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HEALTHY MEAT FOR WEALTH

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HEALTHY MEAT FOR WEALTH

The Vice-Chancellor
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1.0 PREAMBLE

It is indeed a unique opportunity to present the first Inaugural Lecture from the College of Veterinary Medicine of our great University. I thank the University for this invitation to give an account of my academic stewardship of about 20years in the University of Agriculture, Abeokuta.

Today's lecture centres on food safety from the Veterinary Public Health point of view. According to WHO (1999)

Veterinary Public Health is the contribution to the complete physical, mental and social well-being of humans through an understanding and application of Veterinary Medical Science. It involves hygiene of food of animal origin (meat, milk, eggs and fish products) and zoonosis, that is, the surveillance, prevention and control of those diseases and infections that are naturally transmitted between vertebrate animals and man. The general principle is to ensure that foods of animal origin are free from substances and defects which may be harmful to man.

2.0 INTRODUCTION

Food has been, and still is, one of the foundations of human life. A "hungry man is an angry man" as the saying goes. Food refers to materials of plant and animal origin that consist of nutrients, such as, carbohydrate, fat, protein, vitamins and minerals that are essential for body growth and development.

Food adequacy, supply and related issues have been of major concern to consumers all over the world. In the developed countries, governments have been put under pressure to create and strengthen food laws to give protection to consumers to ensure adequate and safe food supplies. In recent times, concern about food adequacy, including how it is being produced, processed and sold in the market is being replaced by concerns about food safety.

In the developing countries however, concerns about food supply and consumers' access to food are still high. The FAO (2010) estimated the per caput food availability of Nigerians between 2003 and 2005 as 2603kcals/day of which meat contributed only 3% as against 3825kcals/day in the United States of America with meat contributing 12%. The need to increase the animal protein intake of the country via increase in livestock and poultry production for the teeming population has since been the subject of many national and international livestock production projects.

2.1 Animal Production

Livestock contributes 40 percent of the global value of agricultural output and supports the livelihoods and food security of almost a billion people (FAO, 2010). Rapidly rising incomes and urbanization, combined with underlying population growth are driving demand for meat and other animal products in many developing countries.

Animal production involves the rearing of animals for the purpose of production of meat and other animal products, such as, milk and eggs. It involves the conversion of feedstuffs to animal products. Shaib *et al.* (1997) gave projected production targets of 232,000 metric tonnes of poultry meat, 175,000 metric tonnes of goat meat, 149,000 metric tonnes of mutton, 678,000 metric tonnes of beef and 324,000 metric tonnes of pork for a projected population of 159 million Nigerians, signifying a growth rate of between 6.49 and 8.76% for the period between 1996 and 2010 (Table 1).

2.2 Importance of Meat in Diet

Meat can be defined as the raw muscle of domestic animals, poultry and game (Rogowski, 1980). Meat plays an important role in the nutrition of man. It is a good source of essential nutrients that support life, such as, high quality protein, vitamins and minerals.

In addition to these nutrients, in most communities meat has long occupied a special place in the diet, for a variety of reasons including taste preference, prestige, tradition and availability. The high quality protein which is in a highly concentrated form is said to be nutritionally superior to plant protein (Hegarty, 1979). Meat protein contains high amounts of essential amino acids (about 40%), which include lysine, isoleucine, phenylalanine, alanine, valine, threonine, methionine, tryptophan, histidine and arginine. The proportions of these amino acids in meat are in accordance with human nutritional requirements.

Meat is also an excellent source of the B vitamins, niacin, pyridoxine, folic acid and cyanocobalamin (Table 2). While the sodium, potassium, magnesium and chlorine contents of meat are comparable to those of vegetable, though it has less calcium. The phosphate content is, however, higher. It is also a very good source of iron as it contains a considerable amount of haem iron, which is more completely absorbed than non-haem iron in plant (WHO, 1991). Also, meat iron enhances the absorption of iron from other sources. Given that iron deficiency is a common problem of humans, especially in growing children, the role of meat in improving iron availability and absorption is particularly important.

The importance of meat in diet cannot be over-emphasized; many epidemiological studies have linked low intake of animal protein to growth failure, morbidity, and high childhood mortality. Protein also plays an important role in the development of immunity. The high protein content of meat makes it invaluable to man. Jensen (1981) observed that as little as 25g of meat will supply 45% of a child's daily need of protein and half of the vitamin B_{12}. A study indicated that the addition of 100g of meat to the average Zambian diet would increase the protein by 50%, iron by 12%, niacin by 40% and energy by 25%. Also, the increased physical stature of the Japanese growing to adulthood since the cessation of the World War II has been ascribed to increases in the consumption of meat and other animal products (Pearson, 1981).

2.3 Types of Meat

Meat is classified into red and white meat. Red meat consists of the flesh of cattle, sheep, goats and pigs while that of poultry (chicken, turkey, duck, pigeon, guinea fowl) is white meat.

In addition to the common domestic animals a wide variety of wild animals are eaten depending on availability and local custom. These include the possum, deer, antelope, rabbit, bear, seal, walrus, as well as the horse, camel, buffalo, dog and rodents. Some of these meat types are termed delicacies in some cultures. Meat from non-domesticated animals is sometimes termed game meat (de Janvry and Sadoulet, 1986).

The amount of carcass meat obtained from animals varies with the type of animal. By parts, a cow is 34% meat, 16% organs, 16% abdominal and the intestinal contents and the hide is 6%. In the pig, the meat is about 52%, bones 17%, organs 7% and the skin is 6%. The organ meats are liver, heart, kidney, brain, pancreas, tripe, feet, tail, testes, intestines, head and fat which are collectively called the offal.

The relative importance of these various meat sources in the diet varies from region to region. Many of these meats that are rejected for various reasons in one culture are fully accepted in others. In the Indian sub-continent, beef is socially and economically perceived as being second class compared with lamb, mutton and poultry, while the reverse is true in most industrialized countries. While many Europeans abhor the thought of eating dog or horse meat, it is relished elsewhere; indeed in some parts of Nigeria, these meat types are considered as delicacies.

Irrespective of the management practice under which livestock are raised, the criterion on which the quality of domestic animal production is based is usually weight gain, which is a measure of the growth of the animal. Growth is an anabolic process characterized in young animals by deposition of protein in muscular tissue and of minerals in the skeleton (Hill, 1988). Of the several factors that are responsible for the growth and development of the animal, some such as breed of the animal (as expressed by the genetic make-up of the animal) are inherent, while others are environmental.

As a business enterprise, profitable animal production connotes the efficient management of animals. Perhaps the major challenge of any entrepreneur is how to ensure that his animals are healthy as disease is known to be one of the most important limiting factors in livestock production (Hill, 1988). Disease can be defined as impairment to normal body health, an illness or malady. It can be caused by both infectious and non-infectious agents.

Disease in animals can lead to great economic loss in the livestock industry. Losses can be total with the death of the animal when nothing is retrieved or partial through morbidity, in which case there is reduced productivity in the affected animal. Diseases of livestock are mainly caused by bacteria, virus, fungi and parasites. Otesile *et al.* (1982; 1983) reported that pneumonia, helminthiasis, peste des petits ruminants and enterotoxaemia are the most important causes of death in sheep and goats in South-Western Nigeria.

In order to minimize such losses, the control of diseases in animals is an important component of livestock production. Consequently, antibiotics and other antimicrobial agents are frequently used in the production of food animals. These agents which are often used for prophylactic (disease prevention), and therapeutic (treatment of diseases) purposes, are also used as growth promoters in these animals.

3.0 GROWTH PROMOTION IN ANIMALS

The desire to increase productivity of livestock has resulted in the development of a range of methods of enhancing growth in farm animals. According to Forrest *et*

al. (1975), improved rate of growth in animals will increase meat production per unit labour and capital resulting in economic gain in livestock production.
Growth promoters are used in food animals usually to enhance their growth and development. These agents function in a variety of ways to improve growth; these include anabolic agents, antibacterials and rumen fermentation modifiers.

Anabolics
Anabolic agents are steroidal hormones which increase nitrogen retention and protein deposition in animals, thereby, increasing food conversion efficiency, lean content of meat and growth rate in animals (Brander *et al.*, 1991). These agents can either be natural sex hormones: estrogen, androgen and progesterones or synthetic steroids. The synthetic steroids, mainly diethylstibesterol, hexoesterol, zeranol and trenbolate acetate, are usually used for growth promotion purposes in livestock production (Table 3).

Antibacterials
Apart from the purposes of disease prevention and treatment, antibiotics are also used as growth promoter in

farm animals. This involves the continual sub-therapeutic use of these compounds to improve weight gain in animals. Growth promotion is produced in a variety of ways. They reduce the number of potentially harmful micro-organisms (and their toxins) in the digestive tract, thereby, causing the promotion of synthesis of vitamins and other growth promoting factors in the animal. They also alter the structure and metabolism of the intestinal wall, thus, improving the efficiency of nutrient absorption (Buttery, 1993).

Effect of Residues of Chemical Agents

The public health concern of drug residues in meat is because of the potential carcinogenicity, mutagenicity, teratogenicity and long term toxic effects of these residues on the human population.

While some of the chemical agents outlined above are quickly excreted from the animal, others are not readily metabolized or excreted. There is, therefore, the possibility that the residues of these drugs or their metabolites will persist in the animal tissues which if proper care is not taken, can enter the human food chain, constituting risks to consumers.

Indeed, there is an increasing public antipathy towards the use of these pharmaceutical products in the production of food animals, because of the fear of the effects of the residues which may be present in the animal products. Nazli *et al.* (2005) reported the presence of residues of zeranol and diethylstilbestrol (anabolic agents) at levels more than the acceptable limits in meat and meat products marketed in Istanbul. Some other studies have also reported the occurrence of residues of antibiotics in meat and meat products.

The Significance of Antibiotic Residues in Food Animal Products

Antibiotics used in the treatment of animals do not pose a health hazard to the consumer, provided they are used properly in accordance with the recommendations for their use; proper dose, proper route of administration, proper species of animal and adequate withdrawal period before slaughter.

Antibiotic residues in food of animal origin constitute a pernicious threat to public health. The risks are usually related to hypersensitivity reactions (usually from penicillin), and the development of micro-organism resistance to antibiotics in humans. Another potential health risk of residues of antibiotics in meat is the development of aplastic anaemia resulting from bone marrow depression associated with chloramphenicol antibiotic.

In Nigeria, like most other countries of the world, antibiotics have been and are still being freely used at low and sub-therapeutic levels in poultry and livestock feeds. Apart from this, extra-label use of veterinary drugs (whereby these drugs are used in a manner that is not in accordance with the drug labelling) is very common. Antibiotics can readily be purchased over the counter without any prescription, resulting in the indiscriminate use of these drugs especially in food animals (Dina and Arowolo, 1991). Thus, as the country's agriculture becomes more and more intensive, larger quantities of these drugs will undoubtedly be used, with the consumers of food animals being increasingly exposed to the dangers of drug residues in animal products.

4.0 RESEARCH THRUST

As noted earlier, one of the main duties of the Veterinary Public Health practitioner is to ensure that meat produced are wholesome, produced in hygienic manner, are safe and fit for human consumption. In this regard, my research has been on the detection of health hazards, such as, antibiotic residues in animal products, and factors affecting meat hygiene and safety.

Studies on Antibiotic Residues in Food Animals in Nigeria

As far back as 1986, studies have been conducted to test the presence of antibiotic residues in meat and eggs sold for human consumption in South West Nigeria. Adetosoye (1986), reported the presence of residues of antibiotics in beef samples obtained from various abattoirs in Ibadan, Oyo State. In their study on broilers in Ogun State, Oyekunle and Olubi (1992), also recorded the presence of residues of tetracycline, penicillin and chloramphenicol in 35.8% of the samples analysed.

Since the average Nigerian is known to consume a diversity of meat products, we extended such antibiotic residue analyses to samples of cattle, goats, pigs, poultry and eggs obtained from open markets in Oyo, Ogun and Lagos States for antibiotic residue deposits. The analyses were done using the microbiological assay procedure which involved the use of bacteria *Bacillus subtilis* (ATCC 6633) and

Bacillus strearothemophilus vas *calidolactis* (ATCC 1172) for the detection of residues of antibiotics on suitable media (Katz and Fassbender, 1972; Inglis and Katz,1978; Vilim and Larocque, 1983). Results of the studies showed that some of the products examined had residues of tetracycline, streptomycin and penicillin antibiotics.

Beef is a popular meat type in Nigeria, and cattle are slaughtered on an almost daily basis in most abattoirs in the country. Dipeolu and Alonge (2001) noted that from the meat samples marketed in Ogun and Lagos States, 16.63, 15.0 and 13.34% of the liver, kidney and muscle samples, respectively, were positive for tetracycline residues. The concentration of the residues in these organs was between 0.01 and 0.50 µg/g. Streptomycin residues were also recorded in the samples (Table 4) as reported by Dipeolu and Alonge (2002).

The analysis of the organs showed that the residue levels in the muscle samples were significantly higher ($P<0.05$) than those obtained from the liver and kidney samples. It could well be that the samples were collected from areas of injection site of the antibiotic since intramuscular injection is the most common route of drug administration in cattle. The antibiotics were not fully metabolized and excreted from the cattle before they were slaughtered for human consumption. The Fulani nomads that usually raise cattle in Nigeria do so under the extensive transhumand husbandry system. Since the animals are not usually given concentrate feed supplement, the residues observed are likely to have resulted from the use of the drug for the purposes of disease prevention and treatment. Given that these nomads are not trained formally in the use of drugs, there is the probability that the antibiotics were injudiciously used in terms of dosage and mode of administration.

Withdrawal period

Non-observance of the withdrawal period of the tetracycline antibiotic is also a major consideration. Van Dresser and Wilke (1989) observed that failure to observe the withdrawal periods of drug is a major cause of drug residue in food animals.

Withdrawal period (also known as drug depletion or withholding period) is the interval required for the residues of toxicological concern to fall to safe concentrations in the tissues of animals. It refers to the interval from the time after the last administration of a drug when milk and eggs are not to be used for food, and during which animals are not to be slaughtered for human consumption. Depending on the animal species, drug product, dosage form, and route of administration, drug withdrawal periods may vary from few hours to several days or weeks (Table 5). An adequate withdrawal time ensures that no harmful residues remain in edible animal tissues and body fluids.

Further research showed that a similar pattern was recorded in samples of meat examined from goats and pigs. Goat meat is considered a delicacy for its peculiar taste. Despite the religious limitations placed on it in some parts of the country, pork is also popularly consumed especially in the South, because it is relatively cheaper than beef and chicken. Residues of tetracycline ranging from 0.01 to 0.28μg/g were recorded in goat samples and between 0.01 and 0.06μg/g in pig samples. Streptomycin residues were also recorded, these were in the range of 0.06 to 1.66μg/g in goat samples, and 0.10 to 1.26μg/g in pig samples (Dipeolu and Alonge, 2002; Dipeolu, 2002).

Tolerance levels are set in most developed countries in order to determine the safety or otherwise of antibiotic residues in animal tissuess. In the absence of such levels in Nigeria, the residue concentrations recorded in the studies were compared with Codex Maximum Residue Level (MRL) as reported by Crosby (1991) and World Health Organization's recommendations (WHO, 1995). Residues at levels higher than the recommended MRL were recorded in some of the muscle samples. Since muscle tissues are usually consumed more than the visceral organs in these animal species, the implication of these results is frightening. Individuals that consume meat with such high residue levels may develop resistance to these antibiotics especially when such meat is consumed at frequent intervals.

The development of the poultry industry has been described as the fastest way of ameliorating the animal protein deficiency problem in Nigeria. This is due to the high turn-over rate associated with poultry production and its consequent economic efficiency. The poultry sector is, therefore, important in meeting the first of the United Nations' Millennium Development Goals of eradicating extreme poverty and hunger in the World's poorest countries. As important as the poultry industry is, residues of antibiotics continue to be a major draw-back to producing wholesome meat and eggs for the teeming populace.

Our studies on locally-produced laying birds showed the residues of tetracycline and streptomycin in the breast and thigh muscles of some of the samples analysed. The concentrations were between 0.004 and 0.063µg/g for tetracycline and 0.18 and 0.91µg/g for streptomycin (Dipeolu and Osikalu, 2002; Dipeolu *et al.,* 2004).

Antibiotics are frequently used in poultry production in order to increase growth rate, improve feed utilization and reduce mortality. Even after culling, it is rife to see the market women giving the birds antibiotics (popularly known as "capsule") especially where the hygienic condition is poor. The birds are then sold before the drugs had opportunity of finding their ways out of the birds. While adherence to withdrawal periods of antibiotics might prevent residues in other food animal products, this may not be feasible in laying birds. This is because it will be difficult for the poultry producer (especially large scale producers) to dispose of eggs during the period of medication. Studies by Dipeolu and Idowu (2004) and Dipeolu *et al. (*2005) showed that antibiotics continued to appear in the eggs of laying birds up to one week of medication, whether administered in feed or water. It is, therefore, important that antibiotic use in laying birds be done with utmost care. The aim of improving animal protein intake of the Nigerian populace by increasing animal production would be defeated if the product is not wholesome.

In order to allow the poultry industry in the country to expand (*protect* as it is known in economic terms), the government placed a ban on importation of poultry into Nigeria. The policy, however, is not fully implemented as imported chickens and turkey parts are still freely available and being sold for human consumption in various markets especially in the South-Western part of the country. These products are becoming popular and the populace has come to embrace them as they are cheaper than those produced in the country. Since these poultry are smuggled into the country, not much attention is given to their inspection and quality control. In our series of studies, residues of antibiotics detected in turkey parts and chickens imported into the country included those of tetracycline (Dipeolu, *et al.,* 2000; Dipeolu and Dada, 2005), streptomycin (Dipeolu and Ayo-Ajasa, 2006) and penicillin (Dipeolu and Ojekunle, 2005).

Since meat is usually consumed (in this part of the world) in the cooked form, the meat samples were subjected to cooking by conventional methods (boiling followed by frying) to give a more accurate estimate of the exposure of the consumers to the drug. It was observed that there was a significant ($P<0.05$) reduction in the residue levels following cooking by boiling. While there was no evidence of penicillin residues in the samples following frying; the residues of streptomycin persisted in the samples and the concentrations were not significantly lower than those in boiled samples. This shows that additional cooking by frying does not necessarily lead to further degradation of the residues (Dipeolu and Ojekunle, 2005; Dipeolu and Ayo-Ajasa, 2006) as shown in Tables 6 and 7.

While cooking may be useful in reducing the residues of antibiotics in the birds, this may not be a solution to the problem of drug residues in food animal products. This is in view of the health hazards associated, especially in the case of penicillin, where minute quantities can have immunological impact on persons with hypersensitivity to this antibiotic. It is also not right for people to use their hard-earned money in purchasing contaminated meat.

Thus, the most desirable option is not to have drugs as residues in food animals (zero tolerance), a situation similar to what obtains in Japan (Cronin, 1998), and I think that this is what we should strive for as a nation.

These results show that the problem of antibiotic residue deposition in meat and meat products is here with us in this country where, the consumers of such animal products are exposed to the health hazards associated with residues of antibiotics in foods of animal origin. The most important of such hazards in the Nigerian environment appears to be drug resistance, whereby the consumers may show resistance to treatment with the antibiotics when the need arises. This may become a problem especially when the people concerned do not have access to substitute antibiotics, which are often expensive.

Antibiotics are an extremely important class of drugs, as they represent a key component in the strategy used in the control of bacterial infections in both humans and animals. It is, therefore, important that their use in food animals be done with utmost care. Proper handling of antibiotics in food animals will drastically reduce such occurrence. The antibiotics should be given at recommended doses and with appropriate supervision.

It is important that withdrawal periods of these drugs be strictly adhered to after treatment and before slaughtering of animals. Veterinarians should encourage stock owners to comply with this in their management practices.

As meat consumption is considered to be important in combating the problem of low protein intake of the populace, it is of utmost importance that it should be presented for sale in a safe and wholesome form. The control of drug residues especially antibiotics in food animal products is therefore important in order to safeguard human health.

5.0 MEAT HYGIENE AND SAFETY

Food-borne infections are important public health issues not only in the developing countries but all over the world (WHO, 2007). As beneficial as meat is, it is equally a ready vehicle for disease transmission especially from animals to humans. The safety of meat calls for control throughout the food chain from the farm of origin, and inspection before and after slaughter, to handling and storage of meat and the products until the time of consumption.

Meat inspection involves the expert supervision of the whole process of producing meat products with the objective of providing wholesome meat for human consumption and preventing danger to public health. The functions of meat inspection, thus, include the detection and destruction of diseased and or contaminated meat, assurance of clean and sanitary handling and preparation of meat, minimization of microbiological contamination of meat, prevention of adulteration and the presence of chemical or drug residues in meat. The process includes ante-mortem inspection, post-mortem inspection, hygiene and sanitation inspection.

Ante-mortem inspection is the examination of animals at the lairage (Plate1) prior to slaughter to assess their suitability as a source of products fit for human consumption. Ante-mortem inspection of meat animals is of prime importance from Veterinary Public Health point of view, as it is the initial step in the detection of any sign of disease, distress, injury, etc, which helps in taking appropriate decision before slaughter of animal. It should be done properly and systematically by Veterinarians, in maintaining high standards of meat quality.

Improper inspection may lead to the release of unsanitary meat for human consumption; such include: self-dead animals (Plate 2), diseased meat, and foetuses (Plate 3).

A study conducted at Bodija Municipal Abattoir (a major abattoir and commercial centre for livestock-related enterprises) in Ibadan Oyo State, between 1990 and 1994 to determine the extent of foetal losses showed that between 2.43 and 6.33% of the cows slaughtered were pregnant (Table 8) according to Abiola *et al.,* 1999. Apart from being ethically unacceptable, the slaughter of pregnant animals represents a tremendous loss, as a potential offspring is also lost without being given a chance to contribute to cattle population and beef meat supply profile of the country.

Plate 1: A Lairage at an Abattoir in South Western Nigeria

Plate 2: Self-dead Animal being Transported for Slaughter

Plate 3: Foetuses of Pregnant Cows Slaughtered at an Abattoir in South West Nigeria

5.1 Meat Processing

The techniques and sequence of dressing operations of food animals following ante-mortem inspection vary from place to place and are influenced by the equipment and facilities available in the abattoir. The present trend in organized abattoirs is towards line dressing, whereby once the animal has being hoisted to the bleeding rail, it is not lowered to the floor till the entire dressing operation is completed (flaying, evisceration, splitting, inspection and dispatch) as shown in Fig. 1 and Plate 4.

In most of the abattoirs in the country, animals are slaughtered on the floor where all the procedures are completed (Plates 5 – 7). This leaves no room for proper separation between the "clean and dirty" operations, and proper post-mortem examination of the carcass.

Post-mortem inspection is the systematic comprehensive examination of carcasses and organs after slaughter to assess whether or not these products are fit for human consumption. The aim is to forestall unwholesome practices (such as blood-splashing on meat, Plate 8), and prevent transmission of zoonotic diseases (Plates 9 - 13) from the slaughtered animals to humans.

Over the years, several reports have been made on the prevalence rate of these diseases in Nigeria, some of which have severe effects on man (Alhaji, 1976; Babalola and Van Veer, 1976, Antia and Alonge, 1981; Ayanwale, 1984; Nwosu, 1987; Dipeolu *et al.,* 2000; Cadmus *et al.,* 2003). Recent studies by Cadmus *et al.* (2008) showed that 1.91% of the slaughtered cattle at the Oko-oba abattoir in Lagos between 2004 and 2007 had lesions of diseases. Of this 0.41% were attributable to tuberculosis and the rest are lesions of other diseases of public health

Purchase and transport
↓
Unloading and lairage
↓
Ante-mortem inspection
↓
Stunning
↓
Shackling
↓
Hoof removal
↓
Head removal
↓
Opening of hide on body and hide removal
↓
Brisket sawing
↓
Eviscerating
↓
Carcass splitting
↓
Removal of spinal cord
↓
Trimming
↓
Carcass weighing, grading and health marking
↓
Washing
↓
Chilling

Fig. 1: Flow of Cattle Slaughter and Dressing Operation
Source: Buncic (2006)

Plate 4: Semi-automation of Cattle Dressing at a Private Establishment in South-Western Nigeria

Plate 5: Slaughter Hall of an Abattoir in South-Western Nigeria

Plate 6: Dressing of Cattle at an Abattoir in South-West Nigeria

Plate 7: A Processor Washing Offal/viscera Lumped together in the Same Basin

Plate 8: Blood-splashing on Dressed Carcass

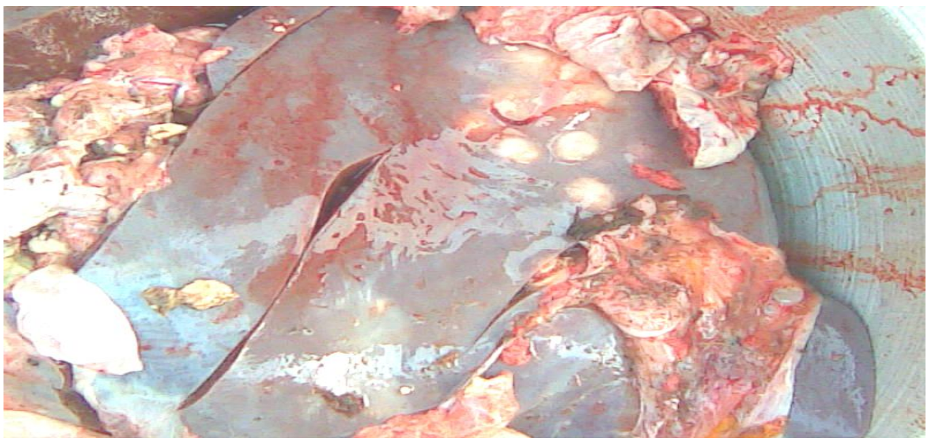

Plate 9: Lesions of Tuberculosis on Liver of Cattle

Plate 10: Lesions Caused by Parasitic Infection of Stomach (abomasum) of Cattle

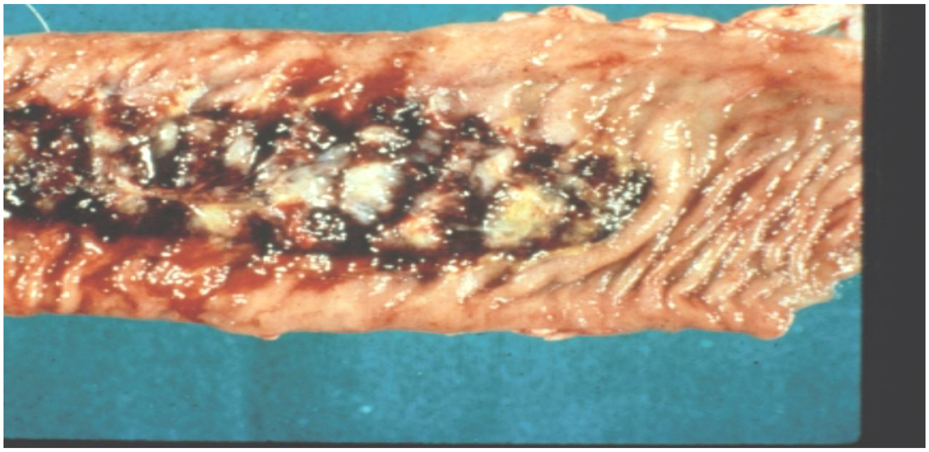

Plate 11: Intestinal Lesions in Cattle

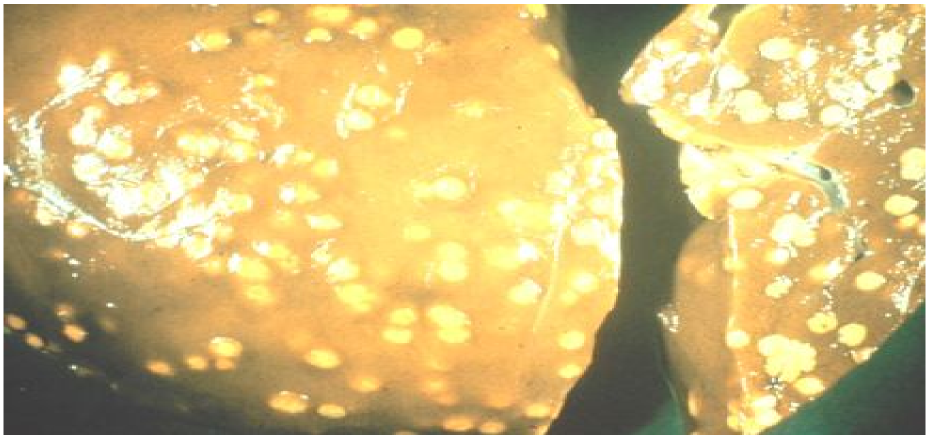

Plate 12: Tuberculosis Infection of Liver of Cattle

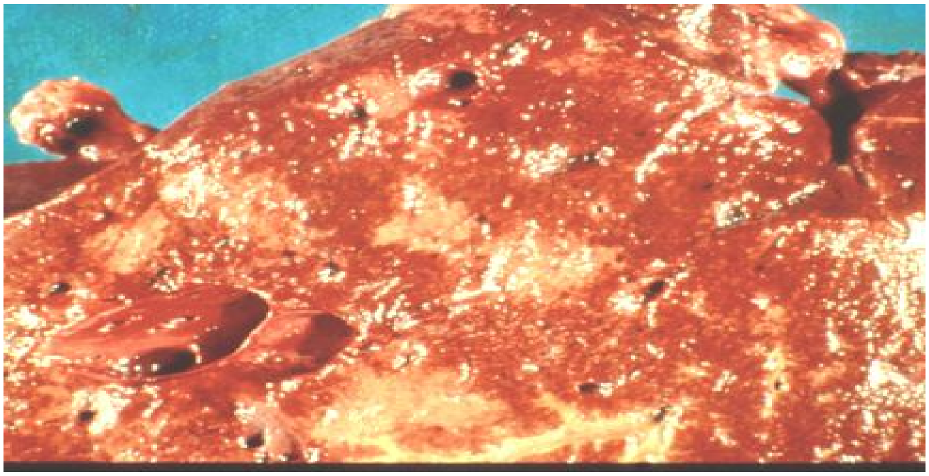

Plate 13: Lesions of Fascioliasis (liver fluke) in Liver of Cattle

importance. These include fascioliasis, internal myiasis, dermatophilosis and cystercosis (Table 9).

While some of the meat-borne diseases can be easily identified at post-mortem examination, others may require laboratory examination. Bacteria pathogens such as *Escherichia coli*, *Salmonella* serotypes, *Campylobacter spp., Clostridium spp.,* and other enteric bacteria which may not cause clinical diseases in animals are potential threat to public health. These pathogens are only detectable by laboratory investigations. Various studies show that there are bacteria contamination of meat produced from various abattoirs in the country (Amaechi and Ezeronye, 2006; Ukut *et al.,* 2010). This is an indication of non-adherence to principles of hygienic processing of meat along the slaughter-processing-marketing chain.

An on-going ((International Livestock Research Institute (ILRI) – Collective Action and Properties Rights (CAPRi) sponsored study being conducted at the Bodija Municipal Abattoir in Ibadan, examined meat samples for bacterial contamination. Preliminary results showed that the samples were contaminated with aerobic bacteria, bacteria associated with faecal contamination, specific human pathogens and bacteria associated with environmental contamination (Table 10). The meat samples had unacceptable levels of contamination of these bacteria (>$5x10^5$ cfu/g TAC* and >$1x10^2$cfu/g CC**) as shown in Table 11 and according to (Dipeolu, *et al.,* 2009).

The types of bacterial contaminants found in meat samples in this study suggested contamination from the environment, hide of slaughter animals and also from the gastrointestinal contents. Lack of demarcation between the clean and the dirty operations increases the possibility of contamination of meat from the gastrointestinal contents. Environmental sanitation, hygienic operations and handling as well as proper storage are required for the prevention of meat contamination.

*TAC: Total Aerobic Count; **CC: Colony Count

Transportation of Meat from Slaughter Place to the Butchers' Shop

The aim of good hygienic practice during slaughter and dressing of food animals is to ensure that inspected meat derived from healthy, properly slaughtered animals reaches the consumer clean, unspoiled and in a wholesome state, free from danger of infection or intoxication. Most of the time, meat are transported from the abattoir to the markets in most unhygienic manner (Plates 13 and 14), exposing meat to dust and bacterial contamination. A recent effort of the Lagos State Government in assisting butchers in the State in the provision of meat vans which facilitates proper meat transportation to the various markets in the State is commendable. It is hoped that other State Governments in the country will emulate this initiative.

5.2 Meat Preservation

Meat preservation is another important issue in order to prevent economic loss due to spoilage and to prevent the transmission of food-borne illness. The common methods of meat preservation include drying, curing, smoking, several forms of thermal processing and refrigeration (chilling and freezing). Smoking is one of the most effective processes of meat preservation in many developing countries, such as, Nigeria, for apart from its consequent flavour and colour attraction, it does not require high costs and constant energy supply which is difficult to maintain in such countries.

Plate 14: Improper Transportation of Dressed Carcass

Plate 15: Unhygienic Meat Handling

Freshly produced smoke has such effects on meat products as aromatization, flavour and preservation. Despite these effects, smoking of meat has public health implications, since it can cause the deposition of phenol (which is a tumour-inducing agent) on the smoked meat products. In order to improve on the hygiene and safety of smoked meats, Dipeolu and Alonge (1995a; 1995b) fabricated ovens that allowed smoking of meat at temperatures below 400°C, which augur well for taste and health (Plate 16).

Plate 16: Meat Smoking Ovens

6.0 HEALTH IS WEALTH

Mr Vice-Chancellor sir, food safety is receiving increased attention due to several worldwide trends affecting food systems. The growing movement of people, live animals and food products across borders, rapid urbanisation in developing countries, increasing numbers of immune-compromised people, changes in food handling and consumption, and the emergence of new or antibiotic-resistant pathogens all contribute to increasing food safety risks (Unnevehr, 2003). It is affected by the decisions of producers, processors, distributors, food service operators and consumers as well as by government regulations. In developed countries, the demand for higher levels of food safety has led to the implementation of regulatory programmes that address more types of safety-related attributes (such as bovine spongiform encephalopathy - BSE, microbial pathogens, environmental contaminants, and animal drug and pesticide residues) and impose stricter standards for those attributes (Caswell, 2003).

My research efforts over the years show that if Nigerians must eat safe and wholesome meat, the current global food safety concerns make it imperative that all issues in the meat production, processing and marketing chain must be addressed holistically to remove inefficiencies throughout the entire chain: from farm to table. The trends in developed countries with regard to food safety calls for a number of mandatory conditions to protect the consumer. One of such systems is known as traceability, in which there is documentation that traces a food product back through the supply chain to its source or forward through the chain to the consumer. In the European Union, there is mandatory traceability for all food products. The primary producer must be able to guarantee the delivery of safe foods. Indeed, it is also a known fact that consumers have a right to be sold safe food. This is a good trend which the country should adopt.

Health they say is wealth. Wealth is defined as the state of being rich, and includes physical, financial and psychological well-being. It is, therefore, in order to say that when healthy meat is supplied to a given population they are on the pathway to wealth. Since food security is about availability of wholesome food at affordable price, it is important that the animal protein available for the Nigerian populace does not become a scourge as the consumption of unwholesome meat may result in ill-health which will necessitate spending money on consultations and medications. In addition, in cases of exposure to chronic debilitating disease such as tuberculosis, affected individuals may go through prolonged periods of illness which may result to loss of job and the attendant financial problems.

This *health is wealth* issue also affects the farmer. As I have enumerated in various sections above, if animals are not well taken care of, such that diseases are endemic, or if the conditions under which they are reared are suboptimal; if withdrawal periods are not adhered to when medication has been given to animals or if the meat from animals are not well processed and preserved, then there can be enormous losses to the entrepreneur at any of the points in the value chain and, in particular, if he is guilty of more than one of these causative factors. Since the basic *raison d'être* for livestock production is for wealth creation, a healthy animal will bring financial rewards to the producer.

Losses can also occur from condemned animals (in part or whole) at the abattoir. Before now, the Federal Government had been known to pay compensation to butchers for condemned meat to cushion the loss incurred by the butchers. This, however, is no longer the situation, so butchers will as much as possible resist the condemnation of diseased parts by the supervising Veterinarians in order to recover some of their investments. **Give Man Healthy Meat, You will be Placing Wealth at His Doorstep.**

7.0 RECOMMENDATIONS

A muck raking treatise such as this cannot end without suggestions to chart the way forward. The following recommendations are being put forward:

Regulation of Veterinary Drugs

There is the need for legislative control over the licensing and supply of Veterinary Medicines, especially their use in food animals, with adequate machinery put in place for strict compliance. The present situation where animal owners can purchase drugs in the open markets, over-the-counter and without prescription should be discouraged. It is also important that animal producers are educated on the ills of injudicious use of drugs in their animals. Ideally, the use of antibiotics in food animals by non-Veterinarians should be discouraged.

In addition, as is done in some developed countries, the use of antibiotics that are not usually employed in the treatment of ailments in humans should also be encouraged especially in laying birds. In other words, it should be possible to separate the antibiotics that are used for livestock from those which human beings use.

NAFDAC and Other Legislative Aspects of the Veterinary Profession

The laxity in the control of Veterinary drugs in Nigeria is due, in part, to the non-recognition of veterinary drugs as a speciality by National Agency for Food and Drug Administration and Control (NAFDAC). It has the mandate to regulate and control quality standards for foods, drugs, cosmetics, medical services among others. The drugs and foods they supervise are both for animals and man. The NAFDAC Act should, thus, be reviewed to incorporate *all* professionals under both animal and human health as is done elsewhere in the developed world. For instance in the US, at least three agencies share the responsibility of insuring the safety of the American food supply. These are Food and Drug Administration (FDA) *Centre for Veterinary Medicine* (CVM), United State Department Agriculture

(USDA) *Food Safety and Inspection Service* (FSIS) and the USDA *Extension Service* (Aliu, 2004).

NAFDAC should be reorganized to reflect the multidisciplinary nature of its mandate as follows: Veterinary Drugs and Biologics Directorate, Directorate of Human Medicine, Food and Nutrition Directorate and Medical Laboratory Directorate.

Investment in Food Safety Systems
For developing countries, investment in food safety institutions and their capacity can play an important role in improving living standards through advances in domestic public health and agricultural production. Investment is needed to establish regulatory systems and technology, build institutions and train staff in food safety. There must be mandatory traceability systems for all food products.

Overhauling of Abattoirs and Monitoring of Drug Residues
Modern facilities that allow animals to be slaughtered in hygienic manner and conditions should be put in place. The provision of potable water, good drainage systems

would go a long way to ameliorate the current environmental sanitation challenges. Where the throughput of animals is very small, slaughter slabs can be put in place. This should be fenced and roofed with basic facilities for hygienic slaughtering and adequate disposal of effluents.

Since food safety is essentially a public health function (Kaferstein, 2003), monitoring of antibiotic residues in meat, meat products and dairy products should be an integral part of the quality control process of these products. There are currently no national programs for monitoring drug residues in food animals neither are there any drug monitoring activities in place in the abattoirs in the country. Ideally, testing of carcass for antibiotic residues should be made an integral part of meat inspection procedures in the abattoirs. While microbiological assay method is good for screening, more sensitive methods, such as, the physio-chemical method (involving chromatography) and immunoassays are good confirmatory techniques. These methods require equipment and while some are very sophisticated and expensive, others are not so expensive. Governments in most developed countries invest heavily in these in order to ensure that their citizens have access to safe and wholesome foods. Nigerian government should be encouraged to do the same with help from the private sector. While all cannot be achieved overnight, efforts should be made in the right direction.

Better Funding of Research

Research can lay the foundation for better results in this sector. To this end, I join others in calling for private sector investments in research to complement government effort. Most universities are well staffed to complement the efforts of Research and Development units of these private sector enterprises. What is important on the part of researchers in the universities is for us to remember that such research is demand led (*he who pays the piper dictates the tune*). In other words, research efforts must be relevant to the needs of the private sector.

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An educational system such as UNAAB is only as good as its managers make it. In this wise, I must put on record the spirited efforts of the past Vice-Chancellors of UNAAB: Professor Nurudeen Adedipe, who as the pioneer Vice-Chancellor, laid the solid foundation in the development of UNAAB, especially his foresight in the establishment of the College of Veterinary Medicine in UNAAB. Professor A. Okojie the succeeding Vice-Chancellor initiated the process of its establishment and Professor I. F. Adu made it a reality through his support and encouragement. When all was bleak and appeared hopeless, Professor Adamson opened a window. I acknowledge and thank them all.

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APPENDICES

Table 1: Projected production targets for livestock ('000metric tonnes)

Year	Poultry	Goat	Mutton	Beef	Pork	Eggs
1996	88	72	62	209	132	295
1997	95	77	66	228	141	317
1998	101	82	70	247	150	341
1999	109	87	75	269	160	367
2000	116	93	80	298	171	394
2001	125	99	85	318	182	424
2002	134	106	90	346	194	456
2003	143	112	96	377	207	491
2004	153	120	102	410	221	528
2005	164	128	109	445	235	568
2006	176	136	116	484	251	611
2007	188	145	124	527	267	657
2008	202	154	132	573	285	707
2009	216	164	140	623	304	760
2010	232	175	149	678	324	817
Growth Rates (1996-2010)	7.12	6.49	6.49	8.76	6.60	7.56

Source:Shaib *et al.* (1997).

Table 2: Typical analyses of Various Types of meat

Source	Protein (X wet wt.)	Fat (% wet wt.)	Na	K	Ca	Mg	P	Fe	Cu	Zn	Cl
			(mg/100g wet wt.)								
Ox, lean, av	20.3	4.6	61	350	7	20	180	2.1	0.14	4.3	59
Sheep lean, av	20.8	8.8	88	350	7	24	190	1.6	0.17	4.0	76
Pig lean, av	20.7	7.1	76	370	8	22	200	0.9	0.15	2.4	71
Calf, fillet	21.1	2.7	110	360	8	25	260	1.2	-	-	68
Rabbit lean, av	21.9	4.0	67	360	22	25	220	1.0	0.54	1.4	74
Chicken, light meat av	21.8	3.2	72	330	10	22	180	0.9	0.25	1.6	86
Dark meat, av	19.1	5.5	89	300	11	25	190	1.2	0.20	2.0	90

Source	Thiamin (mg)	Riboflavin (mg)	Nicotinic Acid (mg)	B6 (mg)	B12 (μg)	Folic Acid (μg)	Biotin (μg)	E (mg)
Ox, lean, av	0.07	0.24	5.2	0.32	2	10	Tr	0.19
Sheep lean, av	0.14	0.78	6.0	0.25	2	5	2	0.10
Pig lean, av	0.89	0.25	6.2	0.45	3	5	3	-
Beef, fillet	0.10	0.25	7.0	0.30	1	5	Tr	-
Rabbit lean, av	0.10	0.19	8.4	0.50	10	5	1	0.13
Chicken, light meat av	0.10	0.10	9.9	0.53	Tr	12	2	0.08
Dark meat, av	0.11	0.22	5.4	0.30	1	12	3	0.14

av - refers to average values
Source: Lawrie (1981).

Table 3: Anabolic growth promoters used in animal husbandry

Anabolic agent	Animal	Dosage (mg)	Withdrawal period (days)
Androgen			
Trebolone acetate	Heifers, calves	300	60
Oestrogen			
Zeranol	Steers, calves, lambs	36	70
Hexoestrol	Steers, calves, lambs	45–60	90
Androgen and oestrogen			
Trebolone acetate + oestradiol	Steers, calves	140+20	60
Trebolone acetate + zeranol	Steers, calves	300+36	65
Trebolone acetate + hexoestrol	Steers, calves	300+45 - 60	90

Adapted from Brander *et al.* (1991).

Table 4: Concentration of streptomycin residues in meat samples

Traits and Location	Mean residue levels (µg/g)	± SEM	Range (µg/g)
Organs			
Liver	0.3200b	0.0844	0.06 – 1.26
Kidney	0.3544 b	0.0822	0.06 – 1.99
Muscle	0.6496 a	0.1145	0.06 – 1.99
Species			
Cattle	0.4769	0.0936	0.06 – 1.99
Goats	0.3871	0.0829	0.06 – 1.99
Pigs	0.4767	0.1383	0.10 – 1.26
States			
Ogun	0.4373	0.0693	0.06 – 1.99
Lagos	0.4476	0.0970	0.10 – 1.09

All values with different superscript are significantly different ($P<0.05$)

Source: Dipeolu and Alonge (2002).

Table 5: Some antibacterial growth promoters used in cattle

Antibacterial	Class	Level	Purpose
Bacitracin	Beef cattle	35-70mg/head/day	Growth promotion, improved feed efficiency
Chlortetracycline	Calves	25-70mg/head/day	Growth promotion, improved feed efficiency
	Beef cattle and non-lactating dairy cattle	70mg/head/day	Growth promotion, improved feed efficiency
Oxytetracycline	Calves	25-75mg/head/day	Increased rate of weight gain, improved feed efficiency
	Beef cattle	75mg/head/day	Increased rate of weight gain, improved feed efficiency
Monensin	Beef cattle	5-30h/tonne of complete feed	Improved feed efficiency

Adapted from Brander *et al.* (1999).

Table 6: Mean residue levels of streptomycin antibiotic in chicken samples following cooking (µg/g)

Location	Raw	Boiled (min)			Fried (min)			SEM
		15	30	45	15	30	45	
Ibadan	0.2425a1	0.1225b	0.1000b	0.1000b	0.0900b	0.0900b	0.825b	0.0139
Badagry	0.1925a	0.1325b	0.1300b	0.0900b	0.0900b	0.0900b	0.0900b	0.0229
Abeokuta	0.0700a	ND*	ND	ND	ND	ND	ND	

[1]: All values within the row having different superscripts are significantly different (P<0.05)
*: residues of streptomycin antibiotic not detected in samples

Source: Dipeolu and Ayo-Ajasa (2006).

Table 7: Residues levels of penicillin antibiotic in chicken samples following cooking (µg/g)

Location	Raw	Boiled (min)			Fried (min)			SEM
		15	30	45	15	30	45	
Lagos	0.0802a1	0.0206b	0.0206b	0.0150b	ND	ND	ND	0.0307
Abeokuta	0.1280a	0.0224b	0.0177b	0.0177b	ND	ND	ND	0.0272
Badagry	0.0740a	0.0138b	0.0138b	0.0138b	ND	ND	ND	0.0151
Ibadan	0.1122a	0.0451b	0.0435b	0.0435b	ND	ND	ND	0.0170

[1]: All values within the row having different superscripts are significantly different (P<0.05)
ND: residues of streptomycin antibiotic not detected in samples

Source: Dipeolu and Ojekunle (2005).

Table 8: Influence of Year and Season of Cattle Slaughter on Foetal wastage

Variables	No. of cattle slaughtered	No. of bulls slaughtered	No. of cows slaughtered	No. of pregnant cows slaughtered	Percentage
	(1)	(2)	(3)	(4)	(4/3)
Overall mean	4718.49	2637.72	2078.94	92.16	4.23
s.e.m	91.67	55.55	44.47	4.75	0.18
Year					
1990	7957.67a	4717.58a	3240.08a	147.50b	4.61b
1991	8416.33a	4482.50a	3933.83a	168.08a	4.29b
1992	1763.50c	915.75c	848.50c	29.75d	3.49c
1993	1622.58c	852.25c	770.33c	18.17d	2.43d
1994	3832.35b	2220.50b	1601.97b	97.301c	6.33a
Season					
Late dry	4949.73	2773.40	2169.67	103.33a	4.48
Early wet	4734.07	2603.27	2121.40	108.47a	4.67
Late wet	4709.51	2636.20	2073.31	80.18b	4.19
Early dry	4479.40	2538.00	1941.40	76.67b	3.57

Within variable group, means bearing different letter differ significantly ($P<0.05$)
s.e.m: Standard error of mean.

Source: Abiola *et al.* (1999).

Table 9: Yearly prevalence rates of bovine tuberculosis and other diseases of public health importance in cattle slaughtered in Oko-Oba abattoir, Lagos state (2004–2007)

Year	No. slaugh-tered	TB in-fected	Others	All	TB (% in No. slaugh-tered)	Others (% in No. slaughtered)	All (% in No. slaughtered)
2004*	156953	1098	1845	2945	0.70	1.18	1.88
2005	381623	1578	5509	7087	0.41	1.44	1.85
2006**	263056	960	4476	5436	0.37	1.70	2.07
2007	352923	1098	5509	6607	0.31	1.56	1.87
Total	1154757	4734	17339	22073	0.41	1.50	1.91

*: Data for January to July not included
**: Data for January, May, July and December not included

Source: Cadmus *et al.* (2008).

Table 10: Bacteria isolated from Fresh Beef from Bodija Abattoir

Bacterial Isolates	[a]Number of samples positive (%)[b]	Number of Groups positive (%)
Staphylococcus aureus	16 (8.0)	5 (50)
Salmonella serotypes	12 (6.0)	7 (70)
Escherichia coli	107 (53.5)	10 (100)
Listeria spp.	3 (1.5)	2 (20)
Shigella	1 (0.5)	1 (10)
Yersinia spp	4 (2.0)	3 (30)
Pseudomonas spp	5 (2.5)	4 (40)
Serratia spp	22 (11.0)	9 (90)
Bacillus spp	150 (75.0)	10 (100)
Micrococcus spp	5 (2.5)	4 (40)
Coagulase –ve *Staphylococcus spp*	104 (52.0)	10 (100)
Enterococcus spp	5 (2.5)	5 (50)
Enterobacter spp	8 (4.0)	7 (70)
Klebisella spp	6 (3.0)	2 (20)
Proteus spp	39 (19.5)	10 (100)
Citrobacter spp	15 (7.5)	5 (50)

a - Number of Samples Positive
b - Percentages

Source: Dipeolu, Ojo and Agbaje (2009); On-going study.

Table 11: Bacterial load of Fresh Beef from Bodija Abattoir

Groups	Total Aerobic Count ($x10^8$ cfu/g)	Enterobacteriaceae count ($x10^8$ cfu/g)	Coliform Count ($x10^8$ cfu/g)
1	455	107	76
2	182	102	76
3	92	69	34
4	62	17	15
5	54	23	22
6	42	16	9
7	42	16	13
8	36	7	7
9	19	13	12
10	16	5	4

Source: Dipeolu, Ojo and Agbaje (2009); On-going study.