

Antibiotics resistance patters of *Pasteurella multocida* isolation from cattle

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ABSTRACT: This study aimed to evaluate the efficacy of multiple antibiotics, including oxytetracycline, enrofloxacin, gentamicin, ampicillin, and erythromycin, against *Pasteurella multocida* isolates from cattle. Antibiotic susceptibility was assessed using the disk diffusion method. The results revealed consistent sensitivity of *P. multocida* to enrofloxacin and gentamicin, whereas three of the five isolates remained susceptible to oxytetracycline. In contrast, all isolates exhibited resistance to erythromycin and ampicillin. Notably, Type A strains displayed higher resistance to oxytetracycline than Type B strains, potentially due to differential selective pressure. These findings underscore enrofloxacin and gentamicin as the most effective therapeutic options for hemorrhagic septicemia in cattle, given their robust antibacterial activity against *P. multocida*.

Keywords:

hemorrhagic septicemia, *Pasteurella multocida*, antibiotic resistance, cattle

■ INTRODUCTION

Pasteurellosis, which encompasses hemorrhagic septicemia and bovine respiratory disease (BRD), remains a major health challenge in cattle and buffalo populations (Wilson & Ho 2013). Hemorrhagic septicemia is caused by *Pasteurella multocida* serotype B:2 in Asia and E:2 in Africa (Verma *et al.* 2020), whereas BRD, involving *Mannheimia haemolytica* and *P. multocida* serotype A, is triggered by stressors such as weaning and transport, resulting in severe pneumonia (Fulton *et al.* 2021). Effective disease control combines antibiotic therapy, vaccination, and stress mitigation to safeguard the health and productivity of herds (Griffin *et al.* 2020).

The indiscriminate use of antibiotics in livestock, particularly as growth promoters, has accelerated the emergence of antimicrobial-resistant (AMR) *P. multocida* strains and other pathogenic bacteria (Diarra & Malouin 2014). This increase in AMR poses a critical threat, leading to therapeutic failure and increased mortality rates. Mitigating this crisis requires prudent antibiotic use, rigorous vaccination protocols, enhanced biosecurity measures, and antimicrobial stewardship programs to ensure sustainable disease management.

■ MATERIALS AND METHODS

This study analyzed five bacterial isolates suspected to be *Pasteurella multocida* from the Laboratory of Bacteriology, School of Veterinary Medicine and Biomedical Sciences IPB University, Bogor Indonesia. Bacterial growth, identification media, and antibiotic discs (oxytetracycline, enrofloxacin, gentamicin, ampicillin, and erythromycin) were used for

characterization. Species identification was performed using biochemical assays (Barrow & Feltham, 2003), whereas molecular confirmation and capsule typing were performed using PCR (OIE 2012). Antibiotic susceptibility was assessed using the Kirby-Bauer disc diffusion method, and the results were interpreted according to the Clinical Laboratory Standards Institute (CLSI 2017) guidelines for infrequently isolated or fastidious bacteria.

■ RESULTS AND DISCUSSION

All bacterial isolates were identified as *Pasteurella multocida* through biochemical assays and confirmed via PCR (Figure 1). Serotyping revealed that three isolates belonged to serotype A, and two were classified as serotype B (Figure 2).

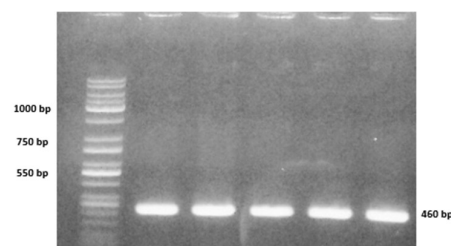


Figure 1. *P. multocida*-specific PCR result of 460 bp target specifically amplified by PCR in all *P. multocida* subspecies and serotypes by means of the primers KMT1SP6 and KMT1T7

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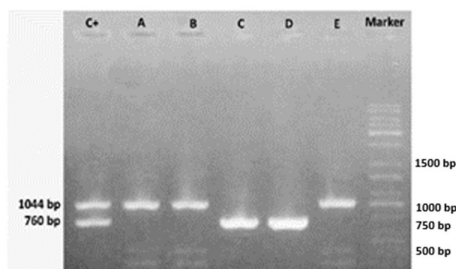


Figure 2. Capsular PCR typing result of 760 bp (serotype B) and 1044 bp (serotype A) target against *P. multocida* isolate. Note: C+=positive control and A-E= number of isolates.

Antibiotic susceptibility testing revealed that *Pasteurella multocida* isolates were highly sensitive to enrofloxacin and gentamicin, while three out of five were susceptible to oxytetracycline. All isolates displayed resistance to erythromycin and ampicillin. The susceptibility of Type A and B *P. multocida* to enrofloxacin aligns with findings by Davis *et al.* (2019), while gentamicin's efficacy agrees with reports by Clark *et al.* (2021).

Variations in oxytetracycline resistance between Type A and Type B *P. multocida* strains likely stem from genetic mechanisms and ecological pressures. Type A strains associated with respiratory infections frequently harbor the tet(H) gene, which encodes an efflux pump that expels tetracycline compounds, conferring higher resistance (Hansen *et al.* 2020). In contrast, Type B strains, linked to hemorrhagic septicemia, exhibit lower resistance levels, likely due to reduced tetracycline exposure in their environment (Chander *et al.* 2017).

The development of AMR in *P. multocida* is driven by plasmid-mediated gene transfer and chromosomal mutations, enabling resistance to multiple antibiotic classes. Plasmids of varying sizes play a critical role in conferring resistance to β -lactams and tetracyclines, and in facilitating the spread of AMR within Pasteurellaceae and other gram-negative bacteria (Johnson *et al.* 2020; Brown *et al.* 2019). *P. multocida* resists ampicillin through β -lactamase production and erythromycin via efflux pumps or ribosomal modifications. In contrast, enrofloxacin and gentamicin remain effective because of their distinct mechanisms of action, bypassing common bacterial resistance pathways (Diarra & Malouin 2014).

Table 1 Interpretation zone based on Clinical and Laboratory Standards Institute (CLSI) 2017 obtained from five isolates of cattle

Antibiotics	Groups	Interpretation					Sensitivity (%)
		I	II	III	IV	V	
Oxytetracycline	Tetracycline	R	S	R	R	S	40
Enrofloxacin	Fluoro-quinolone	S	S	S	S	S	100
Gentamicin	Amino-glycoside	S	S	S	S	S	100
Ampicillin	Beta lactam	R	R	R	R	R	0
Erythromycin	Macrolide	R	R	R	R	R	0

Note: I-V= number of isolates, S= Sensitive, R= Resistant

CONCLUSION

This study demonstrated that *Pasteurella multocida* isolates exhibit the highest sensitivity to enrofloxacin and gentamicin, with moderate susceptibility to oxytetracycline. In contrast, all isolates displayed complete resistance to ampicillin and erythromycin. These findings highlight that enrofloxacin and gentamicin are the most effective antibiotics for treating hemorrhagic septicemia and offer critical guidance for antimicrobial selection in disease management.

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