; from fresh retail ground beef, to foodservice beef patties, hamburgers, cooked meats, and processed luncheon meats to name a few. Beef muscle meat not exposed to oxygen (in vacuum packaging, for example) is a burgundy or purplish colour. After exposure to the air for 15 minutes or so, the myoglobin receives oxygen and the meat turns bright, cherry red. Beef is the third most widely consumed meat in the world, accounting for about 25% of meat production worldwide, after pork and poultry at 38% and 30% respectively.

Beef or meat products in many parts of Nigeria are not well processed and taken care of when compared to Countries like Britain, Canada e.t.c. In these Countries, meat quality is guaranteed because slaughtering, processing and packaging among others are carried out under a clean, hygienic and organized environment. On the other hand, inadequate infrastructures and poor hygienic practices are common in many parts of Nigeria. The negative impacts of this situation on public health are quite evident. However, inadequate research on the public health implications of these practices especially in developing countries continues to be a serious health challenge, even as there are no records that could trace most of the diseases diagnosed in health institutions to microbial contamination of meat. On the other hand, if

such records are available, proper procedures are not in place for corrective measures (Oluwafemi and Edugbo, 2011).

Safety measures and institutional regulations

Safety measures are activities and precautions taken to improve safety, i.e. reduce risk related to human health (Charles, 2011). Some institutions that govern food safety in Nigeria include; National Agency for Food and Drug Administration and Control (NAFDAC), Standard Organization of Nigeria (SON), Veterinary Departments, Public Health and hygiene Departments e.t.c. Their regulatory measures among others are directed at:

1. Identifying causes of poor food processing.
2. Ensuring product quality through compliance to standard regulations.
3. Ensuring that producers know what level of quality is expected.
4. Geological surveys to determine whether land or water sources are polluted.
5. Storage facilities like refrigeration are up to required standard.
6. Traditional Methods of Meat Preservation are in compliance with standard hygiene.
7. Ensuring that products are well tested before being brought out to the consumers.

CONCLUSIONS AND RECOMMENDATIONS

Considering the important role of meat and meat products to food and nutrition security as well as economic development of any Nation, Government agencies, parastatals and other stakeholders should ensure strict compliance with policies and procedures that will provide safe and high quality meat for consumers. Proper hygienic slaughtering, transportation and handling practices should be encouraged to ensure that the consumer get meat of the right quality.

If fresh beef is handled, cut and prepared in a hygienic environment during the distribution chain in the trading market, it will reduce the chance of contamination by exogenous origin that may lead to a reduced shelf life and possible food associated diseases. Maintaining an effective sanitation protocol will limit possible contamination of the meat through dirty equipment and contact surfaces. The importance of public enlightenment in this regard cannot be overemphasized.

Training programmers specifically aimed at management and the staff working in the different areas (abattoir, transport, butchery receiving, chilling, wholesale and retail) should be established and adequate training with assessment should be implemented. Modern manufacture/processing requires that people throughout the company should be equipped with the necessary

attitude, knowledge and skills to deal with quality problems. The development and the introduction of programs aimed at "Good Hygiene Practices" and food safety should be encouraged at all levels of the food supply chain.

In conclusion, this review clearly indicates that the current slaughtering, processing and marketing in many places are not in compliance with the standard quality and hygiene practices and that it may act as source of contamination and ill health for consumers. Therefore, the establishment of modern and well equipped abattoir where standard hygiene/proper sanitation practices including routine monitoring and microbiological verification to determine quality/effectiveness are encouraged. Training and retraining of staff of the regulatory and monitoring agencies like Veterinary Departments, Public health and Hygiene Departments, National Agency for Food and Drugs Administration and Control (NAFDAC) and other stakeholders should be given due consideration. Practical oriented workshops and seminars involving butchers, cattle dealers, transporters in the meat industry, meat shop owners as well as retailers should be organized periodically so as to carry all cadres of stakeholders in the meat processing chain along. In addition to the above measures, the authors encourage Government at all levels to create a conducive environment for smooth compliance and implementation of the laid down rules and regulations regarding this important topic by putting all required infrastructures in place.

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