MICROBIOLOGICAL ATTRIBUTES AND QUALITY OF AVIAN BASED GRINDED MEAT (*DAMBUN NAMA*)

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ABSTRACT

Contamination of ready-to-eat meat products has been reported by many researchers. It is an established fact that, meat and meat products provide an excellent growth medium for bacteria, yeasts, moulds and protozoans. Therefore, this study was aimed at evaluating the microbiological attributes of Avian Based grinded meat (*Dambun Nama*) prepared from chickens, ducks, guinea fowls and quails. Aerobic Mesophilic Plate Count (APC), Total Coliform Count (TCC) and fungal species were evaluated using standard techniques. The result shows that, the product prepared from chickens had the highest APC (2.54×10^3 cfu/g). However, the product prepared from chickens, ducks and guinea fowls recorded the same values for TCC (3 MPN/g), while that of quails had the lowest TCC (< 3 MPN/g). *Escherichia coli* and *Staphylococcus* were present in all the samples while the presence of *Enterobacter* and *Klebsiella* was found in the product prepared from chickens. *Salmonella* was only present in the product prepared from ducks. *Candida*, *Penicillium* and *Rhizoctonia* were detected in the product prepared from chickens while *Aspergillus* and *Rhizoctonia* were detected in that of guinea fowls and quails, respectively. It can be concluded that, the avian based grinded meat had satisfactory microbial quality. Therefore, the study recommends maintenance of personal hygiene while processing, handling and selling the products, alongside proper storage to improve its safety and shelf life.

Key words: Microbial, Contamination, Avian, Grinded meat

INTRODUCTION

Meat contains important nutrients such as amino acids, vitamins, minerals and fatty acids which are essential for human growth and development (Campbell *et al*., 2003). However, the handling and processing methods by the local manufacturers as well as the hawking system of meat and meat products exposes it to both pre – and post – processing contamination, and thus may pose danger to public health. Hence, the need to improve its processing, handling, storage, distribution and overall quality. Umar (2015) reasoned that meat and meat products provide an excellent growth medium for microbes including bacteria, fungi and protozoans. Microbial growth can lead to slime formation, structural components degradation, off odor and appearance (Russell *et al*., 1996). Therefore, unless dried, cured, smoked, or fermented in some way, meat has a tendency to spoil rapidly (Robert, 1994). Poor sanitary practices increase microbial damage resulting in reduced color, flavor and product safety (Umar, 2015). Numerous studies have reported that meat products sold in Nigeria are contaminated with various species of bacteria and fungi (Ologhobo *et al*., 2010, Salihu *et al*., 2010, Umar, 2015, Dahiru and Maigari, 2019). *Staphylococus aureus*, *Escherichia coli* and *Corynebacterium* spp, isolated in meat products are potentially pathogenic (Abubakar *et al*., 2010). Similarly, fungal species such as *Aspergillus niger*, *Aspergillus fumigatus*, *Rhizophus nigricans* and *Hansenula anomala* could affect meat products on storage and could be dangerous (Abubakar *et al*., 2010, Umar, 2015). Most food poisoning results from mishandling foodstuffs, inappropriate temperature of storage, cross contamination and incorrect reheating (Umar, 2015). Considering the high demand of ready to eat meat products and their economic values, coupled with the fact that, grinded meat (*Dambun Nama*) is highly relished by people and incessantly hawked in Kano State, the present study is justified.

MATERIALS AND METHODS

Experimental Design and Preparation of *Dambun Nama*

Chickens, ducks, guinea fowls, quails and the ingredients (onions, ginger, salt, seasonings, sweet pepper, hot pepper, garlic and vegetable oil) were purchased from Rimi market, located in Kano metropolis, Kano State, Nigeria. The *Dambun Nama* was prepared at the Department of Animal Science, Faculty of Agriculture, Bayero University, Kano. The samples were aseptically placed in clean, sterile plastic containers immediately after collection and subsequently transported to the Post Graduate laboratory of the Department of Microbiology, Bayero University, Kano, for analysis.

MICROBIOLOGICAL EVALUATIONS

Samples of *Dambun Nama* were stored at room temperature in sterile plastic containers for 2 weeks. The sample preparation was carried out according to the method described by Food and Agricultural Organization, FAO (2010). Aerobic mesophilic bacterial count was carried out according to Abdullahi *et al*. (2004), and the colonies obtained were counted, averaged and multiplied by the dilution factor to give the number of colony forming units per gram of a sample (cfu/g). The detection and enumeration of coliforms was carried out according to the method described by Atlas (1997). The number of gas positive tubes was compared with the most probable number (MPN) table to estimate the most probable number of coliforms per gram of sample. Three different microbial culture media (nutrient agar and MacConkey agar for bacterial analysis and potato dextrose agar for fungal evaluation) were prepared, and were aseptically distributed into sterile Petri plates. One gram of the meat product was thoroughly agitated in 9 ml of sterile water, serially diluted to 10 - 3 and plated. Following incubation (at 37^0C for 24 hours and 25^0C for 3-5 days for bacteria and fungi, respectively), plate counts and possible identification of the isolates was carried out. The characteristics of the isolates was referred to Bergey‟s Manual of Determinative Bacteriology for identification. Gram staining and other biochemical tests such as IMVIC (Indole, methyl red, Voges-Proskauer Tests and citrate utilization), Catalase, Coagulase, and Triple Sugar Iron Agar Test (TSI) were conducted according to procedure for the identification of bacterial colonies as described by Atlas (1997). Members of the enterobacteriacea family were further confirmed using API 20E identification kit, while yeast and mold counts was carried out according to the method of Atlas (1997), and identified using a color guide and microscopy.

RESULTS AND DISCUSSION

The Aerobic Plate Counts (APC) and Total Coliform Count (TCC) of the avian based *Dambun Nama* is presented in Table 1. Chickens had the highest APC while quails had the least APC. *Dambun Nama* prepared from chickens, ducks and guinea fowls recorded the same values for TCC, while that of quails had the lowest TCC values. The occurrence of bacteria in the experimental *Dambun Nama* indicated that *E. coli* and *Staphylococcus* were detected in all the samples. The presence of *Enterobacter* and *Klebsiella* was confirmed in *Dambun Nama* prepared from chicken meat while *Salmonella* was only detected in the product made from duck meat (Table 2). The occurrence of fungal species is presented in Table 3 where *Candida, Penicillium* mould and *Rhizoctonia* spp. were detected in *Dambun Nama* prepared from chickens. *Aspergillus niger, Penicillium* mould and *Rhizoctonia* species were detected in the product made from ducks. However, *A. niger* was the only fungal species detected in the product prepared from guinea fowl meat, while *Rhizoctonia* spp. was the only fungal species detected from the product obtained from quails.

The low bacterial counts from the products in this study is generally attributed to the clean environment, good personal hygiene of the processor, and the use of clean utensils during processing and packaging. Thus possible cross contamination of the finished product from adjacent raw meat through unclean hands of the handlers and/or flies was minimized. This is in agreement with Shamsuddeen (2009), Fonkem *et al*. (2010) and Inusa and Sa'id (2017). The degree of meat spoilage is usually influenced in part by the microbial load at the beginning of production, packaging and handling of the finished product (Inusa and Sa'id, 2017). The International Commission on

Microbiological Specifications for Foods (ICMSF, 1996) reported the limits for total aerobic bacterial and fungal counts to be in the order of ≤ 103 as acceptable and 104 to 105 tolerable for ready to eat foods. Similarly, London Health Protection Agency, (LHPA, 2009) put <106cfu/g as satisfactory limit, and 106 to <107cfu/g as acceptable range. Thus, the levels of microbiological contamination in the present study, although very low, might portend public health concern as conditions favoring growth and proliferation of microbes prevails in most of the retail outlets. Okonko *et al*. (2013) isolated *Bacillus* species, *Staphylococcus aureus* and *Escherichia coli* in *Dambun Nama* samples from Port Harcourt, Rivers State. Moreover, in addition to *Bacillus cereus*, Edema *et al*. (2008) isolated, *Staphylococcus aureus* and *Salmonella* spp from a study on *Dambun Nama* samples retailed at some selected cities in Southwestern Nigeria. In another study, Fonkem *et al*. (2010) isolated *E. coli* and *Staphylococcus aureus* from Cameroonian *Dambun Nama* while Shamsuddeen (2009) reported the presence of *E. coli*, *Salmonella* species, *Staphylococci* and *Clostridium perfringens* in spices used in the production of *Dambun Nama*.

Abdullahi *et al*. (2004) reasoned that, differences in meat handling practices, ingredients, processing methods and variation in environmental factors may influence the microbial load of meat products. The findings of this study agrees with the work of Badau *et al*. (2001) who reported the presence of *Aspergillus* and *Penicillium mould* in *Dambun Nama* among hawkers in Maiduguri, Borno State. The study also, is in agreement with the report of Abolama and Egbebi (2007) in Ado Ekiti, Ekiti State where *Aspregillus niger*, *Penicillium* and *Rhyzoctonia* were reported. Similarly, Umar (2015) reported the presence of *Aspregillus niger*, *Penicillium*, *Rhyzoctonia* and *Trichophyton* in a study of *Dambun Nama* sold in Kano Metropolis, Kano State. In a more recent study of *Dambun Nama* prepared from goat meat, Garba (2017) reported the presence of *Aspregillus niger*, *Penicillium* and *Candida*. The presence of variety of mould species are points of great concern. This is because, mould like *Aspergillus niger* has the ability to produce extracellular metabolites called mycotoxins (Umar, 2015). One popular example is the aflatoxins which are a group of highly toxic metabolites produced by the fungi of the genus *Aspergillus*.

Table 1: Microbiological Quality of Avian based Grinded Meat

	Microbial count	
Avian Species	APC (cfu/g)	TCC (MPN/g)
Chickens	2.54×10^3	3
Ducks	2.39×10^3	3
Guinea Fowls	2.08×10^3	3
Quails	1.71×10^3	<3

APC: Aerobic Plate Count
TCC: Total Coliform Count

Table 2: Occurrence of Bacteria in Avian Based Grinded Meat

Avian Species	*Escherichia coli*	*Enterobacter*	*Klebsiella*	*Salmonella*	*Staphylococcus*
Chickens	+	+	+	-	+
Ducks	+	-	-	+	+
Guinea Fowls	+	-	-	-	+
Quails	+	-	-	-	+

+ indicates presence; - indicates absence

Table 3: Occurrence of Fungal Species in Avian Based Grinded Meat

Avian Species	*Aspergillus niger*	*Candida*	*Penicillium*	*Rhizoctonia spp*
Chickens	-	+	+	+
Ducks	+	-	+	+
Guinea Fowls	+	-	-	-
Quails	-	-	-	+

+ indicates presence; - indicates absence

CONCLUSION AND RECOMMENDATIONS

It can be concluded that, the avian based grinded meat had satisfactory microbial quality. Therefore, the study recommends maintenance of personal hygiene while processing, handling and selling the products, alongside proper storage to improve its safety and shelf life.

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