

Prevalence and quantification of ESBL/AmpC-producing *Enterobacteriaceae* in retail seafood in Berlin

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Background

The use of β -lactams for disease treatment and growth promotion in veterinary medicine could lead to the increasing resistance to β -lactams in bacteria of animals. The most common mechanism of β -lactam resistance in Gram (-) bacteria is the production of β -lactamases, especially extended-spectrum β -lactamases (ESBL) and AmpC β -lactamases.

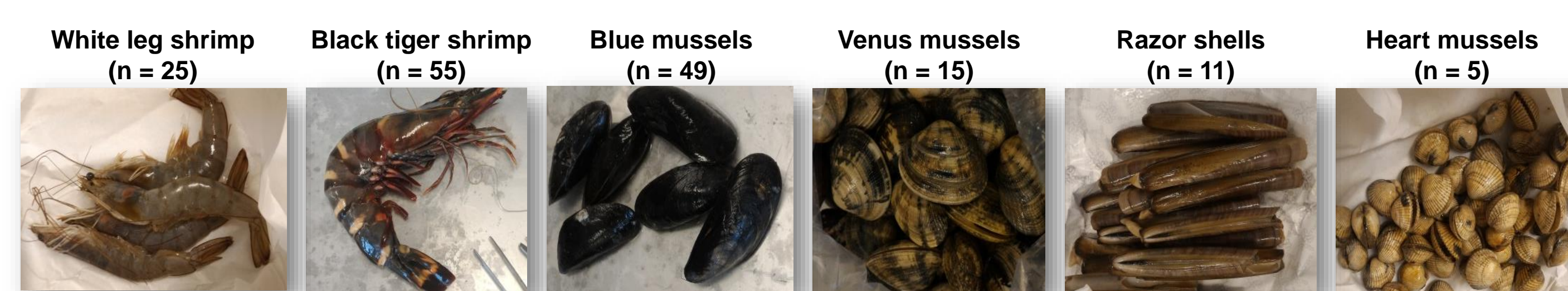
ESBL/AmpC-producing *Enterobacteriaceae* have become an emerging public health concern because of infection treatment mistakes caused by these microorganisms. High contamination rates of several foods with ESBL/AmpC-producing *Enterobacteriaceae* have been reported recently. However, there is limited information on the presence of these microorganisms in seafood.

The objectives of this study were to determine the prevalence and the quantitative load of ESBL/AmpC-producing *Enterobacteriaceae* in retail seafood in Berlin, Germany.

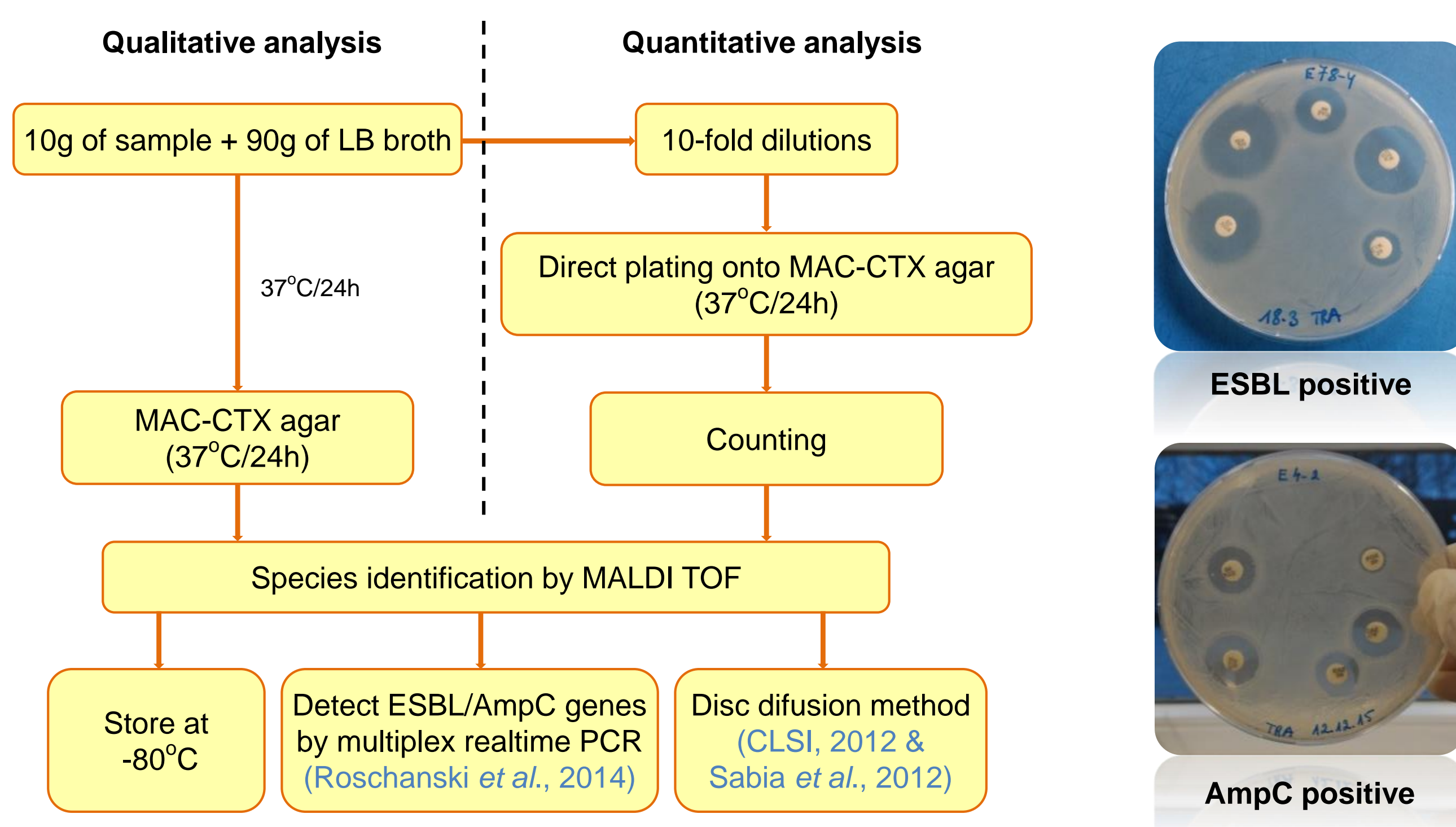
Material and Methods

Sample collection

A total of 160 raw seafood samples, consisted of 80 shrimp and 80 mussel samples, was purchased from supermarkets and seafood shops in Berlin from December 2015 to August 2016.



Isolation and identification of ESBL/AmpC-producing *Enterobacteriaceae*



Data analysis

Data analysis was done using SPSS software. Chi square tests or Fisher exact tests were applied for comparison of ESBL/AmpC prevalences, the significance level was set at $p < 0.05$.

Results and Discussion

Prevalence of ESBL/AmpC-producing *Enterobacteriaceae*

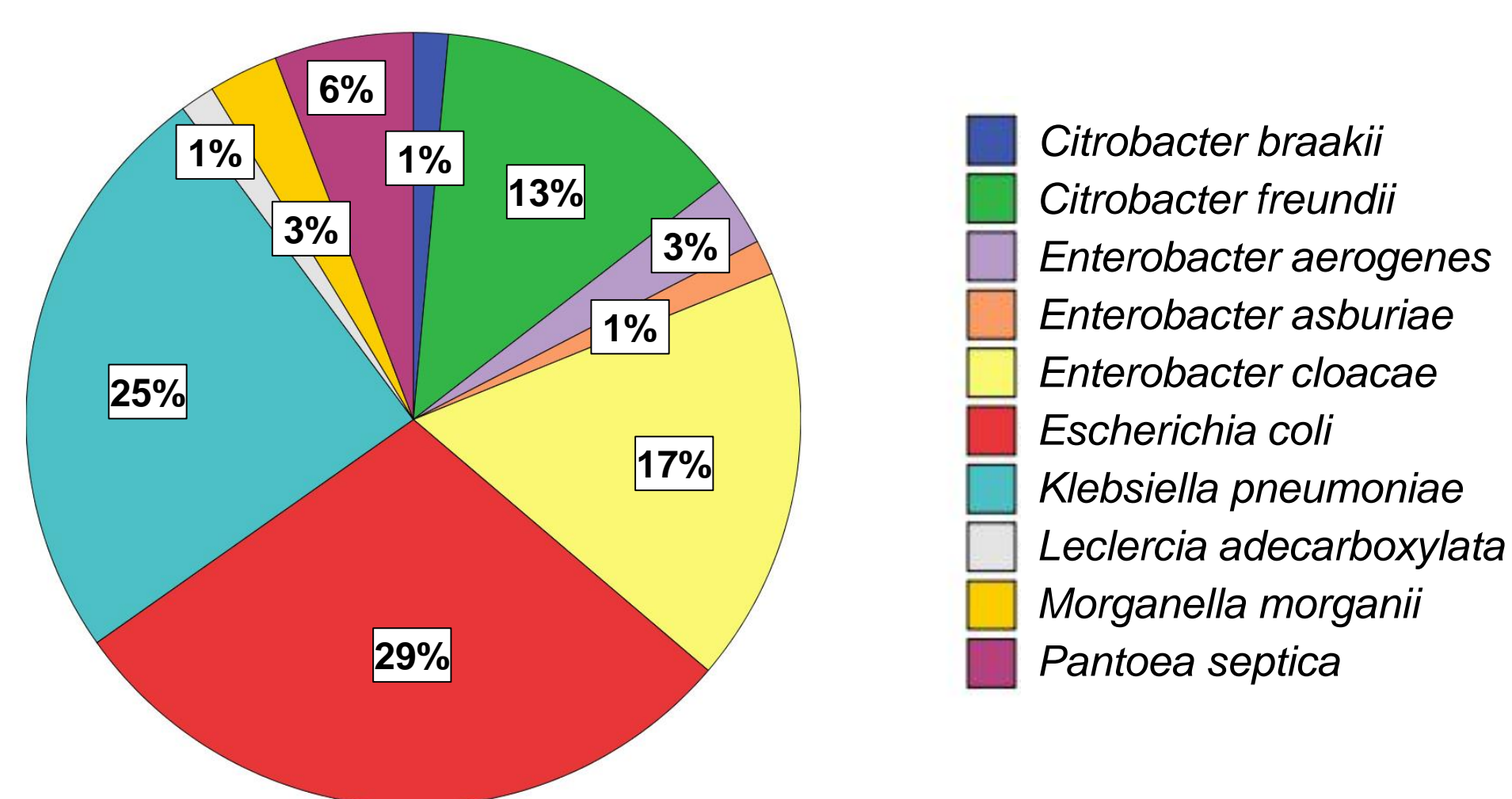


Fig. 1 ESBL/AmpC-producing *Enterobacteriaceae* isolates (n = 69)

In total, 69 ESBL/AmpC-producing *Enterobacteriaceae* isolates from 31 samples were identified, *E. coli* was the predominant species (Fig. 1).

The prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in seafood was 19.4% (95% CI, 13.2 - 25.6%) (Fig. 2). The prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in shrimp was slightly higher than in mussels (22.5% versus 16.3%), however there was no significant difference between prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in two types of samples ($p > 0.05$).

To our knowledge, this is the first report on the prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in retail seafood in Germany. Comparable data on the prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in retail seafood are not available.

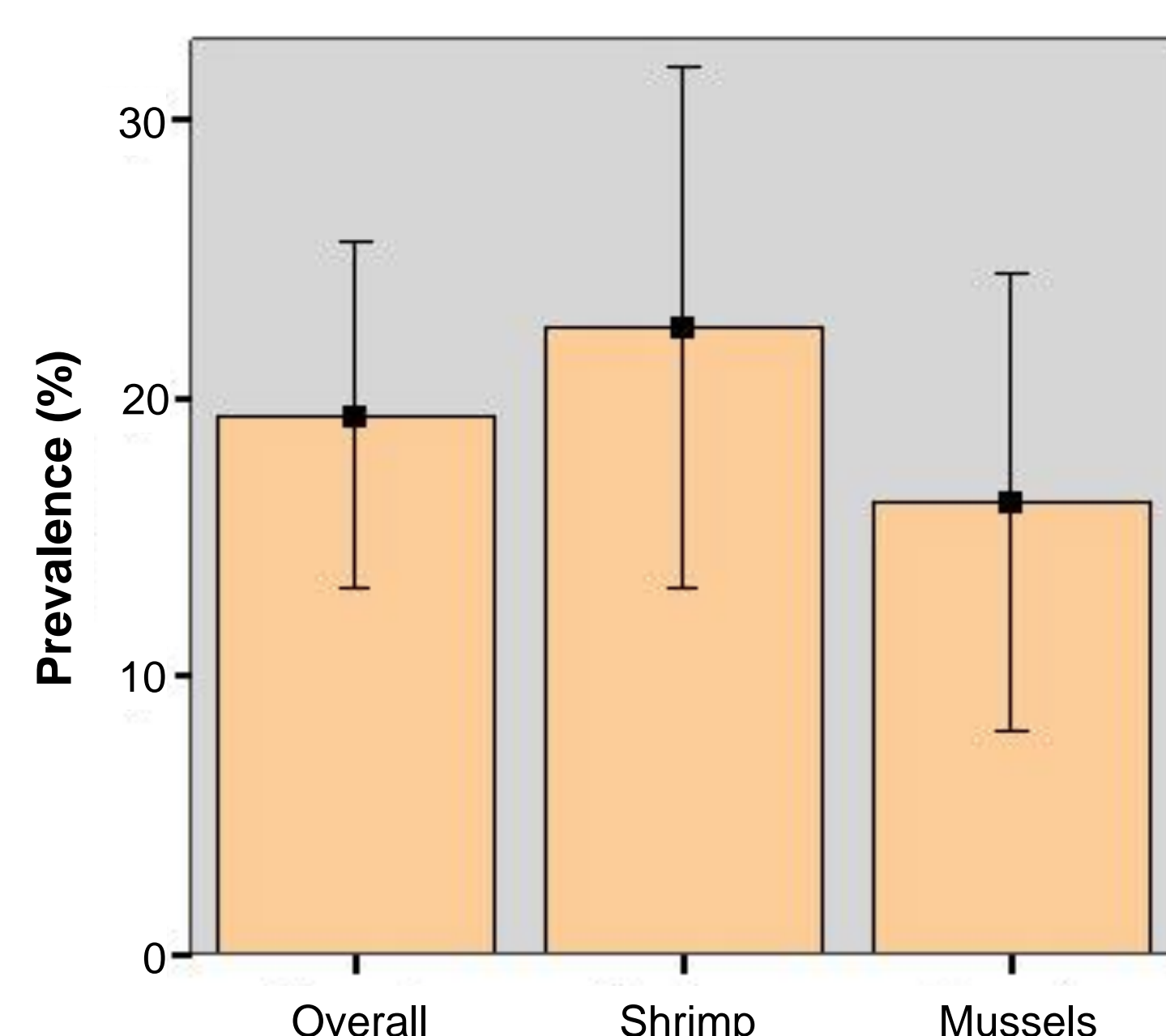
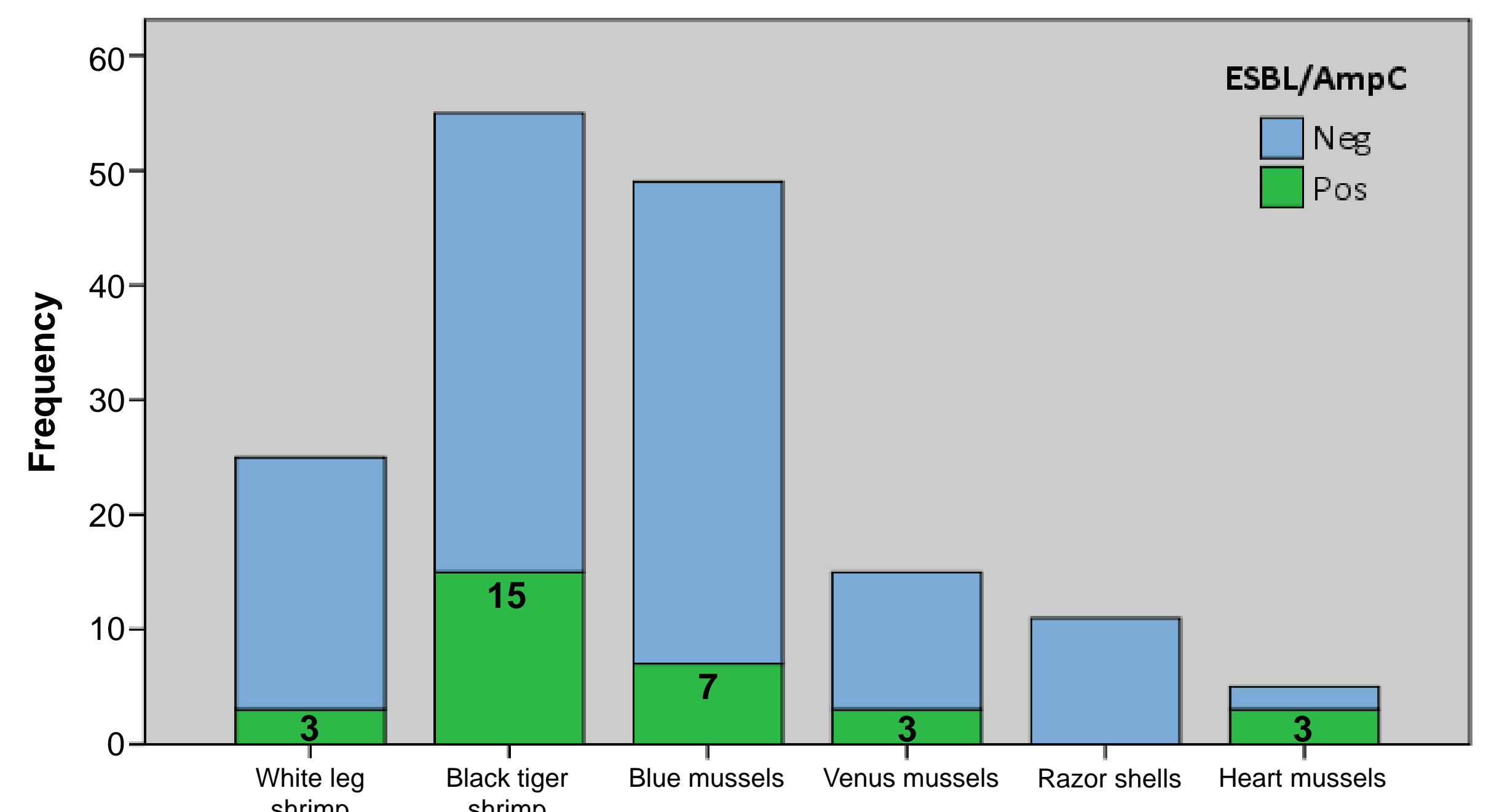


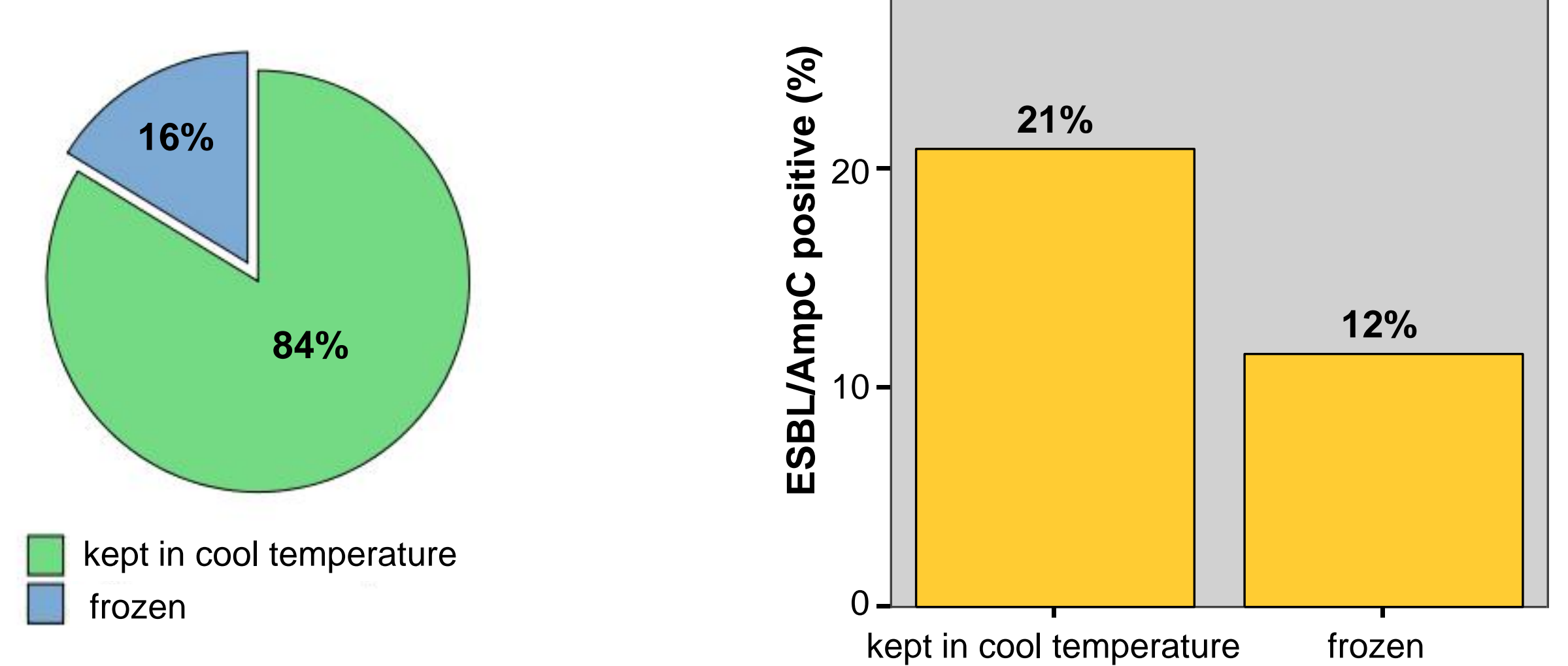
Fig. 2 Prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in seafood (Note: Error bars show 95% CI)



* No significant difference between prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in different seafood species ($p > 0.05$)

Fig. 3 Distribution of ESBL/AmpC-producing *Enterobacteriaceae* in different seafood species

Seafood storage conditions



* No significant difference between prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in different storage conditions ($p > 0.05$)

Fig. 4 ESBL/AmpC-producing *Enterobacteriaceae* in different storage conditions

Quantitative analysis

The quantitative analysis result showed that 1.9% of the samples had ESBL/AmpC-producing *Enterobacteriaceae* counts between 100-1000 CFU/g, while most of the samples (98.1%) had a concentration of these microorganisms < 100 CFU/g. All seafood samples were kept under cool temperature or frozen, therefore, low concentration of ESBL/AmpC-producing *Enterobacteriaceae* would be expected.

Characterization of ESBL/AmpC β -lactamase genes

Fig. 5 shows the β -lactamase genes presented in *Enterobacteriaceae* isolates. The SHV type gene was the most prevalent β -lactamase gene.

Among *Enterobacteriaceae* isolates, 36 isolates were carried a single gene, 9 isolates contained two gene types (CTX-M & SHV, CTX-M & TEM, SHV & TEM) and 24 isolates showed the negative results by realtime multiplex PCR for the presence of CTX-M, SHV, TEM and AmpC-CIT.

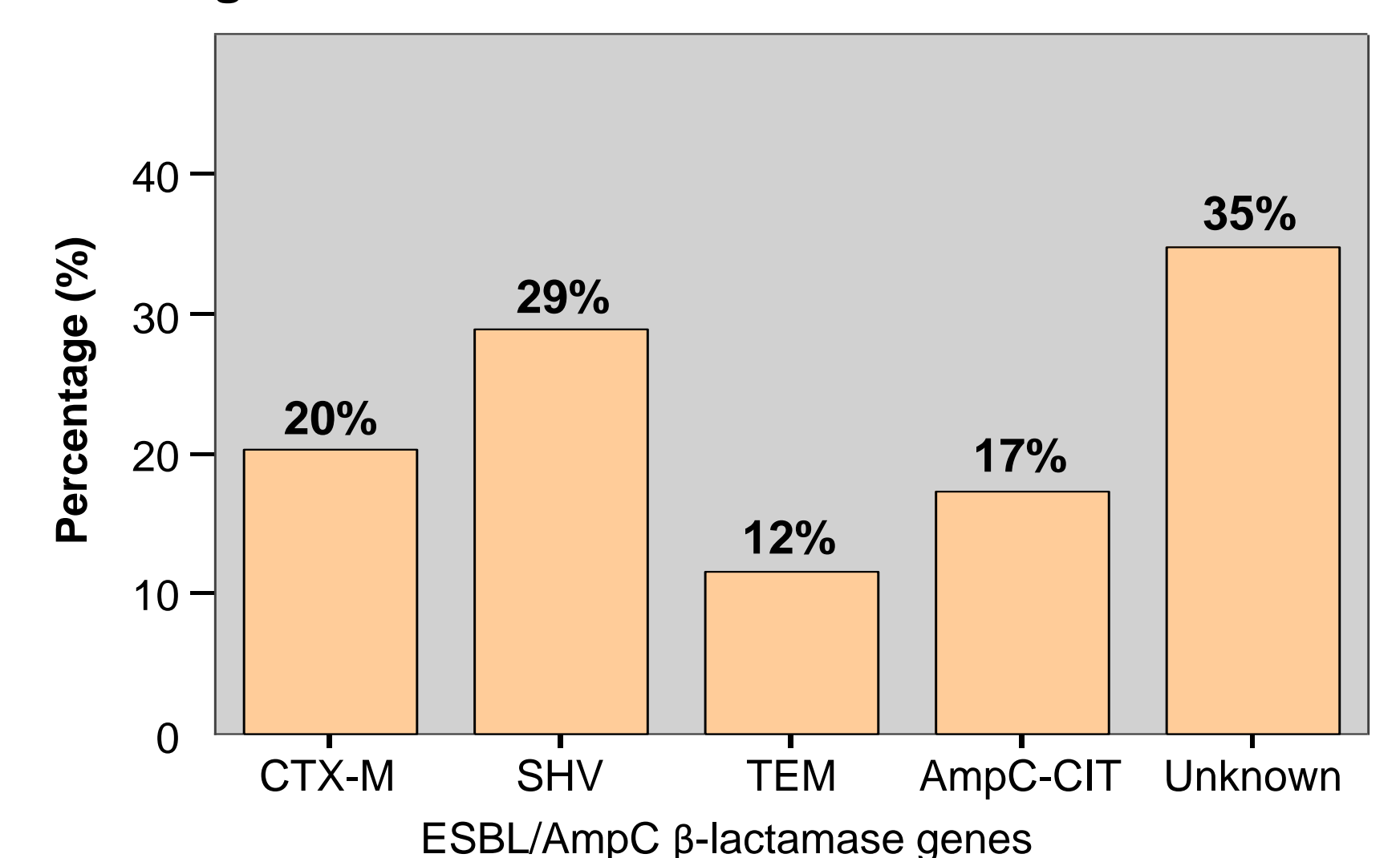


Fig. 5 Distribution of ESBL/AmpC β -lactamase genes in *Enterobacteriaceae* isolates (n = 69)

Conclusion

This study indicated the evidence of hazard potential of seafood containing ESBL/AmpC-producing *Enterobacteriaceae*. Though the quantitative contamination level was low, high prevalence of ESBL/AmpC-producing *Enterobacteriaceae* in seafood has to be of concern to public health.

Acknowledgment

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