

IPD Project Details

Project ID: IPD3790

Project Title: SWATH-LC MS-based quantitative secretomics reveals trigger factor as a novel drug

Description: In the present study, we have analysed the secretory proteins of multidrug resistant (MDR) and -sensitive strains of *E. coli* isolated from a prominent urban river (Yamuna) which traverses through the National Capital Region of India. Both the strains investigated in this study were phylogroup D strains and of the same genomic clade as revealed by REP-, ERIC- and BOX-PCR based genotypic fingerprinting. Comparative secretomic analysis of multidrug-resistant and -sensitive strains was performed and the biological functions and metabolic pathways of the differentially expressed secreted proteins were elucidated. Subsequently, Protein-protein interaction (PPI) networks of the differentially expressed secretory proteins were determined followed by identification of hub proteins. The similarity of the hub proteins with the human proteins was determined and those exhibiting non-homology with human proteins were explored as potential drug targets against MDR *E. coli*. Our results revealed 675 differentially expressed proteins of which 54 proteins were overexpressed and 235 proteins were underexpressed. The differentially expressed secreted proteins were primarily involved in metabolic pathways, biosynthesis of amino acids/proteins and secondary metabolites and stress response. The PPI networks of the overexpressed proteins revealed a hub protein — trigger factor (tig) which was non-homologous to the human proteins. Tig is a cold stress molecular chaperones protein which regulates several biological pathways directly/indirectly related to antibiotic stress. To combat antimicrobial resistance, new drugs which bind to novel biological pathways/components of the pathogens are urgently needed. Microbial secreted proteins (secretome) are important for pathogenesis and adaptation/survival in various environmental stresses, including antibiotics. Thus, they can be explored as novel drug targets. Thus, the protein identified in our study can be explored as a novel drug target against *E. coli*, inhibitors of which might not cross-react with human proteins. To the best of our knowledge, this is the first study comparing the secretomes of MDR and -sensitive strains of *E. coli* isolated from a waterbody.

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Sample Preparation: The secretory proteins of two strains of *E. coli* – *E. coli* IP9 and *E.*

coli IPE were investigated using data independent acquisition (DIA)-based sequential window acquisition of all theoretical fragment ion spectra – liquid chromatography mass spectrometry (SWATH-LC MS/MS). Both the bacterial strains were revived by overnight incubation in Luria-Bertani (LB) broth at 37 °C, 200 rpm from our 50% (v/v) glycerol stocks preserved in our laboratory (-80 °C deep refrigerator). The culture filtrate proteins were prepared after harvesting cells by centrifugation at 8000 rpm for 10 min (at 4 °C) from the exponential phase (OD 600 = 0.8) cultures. The proteins in the cell free supernatant were concentrated using a Vivacell 250 ultra-filtration unit (Sartorius AG, Germany; filter cut off 3 kDa) to a final volume of 0.5 ml. The concentrated culture filtrate proteins were precipitated overnight and the air-dried protein pellet was suspended in a protein dissolving buffer for protein concentration estimation by Bradford assay.

Peptide Separation: Identification of the secretome by nanoLC Triple TOF5600 MS. Equal amounts of secretory proteins from both the bacterial strains were trypsin-digested and analysed using a Triple TOF 5600 mass spectrometer. The separated peptides were ionized and multiply charged molecules were fragmented using the IDA TM (information dependent data acquisition) criteria of the analyst software for library generation in triplicates. MS1 was acquired in the mass range of 1.25 kDa-0.35 kDa and the 20 most abundant multiply charged peptides were fragmented in the mass range of 0.15 kDa to 1.50 kDa in MS2. After peptide identification, the pooled peptide list was used as a spectral library for further SWATH analysis. Experiments were performed in biological and technical replicates.

Protein Characterization: SWATH parameters. During SWATH, Q1 transmission window was set to 12 Da with the mass range 0.35-1.25 kDa. Total 75 windows were acquired independently with an accumulation time of 62 ms, along with three technical replicates for each of the sets. Total cycle time was kept constant at less than 5 s. For label free quantification, the peak extraction and spectral alignment were performed using PeakView® 2.2 software with SWATH TM micro app (ver 2.0) using the following criteria: number of peptides selected for quantitation 2, confidence of peptide identification (greater than 95%), number of fragment ions for each peptide as 5, extraction ion chromatogram (XIC) peak width was fixed at 30 ppm for matching the retention time (RT), XIC extraction window for matching the peptide across different samples was set at 5 min. The statistical analysis and fold change calculations of the data was done using the software MarkerView TM (ver. 1.3.1 Sciex). The peak area under the curve for the selected peptides was normalized using the total peak area.

Experiment Type: Bottom-up

Species: Escherichia coli -561 No Data

Tissue: Data in tissue_details No Data

Cell Type: Data in cell_details No Data

Disease: Data in disease_details No Data

Instrument Details: AB SCIEX TripleTOF 5600 Data in instrument_details

Protein Modifications:

PubMed ID: