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A Comparative Study on the Antimicrobial Resistance of *Escherichia coli* Isolates from Chickens and Fish Grown on Integrated and Traditional Fish Farms

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Escherichia coli **was isolated from fish grown in a pond that had never been exposed to antibiotic-supplemented feeds (control group), and from fish on an integrated farm, fed for 6 wk with manure of chickens that received tetracycline-supplemented and chloramphenicol-supplemented feeds.** ***E. coli*** **was also isolated from these chickens after being fed such for 23 d. The antibiograms of the isolates were determined using the disk diffusion method. The prevalence of** ***E. coli*** **isolates from fish and chickens on the integrated farm that were resistant to tetracycline and chloramphenicol, to trimethoprim-sulfamethoxazole, gentamicin, ciprofloxacin and amoxicillin were significantly higher ($p<0.05$) than those from fish in the control farm. In addition, the diversity of resistance was also greater among** ***E. coli*** **from the integrated farm group, which concurs with the results of other studies that exposure to antimicrobials results in higher prevalence of resistant isolates as a consequence of positive selection. On the other hand, the prevalence of resistant** ***E. coli*** **from fish and chickens on the integrated farm that received and those that did not receive antibiotics in their feeds were not significantly different ($p>0.05$), indicating that exposure to antimicrobials was not required for the occurrence and maintenance of resistant strains. The data suggest that prevalence of antimicrobial resistant strains is a result of the dynamic interplay of environmental and host-specific factors.**

Key Words: antibiotic resistance, antibiotic-supplemented feeds, antimicrobial resistance, integrated fish farms, livestock

INTRODUCTION

Integrated fish farming combines agriculture with aquaculture. Manure from livestock such as chickens and pigs, is used as food for the fish in the pond. To protect livestock from diseases, antibiotics are mixed with the animal feeds. Antibiotics are also used for growth promotion. Other studies have observed that animals fed with antibiotic-supplemented feeds were meatier than those fed with feeds lacking antibiotics (Dupont and Steele 1987; Witte 1998). More antibiotics are used for this purpose than for medical reasons. In the United States, as much as 70% of the antimicrobials are used in agriculture (Mellon et al. 2001). In Denmark, 24,000 kg of antibiotics related to glycopeptide avoparcin were utilized in animal feed, while only 24 kg were used for treating human infections (Witte 1998).

The use of antimicrobials in agriculture for nontherapeutic purposes and its consequences are unresolved issues that have to be addressed (Waldenstrom et al. 2005). On one hand, studies have shown that persistence or increase in the resistance level of microorganisms occurs independently of antimicrobial drugs (Chaslus-Dancla et al. 1987; Enne et al. 2001; Khachartryan et al. 2004). On the other hand, it is believed that the use of antimicrobials for prophylaxis and growth promotion contributes to an increase in the number of resistant microorganisms due to the positive selection pressure (Bryan et al. 2004; Sayah et al. 2005). Studies have shown that reducing consumption of antimicrobial drugs has been associated with a decrease in the prevalence of resistant microorganisms (Klare et al. 1999; Langlois et al. 1984)).

On integrated fish farms, there is an increased likelihood that more antimicrobial resistant bacteria will develop in the fish due to the antimicrobial residue and resistant bacteria present in the manure that is used to feed the fish, which may contribute to antimicrobial resistance in humans through the food chain. The incorporation of aquaculture and agriculture without proper management may pose a risk to public health (World Health Organization 1999).