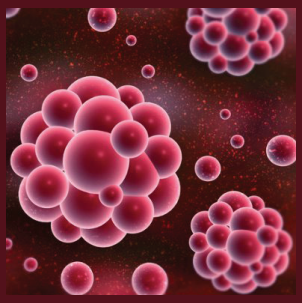
ISSN: 2766-838X

RAS MICROBIOLOGY AND INFECTIOUS DISEASES

Research Article: *Aeromonas* Species in Meat Samples Obtained From Some Markets in Parts of Plateau State, Nigeria



Issue Type: Volume 2 Issue 2

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Citation: Eluma, M., *Aeromonas* Species in Meat Samples Obtained From Some Markets in Parts of Plateau State, Nigeria

Received Date: 10th June 2022

Published Date: 13th July 2022

Abstract:
Aeromonas species are emerging food borne pathogens with serious potentials for causing food borne diseases. They are estuarine bacteria and are ubiquitous in fresh water, ground water, bottled water, meats and fresh vegetables. A total of 800 meat samples, comprising of 4 different meat types; Chicken (200), beef (200), Fish (200) and chevon (goat meat) (200) were collected in the period of one year (from June 2017—June 2018) in Jos, Miango, Bukuru, Vom and Lamingo areas of Plateau state. These meat samples were analyzed for the presence of *Aeromonas* species using *Aeromonas* Dextrin agar and MacConkey agar. Overall 114 meat samples out of the 800 samples analyzed were positive for *Aeromonas* species with the beef having the highest percentage prevalence of 9.25% while the chevon had the lowest percentage prevalence of 5.75%. The result of this study revealed the presence of potentially pathogenic *Aeromonas* species in the meat samples obtained from these locations.

Introduction

The genus *Aeromonas* are gram-negative, non-spore forming, rod shaped bacteria that are motile by polar flagellum. They are facultative anaerobes of the family *Aeromonadaceae* (Janda & Abbott, 2010; Bogdanovic et al., 1999). *Aeromonas* species are widely distributed in the aquatic environment, including raw and processed drinking water (Colwell et al., 1986) and have been frequently isolated from various food products such as fish, milk, meat, vegetables and pies (Palumbo, 1996 and Janda, 1991). *Aeromonas* species have been implicated as causative agents of human diseases including meningitis, gastroenteritis, septicemia, pneumonia, ocular and wound infections. (Janda and Abbott, 2010)

The dramatic rise in the number of infections caused by *Aeromonas* species reported in recent years indicated that they are more widely spread than previously believed. The first reported association of *Aeromonas* with gastrointestinal diseases was in 1958 in Jamaica (Ghenghesh et al., 2008). Since then there have been reports from other Nations including Italy, England, Australia, USA, China and Egypt (Gracey et al., 1988). In Nigeria, Obi et al. (1997); Nzeako et al. (2002); Adegoke and Ogunbanwo, (2016) identified *Aeromonas* species as agents of diarrhoea in both urban and rural areas.

Meat is highly nutritive, containing protein, glycogen, peptides, amino acids as well as metal ions with soluble phosphorous and has a water activity of 0.99 with a corresponding water content of 24 to 80% (Gil, 2015). As a result of this, meat is a highly favourable environment for microbial growth, supporting the growth of most gram-positive and gram negative bacteria. There is evidence to suggest that the prevalence of *Aeromonas* infections may be underestimated in developing nations and that routine endemic exposure to water borne and food borne pathogens may occur more frequently than perceived (Ghenghesh et al., 2008). Therefore, the present study was undertaken to identify *Aeromonas* species isolated from different meat samples with a view to highlighting the impending health hazard posed by the organism.

MATERIALS AND METHODS

Study Area

The study area included Jos North, Jos South, Bassa and Jos East Local Government areas of Plateau state. Jos the capital of Plateau State is located in the north central part of Nigeria between latitudes 8o.30' and 10o.10'N and longitudes' 8o.20' and 9o.30'E. It lies on the Delimi River near the source of the Jamaari River, in Bauchi State (Ehizibolo, Perez, Carrillo & Metwally, 2013).

Sample Collection

Eight hundred (800) meat samples comprising of 200 beef, 200 chicken, 200 fish and 200 chevon were procured from different abattoirs, markets and retailers within the study areas. All samples were collected in sterile polythene bags and transported to the laboratory in an insulated icebox with ice packs as described by Cheesebrough (2005). The samples were processed within 4 hours of collection.

Examination of Meat Samples

The method described by Nzeako et al. (2002) was modified and used to isolate *Aeromonas* species from the meat samples. Ten grams of each meat type was aseptically weighed out using electrical weighing balance and mixed with 90ml of alkaline peptone water. The mixture was homogenized using sterile electric blender for one minute. Serial dilution (10-1, 10-2 and 10-3) of the homogenate was carried out using sterile alkaline peptone water and incubated at 35^{o}C for 2 hours. A 0.5ml of the mixture was sub-cultured unto Ampicillin dextrin agar, Mac-Conkey agar and Sheep blood agar (SBA) (5% sheep blood) supplemented with 10mg/l ampicillin in triplicate and re-incubated at 37^{o}C for 24 hours. Ampicillin-resistant β-hemolytic colonies that appeared grayish white and translucent on SBA and colonies that failed to ferment lactose on MacConkey agar were Gram stained and stored on nutrient agar slants as presumptive *Aeromonas* species.

Biochemical Characterization of Isolates

The growth type, shape, elevation, size, pigmentation and consistency of the isolates were observed by employing both macroscopic and microscopic processes and the isolates were differentiated on the basis of their cultural and cellular morphology. Different biochemical tests were carried out to determine the reaction of the organism to different chemicals and reagents. These tests include: Oxidase, catalase, sugar fermentation, citrate utilization, methyl red and Voges-proskauer tests. The isolates were further identified to species level after speciation based on Aerokey II group of tests for the identification and speciation of *Aeromonas* species (Carnahan et al., 1991). These test included bile esculin hydrolysis, gas from glucose, acid from arabinose, mannitol and sucrose, indole production and resistance to cephalothin (3ug)

Statistical Analysis

The chi-square test was used for comparison of the different variables, P value of <0.05 was considered to be statistically significant.

Results

The results of the prevalence of *Aeromonas* isolated from the different meat types in the study areas are presented in Table 1: Out of the 800 meat samples investigated, 114 (14.25%) were positive for *Aeromonas*. From the result, it was observed that among the four meat types, beef had the highest percentage prevalence of *Aeromonas* with a prevalent rate of 37(4.62%) while the lowest was chevon with a percentage prevalence of 2.88% (Table 2). The prevalence rate of *Aeromonas* spp. in fish and chicken are 3.25% and 3.5% respectfully. When the prevalence of the organism was compared with respect to study areas, it was noted that the organism varied in its occurrence in some places while the frequency was equal in other places.

Meat samples were examined according to location and it was observed that the meat samples obtained from Lamingo Area of Jos East has the highest percentage growth with a prevalence of 28 (3.5%) while the lowest was obtained from Bukuru with a percentage prevalence of 20 (2.5%). However, statistical analysis of the result showed that there was no significant difference (p>0.05) in the prevalence of the organism in the different meat type with respect to the study areas. The percentage prevalence of *Aeromonas* species isolated from the various meat types in relation to season was obtained and it was observed that the organism occurred more often in the wet season than in the dry season as presented in figure (1) with an overall percentage prevalence of 10.13% and 4.12% respectively. Table 3 presents the effect of sources on the prevalence of *Aeromonas* species in the various meat samples. It was observed that the meat obtained from the market have higher percentage prevalence of the organism with a percentage prevalence of 53% than those obtained from the abattoirs with a percentage of 47%

Table 1: Prevalence of *Aeromonas* Isolated from Different Meat Types obtained from the Study Area.

Study Area	Chicken	Beef	Fish	Chevon
Jos	5.00^{bc}	6.00^{c}	4.00^{b}	6.00^{a}
Miango	5.00^{bc}	7.00^{bc}	5.00^{b}	4.00^{b}
Bukuru	4.00^{b}	7.00^{bc}	5.00^{b}	4.00^{b}
Vom	6.00^{b}	8.00^{ab}	5.00^{b}	5.00^{ab}
Lamingo	8.00^{a}	9.00^{a}	7.00^{a}	4.00^{b}
SEM	0.42	0.35	0.34	0.31

a-b-c: Means along the same row with different superscripts are not significantly (p>0.05) different.
S.E.M= Standard Error of Mean

Table 2: Percentage Prevalence of *Aeromonas* Species Isolated from Different Meat Types

Study Area	Chicken	Cow	Fish	Goat	Total
Jos	5/40 (0.625)	6/40 (0.75)	4/40 (0.50)	6/40 (0.75)	21/160(2.63)
Miango	5/40 (0.625)	7/40 (0.87)	5/40 (0.625)	4/40 (0.50)	21/160(2.62)
Bukuru	4/40 (0.50)	7/40 (0.88)	5/40 (0.625)	4/40 (0.50)	20/160(2.50)
Vom	6/40 (0.75)	8/40 (1.00)	5/40 (0.625)	5/40 (0.625)	24/160(3.00)
Lamingo	8/40 (1.00)	9/40 (1.125)	7/40 (0.875)	4/40 (0.50)	28/160(3.50)
Total	28/200 (3.50)	37/200 (4.62)	26/200 (3.25)	23/200 (2.88)	114/800 (14.25)

Since p>0.05, there is no significant difference between the percentage prevalence of *Aeromonas* species isolated from the different meat types with respect to the various study areas at 95% confidence level

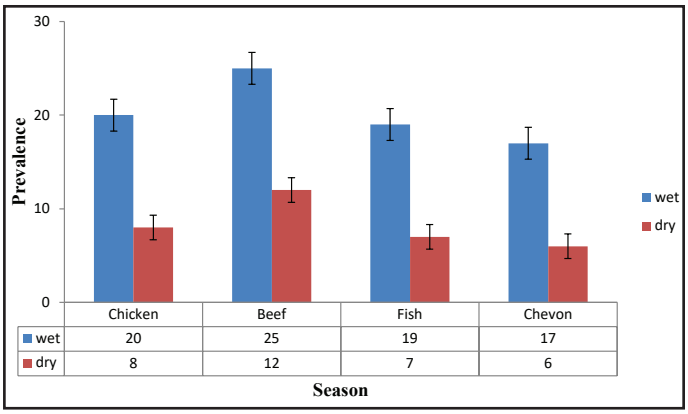

Figure 1: Percentage Prevalence of *Aeromonas* Isolated from Various Meat types in Wet and Dry Season

Table 3: Effect of Sources on the Prevalence of *Aeromonas* Species isolated from Different Meat and Fish Samples

Source	Chick-en	Beef	Fish	Chev-on	Total	Chi-square	P-val-ue
Abattoir	15.00	17.00	12.00	10.00	54.00	8.00	0.24
Market	13.00	20.00	14.00	13.00	60.00		
Total	28.00	37.00	26.00	23.00	114.00		

Since P>0.05, there is no significant difference between the prevalence of *Aeromonas* spp. in the different meat types with regard to sources at 95% confidence level.

Discussion

The study indicated that *Aeromonas* was isolated from (14.25%), out of 800 meat samples examined. The results showed that *Aeromonas* species were higher in beef with a percentage prevalence of 4.62% while chevon had the least percentage prevalence of 2.88%. This finding is in agreement with the report of Neyts et al. (2004) who isolated similar percentage of *Aeromonas* from meat. The result of this study showed a prevalent rate that is lower than that (82.9%) reported by Koca & Sarimehmetoglu, (2009). Most times the skin of goat is roasted prior to it being sold to consumers as meat. This may explain why it has lower prevalence rate when compared to the other meat types examined in this study since *Aeromonas* species cannot withstand high temperatures.

Some studies on chicken samples done by Ternström & Molin, (1987); Barnhart et al. (1989); Hanninen, (1993) and Akan et al. (1998) had significant contamination levels by *Aeromonas* species of 53.3%, 98%, 93% and 90.5% respectively. This study showed the ease and frequency of the isolation of these organisms from retail meat and confirms the work of Palumbo, Abeyta et al. (1992) indicating its presence in almost all fresh retail foods of animal origin. Since Drazek et al. (1986) had reported a very low prevalence of aeromonads in the feces of beef, pigs, sheep and turkeys it then means that the organism was introduced into the meat during handling. Though the contamination levels of meat samples examined in this study was not too high, caution needs to be taken in consuming this meat product as the presence of *Aeromonas* spp. in meats even in minute quantity is a risk for public health especially for the immuno-compromised persons, children and the aged. Necessary controls should be taken in every step of meat production, from the slaughter houses to the table. As the pathogens are able to survive and grow in refrigerated conditions, the preservation times should be made short in both markets and houses.

Studies have shown that cases of *Aeromonas* induced gastroenteritis occurred more in the summer months (Albert et al., 2000 and Gavriel., 1998) than at other times of the year, which might indicate either water transmission, food abuse, or a combination of both. With an increase in awareness of aeromonads as possible causes of gastroenteritis in developed countries, more laboratories are testing for their presence. This surveillance should also be encouraged in Nigeria as it has been established from this study and studies from other researchers that *Aeromonas* is present in our environment. This may ultimately provide the answer to the public health significance of these organisms.

The fact that *Aeromonas* was detected in different meat types examined in this study can be attributed to factors such as seasons, location and production criteria. These factors can influence the rate at which the meats are contaminated (Koca & Sarimehmetoglu, 2009). The finding of the present study showed that there was no significant difference (p>0.05%) in the prevalence of *Aeromonas* from the different meat types with regards to the various sampling sites. Similarity in the rate of meat contamination by the organism as observed in the various sites may be due to the fact that the same abattoir practices are employed when meat are being processed in the various study areas.

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