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Mass spectrometric detection of the addition of porcine blood plasma to emulsion-type pork sausages

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INTRODUCTION

Porcine blood plasma powder has high protein content at low costs, and advantageous functional properties. It may be added to meat products, but must be declared. If undeclared, this type of food fraud has been difficult to detect, especially if plasma is added to meat of the same animal species. In order to detect porcine blood plasma in meat products, we developed a rapid UHPLC-MS/MS method, using the example of emulsion-type pork sausages.

CONCLUSION

This method allows to detect the addition of porcine plasma powder with an LOD of 1 % meat substitution ($P<0.05$). The method is based on the multi-peak area from 4 plasma peptides, measured in control samples and sausages spiked with plasma powder. An application to unknown samples should comprise comparative measurements of the samples to be tested together with adequate blank and spiked reference samples.

RESULTS

Meat and meat products always contain some residual blood and, consequently, blood proteins (Figure 1A). Therefore, the qualitative detection of plasma peptides alone does not identify an addition of blood plasma. But signals increase with the amount of plasma powder added (Figure 1).

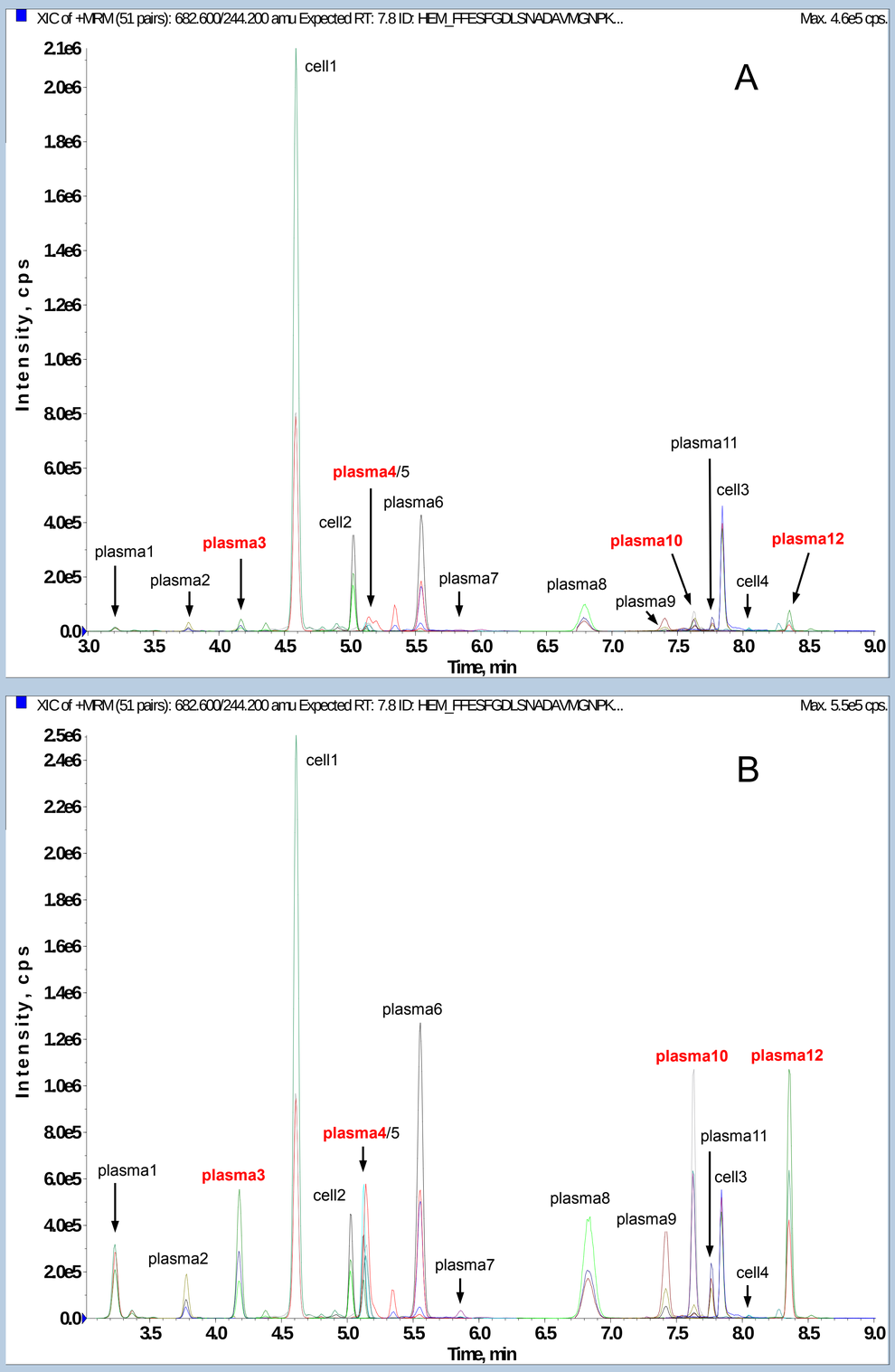

Figure 1: Chromatograms of the cell and plasma marker peptides in control sausages (A) and in sausages with 5 % meat substitution (B).

Four out of 12 plasma peptides were most robust and differentiated best between control samples and sausages spiked with plasma powder. Their combined multi-peak area was used to identify the detection limit of the method, controlling the false-positive and false-negative error rates at 0.01 or 0.05 (Figure 2).

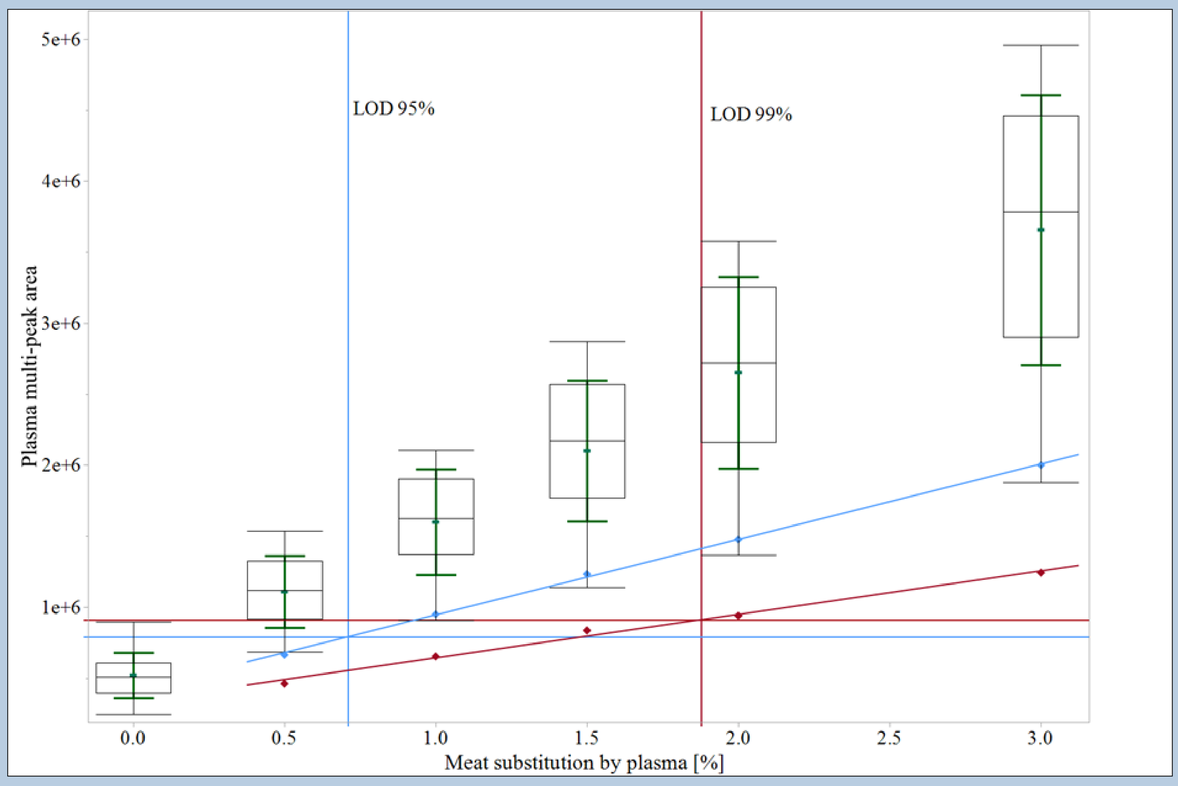

Figure 2: Determination of the limit of detection (LOD) to identify meat substitution by plasma from the plasma peptide multi-peak area. Box plots (black) and mean ± SD (green) display the distribution of measured values per level of meat substitution (0 – 3 %); horizontal lines are upper prediction limits for the control sausages (0 % meat substitution, N = 50), dots and their regression lines are lower prediction limits for the spiked sausages (0.5 – 3.0 % meat substitution, N = 25 for each level); blue or red dots and lines are for 0.95 or 0.99 prediction limits, respectively; LODs (vertical lines) are at the intersection of control upper limits and lower-prediction-limits regressions for spiked sausages.

MATERIALS AND METHODS

Emulsion-type pork sausages with 0.5, 1, 1.5, 2, 3 or 5 % meat substitution by plasma (16 series, each) and blank samples (32 series) were produced from different raw materials, each with one out of two commercial plasma powders, and as semi- or full- preserves.

Blood plasma powder proteins were extracted from the meat products, and were digested with trypsin in a rapid one-pot process (1 h at 55 °C). HPLC-MS/MS measurements with a QTrap 5500, and reference to the MASCOT database, identified species-specific peptides, 12 for plasma and 4 for cell proteins.

Reference:

Stader et al. (2019): A rapid UHPLC-MS/MS screening method for the detection of the addition of porcine blood plasma to emulsion-type sausages. Submitted to *Analytical and Bioanalytical Chemistry*.