

Animal Products and Handling: A Caution for Consumers and Entrepreneurs

Balarabe, *¹S., Doma¹, U.D., Kalla, D.J,U.¹and Zahraddeen, D²

¹Department of Animal Production, Faculty of Agriculture and Agricultural Technology, AbubakarTafawaBalewa University, Bauchi,²Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria

*Corresponding author e-mail: zdzariya@yahoo.com

Target audience: Animal Product Consumers and Entrepreneurs

Abstract

This study reviewed pertinent literature on edible animal products and handling with respect to contaminations and adulterations. Animal products include eggs, meat, milk, fish, skin/hide that are processed into other by products for human consumption. There is the need for awareness campaignsto consumers and entrepreneurs that engage in the handling and processing of these products. The high micro flora load commonly observed in these products is an indicative of poor hygiene and handling operations.For instance, viable count for pasteurized milk that should be consumed ought not to exceed 30, 000 microbes per ml, and bacterial count exceeding 10^5 /g or coliform count higher than 10^2 /g in delicatessen food products are indicative of dangerous contaminations. Contaminations may occur at various stages of the food chain; at farm, during slaughter; further processing or in the kitchen. However, many diseases such as anthrax, Escherichia coli, leptospirosis, tuberculosis, brucellosis, diphtheria, scarlet fever; Q fever, gastroenteritis, salmonella etc are known to be transmitted via contaminated animal products. Methods of preserving animal products include the use of high temperature (canning), low temperature (freezing), drying (sun drying, smoking, use of radiation and chemical preservatives). Drying reduces the moisture content to a level that prevents the growth of microorganisms especially fungi and bacteria. It is, however, suggested that all animal products meant for consumption should be adequately washed or heat treated to enhance processing and preservation/storage for improved keeping quality.

Key words: Animal Products, Handling, Consumers, Entrepreneurs

Description of Problems

A wide range of edible animal products that are processed and handled locally abound in Nigerian markets. These include various products from eggs, meat, milk, fish and skin/ hides. Despite the huge benefits of consumption of these products in terms of provision of quality nutrients for normal growth and reproduction, less significance is

attached to the possible effects on health due to product adulterations and contaminations. The main objection to consumption of these products lies with the poor sanitary conditions associated with their production and handling processes.

It has been shown that the high microflora count in meat and milk products is indicative of poor hygiene and handling

practices(1, 2). It is observed that the interval between processing and delivery to market be reduced, as this would limit the time for microbial multiplication (3). It has been reported that acceptable viable count for pasteurized milk that should be consumed ought not to exceed 30, 000 microbes per ml (4). It has also been indicated that bacterial count exceeding 10^5 /g or coliform count higher than 10^2 /g in delicatessen food products are indicative of dangerous contamination (5, 6). However, in eggs and poultry meat products, Salmonella has been shown to infest a number of egg products (7). It has been reported that many diseases such as anthrax, *Escherichia coli*, leptospirosis, tuberculosis, brucellosis, diphtheria, scarlet fever; Q (Query) fever, gastroenteritis etc are known to be transmitted via meat (8) and milk(9)products.

Food can be contaminated at different stages of food chain, these are: on the farm; animal feed can be contaminated with bacteria such as Salmonella which can cause infection in animals and potentially lead to human infection from derived food products, parasites may infect food producing animals, milk can be contaminated by coming into contact with, for example, faeces or environmental dust, animal skin and fur can be contaminated by faeces and environment. Eggs and different vegetables can also be contaminated on the farm (10). At slaughter; meat can be contaminated by coming into contact with intestinal contents or animal skin. It can also be contaminated during further processing; microorganisms present in another raw agricultural product or on

food contact surfaces may contaminate food, infected humans handling food may also contaminate food. Also, in the kitchen; microbes can be transferred from one food to another by improper use of kitchen utensils or by infected humans handling the food (10).

Methods of preserving meat include the use of high temperature (canning), low temperature (freezing), drying (sun-drying, smoking, use of radiation and chemical preservatives) (11). This worker also reported that drying reduces the moisture content to a level that prevents the growth of microorganisms especially fungi and bacteria. All handling and storage methods are therefore primarily concerned with minimizing microbial contamination and retarding microbial growth and activities (12). Meat samples meant for consumption should be adequately heat-treated to enhance processing and preservation/storage (2).

There is paucity of information on awareness campaigns to consumers and entrepreneurs on the need to improve production/processing quality of edible animal products that are being offered for sale in Nigerian markets. Proper hygiene inprocessing and handling of animal products will go a long way towards possible extension of shelf life through special storage techniques that will not only boost the local animal product industry but also enable its all-year availability and supply at affordable price for enhanced quality protein intake for normal human growth, reproduction and good health. Therefore, this study was designed to investigate contaminations and adulterations of animal products being displayed for

sale.

Some Food Borne Diseases

Food borne zoonotic diseases are caused by consuming food or drinking water contaminated by pathogenic microorganisms such as bacteria and their toxins, viruses and parasites (13). These pathogens enter the body through the gastro-intestinal tract where the first

symptoms often occur. Many of these pathogens are commonly found in the intestines of healthy food producing animals, as the risks of contamination are present from farm to fork and require prevention and control throughout the food chain (13). Some diseases associated with contaminations and adulterations of animal products are depicted in Table 1.

Table 1: Some common pathogens (microorganisms) associated with food borne diseases

Bacteria:	Campylobacter (causing Campylobacteriosis), Salmonella (causing Salmonellosis), Listeria (causing Listeriosis), Pathogenic <i>Escherichia coli</i> , Yersinia
Bacterial toxins:	toxins of <i>Staphylococcus aureus</i> , <i>Clostridium perfringens</i> , <i>Clostridium botulinum</i> , <i>Bacillus cereus</i> .
Viruses:	Calicivirus (including norovirus); rotarotavirus, hepatitis A virus, hepatitis E virus, infected humans handling goods may contaminate food.
Parasites:	Trichinella, Toxoplasma, Cryptosporidium, Giardia.

Source: (13)

Meat and Meat Products

The various meat products indigenous to Nigeria have been reported by various workers. This worker described local meat products as *suya* which is a popular, traditionally processed, ready to eat Nigerian meat product which may be served or sold along streets, in club houses, at picnics, parties, restaurants, and within institutions (14, 16, 18). It has been stated that it is a mass consumer fast food, its preparation and sales along streets are usually not done under strict hygienic condition because they are still done locally (15). The contamination of meat products are presented in Tables 2 and 3. The different local *suya* meat products to include *tsire*, *kilishi*, *balangu*, *dambunnama*, pepper soup, *ganda*, *pomo* among others (16, 17).

These products are at risk of being contaminated since they are processed traditionally.

Tsireis obtained from lean meat of cattle, sheep and goats which is cut into pieces and sliced with a sharp knife. The sliced meat is then staked on an iron rod and heavily dusted with spices. The spices comprised of groundnut cake, maggi seasoning, salt, ginger and aromatic spices. The fire was first set by burning the fire wood into red hot charcoal before staking the meat for roasting. The roasting was then done on a local *tukuba*, a heap of soil built for the same purpose. The fresh meat staked on an iron rod was fixed into the soil around the glowing charcoal fire to roast as described by (14) and (15).

Table 2: Range of total bacterial count (cfu/g) in raw meat and *tsire-suya*

Products	Bacteria	Coliform	<i>Staphylococcus</i>
Raw meat	20.0 x 10 ² to 289 x 10 ²	4.0 x 10 ² to 71.0 x 10 ²	1.0 x 10 ² to 60 x 10 ²
<i>Tsire -suya</i>	7.0 x 10 ² to 171.4 x 10 ²	1.0 x 10 ² to 42 x 10 ²	1.0 x 10 ² to 12.0 x 10 ²

Source: (15)

Balangu is prepared from boneless meat of a sizeable cut, which was placed on a wet brown paper on a wire mesh over fire to roast. The pieces of meat were sliced into thin sheets not less than 1 cm in thickness. Groundnut oil, spices and salt were added during roasting. The meat was turned continuously until it was well roasted as reported by (16) and (18).

Table 3: Some indications of Meat Spoilage by Bacteria, Yeast, Moulds and Other Factors

Indication of Spoilage	Cause
Ammonia or sulphur smell, bad odour, tallow or chalky taste	Degradation of proteins, lipid (fat) and carbohydrates caused by bacteria and/ or enzymes naturally present in meat
Slime formation, bad odour and rancid flavour, colour change (such as grey, brown or green)	Bacterial and yeast spoilage
Sticky meat surface	Mould spoilage
'Whiskers'	Mould spoilage
Surface colouration such as cream, black or green	Growth of mould colonies
Tainting, souring and putrefaction	An aerobic bacterial spoilage of meat interiors, Vacuum packed products and sealed containers
Oxidative rancidity (rancid flavour and odour)	Oxidation of meat fat due to improperly wrapped meat
Brown or grey discolouration	Protein denaturation caused by heat, salt, ultraviolet light, low pH and surface dehydration
Dehydration and discolouration during freezing resulting in dryness of cooked meat,	Freezer burn and drip which occurs during slow freezing
Nutrient loss, and sometimes a bitter flavour	
Absorption of off-flavour	Storage of meat next to foods such as apples and onions which give off strong odour

Source: (19)

Tukunya is similar to *Balangu* except that the sizeable cuts are wrapped in a wet brown paper after adding groundnut oil, spices and salt. It is then placed on a wire mesh over fire to roast (17). *Kilishi* is from lean meat which is cut into long pieces and sliced to about 0.2 to 0.4 cm thick, 15 cm long with the aid of a sharp knife. The sliced meat was first spread out on a mat to dry for 2 to 3 hours under the sun. The dried meat was then immersed into a 7 litre-bowl containing

about 3-litres of the slurry of spices. The slurry contained groundnut paste, maggi, ginger and aromatic condiments. This seasoned meat was then sun-dried for the second time for 4 to 6 hours and roasted on a wire over a red-hot charcoal for 5-10 minutes at a temperature above 100°C as stated by (14). The product was then cooled and it is ready for consumption as a delicacy.

Dambunnama is from fresh meat of good grade is cut into pieces of approximately 4 cm by 2.5 cm dimensions and washed with water, mixed with spices and ingredients, boiled for about 90 minutes and pounded into shreds using a mortar and pestle. This was then shallow fried using groundnut oil in a stainless steel pot to obtain *dambunnama*, which is usually brownish in colour (18, 20). There are other local meat products that are not given too much emphasis by researchers. For instance, *ganda* has

been reported by (17) which is usually prepared from the head and legs as well as the skin after burning the hair attached to these parts. They are then cooked after adding spices and condiment. *Ragadada* is similar to *ganda* except that it is being processed from meat of very low grades and is popular among children of school age. Pepper soups are also widely recognized as local meat products and are also prepared from various components of carcass. Mode of preparation is similar to that of *ganda*, except that it is usually prepared from meat of high grades, and also from various animal species including fish and poultry. *Pomo* is widely cherished by the locals. It is prepared from the skin and hide of edible farm animals. Its mode of preparation is similar to that of *ganda*. The use of animals' skin and hides in processing *pomo* in Nigeria has been discouraged (21).

Table 4: Bacterial load (cfu/ml), shelf life (days) and pH of unpasteurized fresh UFM, PFM and Yoghurt

Products	Bacterial load (cfu/ml)	Shelf life (days)	pH
Unpasteurized fresh milk (UFM)	7.0 x 10 ⁷	2	6.5
Pasteurized fresh milk (PFM)	7.4 x 10 ⁶	7	6.7
Yoghurt (Y)	2.4 x 10 ⁷	14	4.5

Source: (22)

Table 5: Bacterial count (mean) of fresh milk sampled from three locations (markets) in Plateau State

Market	Agar Plate Count*	n	Direct Microscopic Count	n
BarkinLadi	2.10 x 10 ⁶	8	4.49x 10 ⁶	34
Jos	2.54x 10 ⁶	8	3.93x 10 ⁶	34
Buruku	1.97x 10 ⁶	8	3.54x 10 ⁶	32

N= Number of samples, *= Number of cells per ml
Source: (3)

Milk and Milk Products

It has been reported a wide range of milk and milk products available in Bauchi market (23). These include fresh whole milk, *kindirmo*, skim milk, butter fat, ice cream, yoghurt, cheese, among other. It

is reported that the consumption habit of people may greatly influence their preferences (24). Contaminations and adulterations of milk and milk products have also reported in the literature (3, 8, 22), as shown in Tables 4 and 6

Table 6: Micro flora of raw Borana goat milk collected from Awassa College of Agriculture Goat Farm

Bacterial category	% total count
<i>Enterobacteriaceae</i>	20 – 30
<i>Bacillus</i> spp	10 - 20
<i>Staphylococcus</i> spp	12 - 36
<i>Micrococcus</i> spp	5 - 13
<i>Streptococcus</i> spp	1 - 3
<i>Lactococcus</i> spp	1 - 40
<i>Leuconostoc</i> spp	0.3 - 6
<i>Lactobacillus</i> spp	5 - 18
Others	8 – 15

N = 10 Source: (8)

Table 7: Incidence of Salmonella species in table eggs

Species	No. of eggs examined	No. of eggs infected	Infection (%)
<i>S. gallinarum</i>	160	11	6.9
<i>S. typhimurium</i>	160	13	8.1
<i>S. typhi</i>	160	24	15.0
<i>S. pollurum</i>	160	4	2.5
Total		52	32.

Source: (7)

Eggs and Egg Products

Eggs and egg products to include whole egg, dry whole egg, dry albumin and yolk and other powdered egg products are sold as independent products. The rule of the thumb is that all eggs broken out of the shell and meant for

consumption should be properly pasteurized to minimize risk of infections. It has been reported that salmonella has been shown to infest a number of table egg products(7), as presented in Table 7. A range of other bacteria have been isolated in table eggs (Table 8).

Table 8: Other bacterial isolates in table eggs

Species	No. of eggs examined	No. of eggs infected	Infection (%)
<i>Proteus</i>	160	28	17.5
<i>Escherichia coli</i>	160	44	27.5
<i>Streptococcus</i>	160	6	3.8
<i>Klebsiella</i>	160	34	21.3
<i>Lactobacillus</i>	160	9	5.6
<i>Pseudomonas</i>	160	4	2.5
<i>Staphylococcus</i>	160	19	11.9
Total		144	90.0

Source: (7)

Conclusions and Applications

This review concludes as follows:-

- a. Animal products offered for sale in joints/markets are heavily contaminated/adulterated along the food chain
- b. Animal slaughtering houses/slabs, milking, egg collection and other aspects of handling of products were identified as major sources of animal products adulterations and contaminations.
- c. Prevention/reduction of the risk imposed by microorganisms on raw and processed animal products and other food ingredients can be achieved through thorough proper handling, cooking and good kitchen hygiene
- d. Adequate and clean fresh water should be used in processing and handling of animal products are prerequisites for reduced microbial load, extended shelf-life and improved acceptability.
- e. All processed animal products not for immediate use should be adequately preserved to enhance storage and keeping quality

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