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INVESTIGATION ON THE PENETRATION VITALITY OF MEAT-DERIVED *PSEUDOMONAS FRAGI* IN FRESH PORK

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I. INTRODUCTION

Penetration could accelerate the meat spoilage by enabling spoilage microorganisms to penetrate from the surface of the meat to the inner [1]. Current evidences suggested moveability, chemotaxis toward nutrients and proteolytic activity of bacteria may facilitate penetration in meat, though not conclusively established [2-3]. There are still gaps in the knowledge of the complete mechanism of bacterial penetration. This study aimed to investigate the strain characteristic influencing the penetration vitality in meat of *Pseudomonas*, underscoring the significance of their motility and nutrient utilization abilities, thereby enhancing the understanding of bacterial penetration in meat.

II. MATERIALS AND METHODS

Three strains of *Pseudomonas fragi* (*P. fragi*) were selected from a pool of 73 *Pseudomonas* strains based on their varying motility and proteolytic activity. The growth curves, flagella count, chemotaxis towards meat nutrients, and glucose utilization activity of these 3 strains were measured. And 3 strains were uniformly inoculated onto sterile pork cuboids and stored at 25°C for 0 h, 10 h, and 16 h. The total viable count in each layer of the meat was determined to assess the penetration vitality of the strains.

III. RESULTS AND DISCUSSION

As shown in Figure 1, *Pseudomonas lundensis* exhibited strong motility, with strain 49 showing the strongest motility (47.76 mm). *Pseudomonas fluorescens* had strong swarming ability, with strain 73 displaying the strongest swarming motility (23.88 mm). And strain 45 had the strongest protein proteolytic activity (16.10 mm). Three strains (Strains 49, 54, and 55) of *P. fragi* were selected from a pool of 73 *Pseudomonas* strains based on their varying motility and proteolytic activity for further investigation.

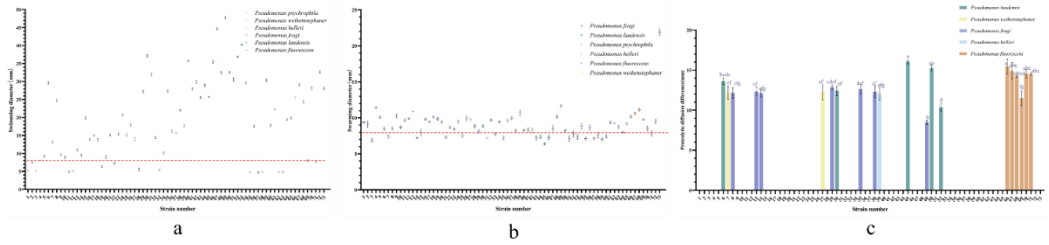


Figure 1. The swimming (a), swarming (b), and protein proteolytic (c) diameter diagrams of 73 strains of *Pseudomonas*.

After treatment with strain 49, the sarcoplasmic protein (48 kDa) was degraded on 3d, and the myofibrillar protein (45 kDa) degraded on 2d and 3d, which was due to the fact that only strain 49 had proteolytic activity (Fig. 2).

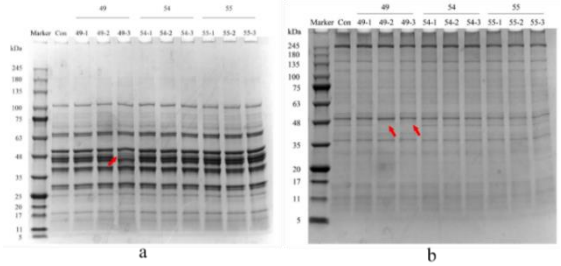
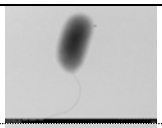
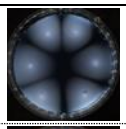
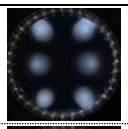
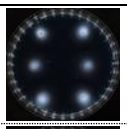
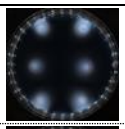
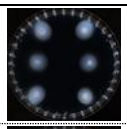
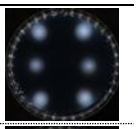
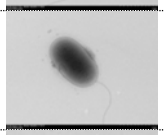
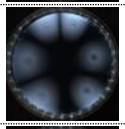
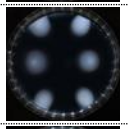
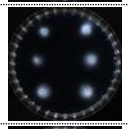
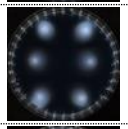
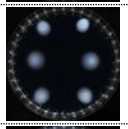
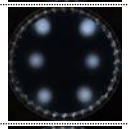
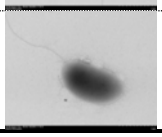
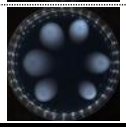
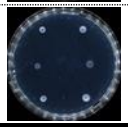
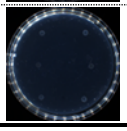
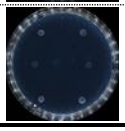
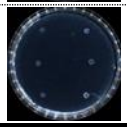
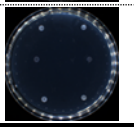


Figure 2. The SDS-PAGE results of the degradation of sarcoplasmic protein (a) and myofibrillar protein (b) for three strains of *P. fragi* with different permeability.

In Table 1, results revealed that strain 49, which exhibited strong motility and proteolytic activity, demonstrated significantly superior growth ability, nutrient chemotaxis, and glucose utilization activity compared to strain 54 (which had motility but no proteolytic activity) and strain 55 (which lacked both motility and proteolytic activity).

Table 1. Flagella counts and the chemotaxis of the three *P. fragi* strains towards nutrients.

Strains	Flagella	The chemotaxis of the three *P. fragi* strains towards nutrients					
		Glucose	Lactic acid	Aspartic acid	Glutamic acid	Leucine	Lysine
49							
54							
55							

The results of penetration ability showed that strain 49 took only 10 h to penetrate into the third layer of meat. However, strain 54 and 55 took 16 h to penetrate into the third layer of meat (Fig. 3). Proteolytic activity may be a prerequisite for bacterial penetration, as the bacteria penetrated by degrading proteins in muscle tissue. However, the results indicated that bacterial penetration did not entirely depend on proteolytic activity. These results were consistent with the viewpoint of Sikes et al. [4].

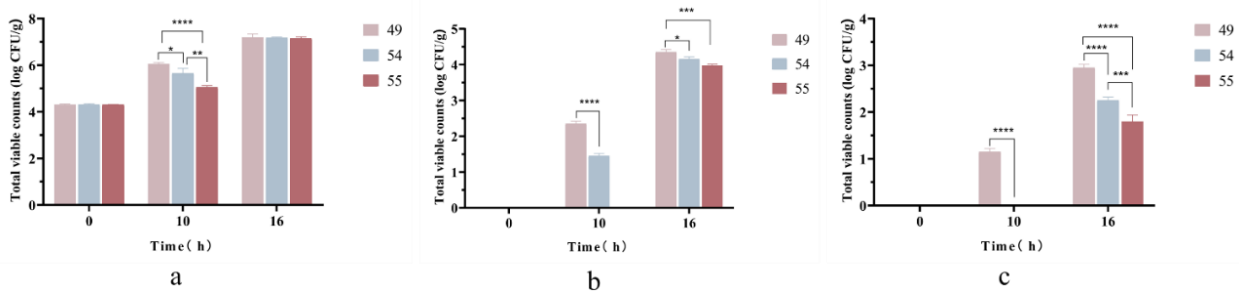


Figure 3. Total colony counts of three *P. fragi* strains in each meat layer: First layer (a), second layer(b), third layer(c)

IV. CONCLUSION

This study demonstrated that *P. fragi* strains with different characteristics (including motility and nutrient utilization abilities) exhibited varying levels of penetration vitality in meat. This study provided new insights into the penetration of spoilage microorganisms to better control the spoilage process of meat in meat industry.

ACKNOWLEDGEMENTS

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