

Microbial flora of *Anchovis* spp. used in poultry and livestock feed preparation in Ghana

A. OSEI-SOMUAH & P. W. K. NARTEY

Animal Research Institute (CSIR), P. O. Box 20, Achimota, Ghana

SUMMARY

Anchovis spp. is of great importance in non-industrial feed formulation in Ghana as the main protein ingredient. Many microbial diseases found in poultry/livestock in Ghana are suspected to be due to contaminants on the fish in feed. Results from this survey suggest high levels of microbial contamination on the *Anchovis* fish. Seventeen genera of bacteria were isolated from *Anchovis* spp. samples taken along the coastal towns and markets in Ghana. The genera of bacteria isolated included *Coliforms*, *Staphylococcus*, *Salmonella*, *Streptococcus*, *Pasteurella*, *Escheriachia*, *Shigela*, and *Pseudomonas*. These organisms are known to cause various diseases in man and animals, resulting in economic losses. Caution should, therefore, be taken in the use of *Anchovis* spp. in human food and animal feed, since it can be a source of bacterial infection.

RÉSUMÉ

OSEI-SOMUAH, A. & NARTEY, P. W. K.: *La flore microbienne d'Anchovis spp. utilisé pour la préparation de la ration de volaille et de bétail au Ghana. Anchovis spp. est de grande importance dans la formulation de ration non-industrielle au Ghana comme l'ingrédient principal de protéine. L'existence de plusieurs maladies microbiennes dans les volailles/ les bestiaux au Ghana avait été soupçonné d'être à cause des polluants sur les poissons dans les rations. Les résultats de cette enquête suggèrent des hauts niveaux de contamination microbienne sur poisson d'Anchovis. Dix-sept genres de bactérie étaient isolés d'échantillons d'Anchovis spp. prélevés au bord de villes et de marchés côtiers du Ghana. Les genres de bactérie isolés comprennent Coliforms, Staphylococcus, Salmonella, Streptococcus, Pasteurella, Escheriachia, Shigela et Pseudomonas. Ces organismes sont bien connus d'être les causes de diverses maladies des êtres humains et des animaux aboutissant à des pertes économiques. Donc il faut prendre des précautions dans l'utilisation d'Anchovis spp. pour la nourriture humaine et la ration d'animal puisque ça pourrait être une source d'infection bactérienne.*

Original scientific paper. Received 16 Oct 98; revised 1 Nov 99.

Introduction

The importance of fish and fish products in poultry and livestock production in Ghana cannot be underestimated. It is more significant in the poultry industry with a population of about 13 million birds (FAO, 1995) in the country.

Fish and fish meal are the major sources of animal protein in commercial poultry ration in Ghana. Apart from fish meal, some amount of other forms of animal protein such as blood meal and meat meal are occasionally imported to supplement the locally produced fish meal. The patronage of these imported meals is low due to high cost and irregular supply. It is, therefore, a

common practice for farmers to supplement imported meals with locally prepared rations to reduce cost.

The most common type of fish used locally in feed preparation is the *Anchovis* spp., popularly known as "Keta School Boys" (named after a Ghanaian town "Keta" where the bulk of the species is obtained). *Anchovis* spp. is also consumed by humans.

When most Ghanaian farmers prepare their own feed, the fish used for the preparation is either bought or supplied directly from markets and most often stored before use. Storage conditions are often poor and the fish is seldom treated to reduce

microbial contamination.

The causes of microbial contamination and proliferation are diversified. The notable contributory factors include climatic conditions (Adeoye, 1984; Oppong, 1987), human and animal physiological activities (Mulder, 1996), and the "air spora".

Ingram & Simonsen (1980), Frankland, Frankland & Lankester (1987), and Pedrosa-Menabrito & Regenstein (1988) have suggested that the shelf life of fresh fish in particular depends on factors including the area of catch, season, and handling. These factors contribute to microbial contamination and survival.

Work on microbial contamination of smoked or sundried fish in Ghana and elsewhere is scanty. Marja-Liisa, Pakka & Varpu (1997) have isolated *Aeromonas* spp. from fish and other aquatic creatures at retail markets. The incidence of contamination of other food items such as meat and eggs by various groups of bacteria has been reported in many areas. Some of the bacteria isolated in such studies included *Salmonella* spp., *Listeria* spp., *Escherichia coli*, *Yersinia* spp., *Streptococcus* spp., and other *Coliforms* (Schillinger & Luecke, 1987; Ashenafi, 1994).

The Animal Research Institute (ARI) (1992) estimates that 46 per cent of causes of death in poultry in Ghana result from infection by the same genera of bacteria.

This study aimed at finding out whether *Anchovis* fish used in feed preparation especially for poultry could be a source of infection of pathogenic bacteria in poultry and livestock production.

Materials and methods

Sampling

Two or three fingers of processed (smoked/sundried) *Anchovis* spp. were randomly collected with sterilized forceps from market tables, baskets, sacks, storerooms, and feedmills.

Samples were put into sterile, screw-capped universal bottles. A total of 327 samples was taken

from different towns and markets, including Elmina, Apam, Winneba, Senya Breku, Accra, Tema, Ada, and Keta. These towns are located along the coast of Ghana, covering a distance of 372 km.

The samples were kept at 2-8 °C in the refrigerator. Bacteriological work was done within 48 h of collection.

Bacteriology

The Satorius electronic balance was used to weigh 1g of each sample. The sample was chopped into pieces and was then added aseptically to 9 ml of sterile 0.1 per cent Peptone Water (PW) in a screw-capped universal bottle. This was shaken to disperse bacteria and kept at room temperature (31°C) for 30 min. Three loopfuls of the suspension were plated unto Blood Agar (BA) and MacConkey Agar (MA) (Oxiod) with the standard bacteriological plating loop.

The Standard Plate Count (SPC) method was used to make a viable count on each sample which had been incubated at 37 °C for 24 h.

From the same batch of sample, 1g was weighed into a double strength Selenite F Broth and incubated overnight at 37 °C. A subculture of the Selenite Broth was made unto Desoxycholate - Citrate Agar (DCA).

Colonial characteristics and Gram's reaction were the bases for primarily identifying cultures giving counts $>10^5$ CFU/g. The Systek identification kit (Eiken Chemical Co. Ltd) was used to further identify to species level.

Results and discussion

Out of the 327 samples, 260 isolates of 17 genera and one isolate of *Mucor* were obtained (Table 1). Mixed contamination was observed in most samples.

A total of 232 (70.9 %) of the samples was contaminated. Of these, 216 (66.1%) had counts $>10^5$ CFU/g and 16 (4.9 %) had counts $<10^5$ CFU/g. *Mucor* was isolated from one sample.

The bacterial load on *Anchovis* spp. from various areas in Ghana was high. The hygienic

TABLE 1

Frequency of Microflora Isolation from Anchovis spp.

Genera of bacteria	Frequency	Frequency (%)
<i>Coliforms</i> spp.	59	22.6
<i>Bacillus</i> spp.	52	19.9
<i>Enterobacter</i> spp.	27	10.3
<i>Staphylococcus</i> spp.	24	9.2
<i>Klebsiella</i> spp.	18	6.9
<i>Salmonella</i> spp.	18	6.9
<i>Streptococcus</i> spp.	17	6.5
<i>Shigella</i> spp.	16	6.1
<i>Citrobacter</i> spp.	7	2.7
<i>Pasteurella</i> spp.	5	1.9
<i>Proteus</i> spp.	5	1.9
<i>Actinobacillus</i> spp.	4	1.5
<i>Escherichia</i> spp.	3	1.1
<i>Pseudomonas</i> spp.	2	0.8
<i>Yersinia</i> spp.	1	0.4
<i>Aeromonas</i> spp.	1	0.4
<i>Kluyvera</i> spp.	1	0.4
<i>Mucor</i> spp.	1	0.4
Total	261	

conditions of the areas of processing, the personnel involved, and the equipment such as sacks and baskets, among others, could contribute to the contamination (Hauge, 1955; Ashenafi, 1994).

The 17 genera of bacteria isolated from the samples were among many organisms known to cause various diseases in animals and man (Blood, Radiostis & Henderson, 1985; Hofstad *et al.*, 1972; Cruickshank, Duguid & Swain, 1973). Hauge (1955) had documented that notable among the isolates were *Coliforms*, *Bacillus* spp., *Enterobacter* spp., *Staphylococcus* spp., *Salmonella* spp., *Streptococcus* spp., *Pasteurella* spp., *Proteus* spp., and *E. Coli*.

Some of the organisms such as *Pseudomonas* spp., *Klebsiella* spp., *Salmonella* spp., *E. Coli* and *Proteus* spp. had been isolated from dead-in-shell in hatcheries in Ghana (Akanmori & Sarpong,

1996). Similar results had also been reported by Quarles & Bressler (1970). Most of the organisms had been isolated from the respiratory tract of chicken at *post-mortem* (Adedayo, 1992).

Diseases caused by these organisms are of great importance to livestock and poultry production. *Salmonella* infection can result in acute systemic disease and a high incidence of mortality in young poultry (Gast, 1997). *Salmonella pullorum* infections are common and are among the principal disease threats in the poultry industry (Bouzoubaa & Nagaraja, 1984). Reports in *Misset International* indicate that increased *Salmonella* contamination in animals, particularly pigs, is considered the most important single source of infection in a herd.

Salmonella spp. is also important to man, causing various disease conditions including typhoid fever. This has been the result of *Salmonella typhi* in human consumers of contaminated eggs (Cowden *et al.*, 1989).

Even though the level of contamination by *E. coli* is low, it is important as it indicates faecal contamination. It is considered to be the most important single cause of diarrhoea in newly born animals and man (Goda, 1976; Adetosoye, 1980). Studies in Ghana have indicated that diarrhoea caused mainly by *E. coli* scores highest on the list of causes of death in lamb kids (26.6%) and piglets (Aning, 1992). *E. coli* is also known to cause other diseases such as abortions in cattle (Masralla & Zubeir, 1978) and omphalitis, peritonitis, salpingitis, and air sac infection in poultry (Hofstad *et al.*, 1972).

Conclusion

Anchovis spp., which is the major protein source used in livestock and poultry feed preparation in Ghana, is highly contaminated with many bacteria.

All the bacteria isolated are potential pathogens that can cause various diseases especially in poultry.

In Ghana, fish mongers, farmers, feed millers, and those who use the fish to prepare food for

human consumption, among others, are all at risk of being infected by any of the contaminants.

Recommendations

Processed *Anchovis* spp. should be properly handled and then packed in polyethylene sacks before being transported or stored. It should be heated again before milling.

REFERENCES

- Adedayo, B. K.** (1992) *The identification of the bacteria flora of the respiratory tract of chickens at post-mortem*. Federal University of Technology, Akure, Nigeria.
- Adeoye, S. A. O.** (1984) Disease profiles of sheep and goats in two groups of villages in southern Nigeria. In *Sheep and goats in humid West Africa*. Proceedings of the workshop on small ruminant production systems in the humid zones of West Africa, Ibadan, Nigeria, 23-26 January 1984. pp. 13-16.
- Adetosoye, A. I.** (1980) *Escherichia coli* and diarrhoea in kids and piglets. *Bull. Anim. Hlth Prod. Afr.* **28**(4), 300-306.
- Akanmori, B. D. & Sarpong, A.** (1996) Assessment of the bacterial contamination of hatcheries in Greater Accra. *Proceedings of the West African Commonwealth Veterinary Association/Ghana Veterinary Medical Association*.
- ARI** (1992) Anim. Res. Inst. (CSIR) *Annual Report*. 1992.
- Aning, K. A.** (1992) *Factors influencing the multiplication of Porcine, E. coli* (Ph D Thesis). University of Liverpool, UK.
- Ashenafi, M.** (1994) Microbial flora and incidence of some food-borne pathogens on fresh raw beef from butcher's shops in Awassa, Ethiopia. *Bull. Anim. Hlth Prod. Afr.* **42**(4).
- Blood, D. C., Radiostis, O. M. & Henderson, J. A.** (1985) *Veterinary medicine*, 6th ed. London, Balliere Tindall.
- Bouzoubaa, K. & Nagaraja, K. V.** (1984) Epidemiological studies on the incidence of *Salmonellosis* in chicken breeder/hatchery operations in Morocco. *Proceedings of the International Symposium on Salmonella* (ed. G. H. Snoeyenbros), Kennett Square, M. A. American Association of Avian Pathologists.
- Cowden, J. M., Lynch, D., Joseph, A. A., O'Mahony, M., Mawer, S. L., Rowe, B. & Bartlett, C. L. R.** (1989) Case control study of infections with *Salmonella enteritidis* phage type 4 in England. *Br. med. J.* **299**, 771-773.
- Cruckshank, R., Duguid, J. P. & Swain, R. H. A.** (1973) *Medical microbiology*, 12th ed. Edinburgh, London and New York, The English Language Book Society and Churchill Livingstone.
- FAO** (1995) *Year book on production*, Vol. 49. Rome, FAO.
- Frankland, G. C., Frankland, P. F. & Lankester, E. R.** (1987) Studies on some new microorganisms obtained from air. *Phil. Trans. Soc. Ser. B. Biol. Sci.* **178**, 257-287.
- Gast, R. K.** (1997) Recent *Salmonella pullorum* isolates using standard serological methods. *Poultry Sci.* **76** (1).
- Goda, F. F. M.** (1976) Serogrouping of pathogenic *E. coli* isolated from carcasses of new born Friesian calves at Benghazi and their sensitivity to certain antibiotics. *Bull. Anim. Hlth Prod. Afr.* **24** (2), 107-112.
- Hauge, S.** (1955) Food poisoning caused by aerobic spore bacilli. *J. appl. Bact.* **18**, 591-598.
- Hofstad, M. S., Calnek, B. W., Helmboldt, C. F., Reid, W. M. & Yoder, Jr. H. W.** (1972) *Diseases of poultry*, 6th ed. The Iowa State University Press.
- Ingram, M. & Simonsen, B.** (1980) *Microbial ecology of foods*. Academic Press for International Commission on Microbiological Specification for Foods.
- Marja-Liisa, H., Pekka, O. & Varpu, H. K.** (1997) *Aeromonas* spp. in fish, fish egg, shrimps and freshwater. *Int. J. F. Microbiol.* **34**, 17-26.
- Mulder, R. W. A. W.** (1996) Impact of transport on the incidence of human pathogens in poultry. *Wld Poult. Misset* **9**, 18-19.
- Masralla, H. & Zubeir, A. A.** (1978) Isolation of haemolytic *E. coli* from cases of bovine abortions. *Trop. Anim. Hlth Prod. Afr.* **10**, 214.
- Oppong, E. N. W.** (1987) Health control for sheep and goats in the humid tropics of West Africa. Sheep and goat meat production in the humid tropics of West Africa. *FAO Anim. Prod. Hlth Paper* **70**, 50-67.
- Pedrosa-Menabrito, A. & Regenstein, J. M.** (1988) Shelf-life extension of fresh fish: A review. 1. Spoilage of fish. *J. Fd Quality* **11**, 117-127.
- Quarles, C. L. & Bressler, G. O.** (1970) Bacterial contamination in poultry houses and its relationship to egg hatchability. *Poult. Sci.* **49**, 60-66.
- Schillinger, U. & Luecke, F. K.** (1987) *Food Microbiol.* **4**, 199.