MIcrocalorimetry: new method to evaluate metabolism of healthy and injured pancreatic islets and RINm5F insulinoma cells

Grazioli, G.[1]; Mariani, D.B.[1]; Campos-Lisboa, A.C.V.[1]; Silva-Alves, J.M.[2]; Santoro, M.M.[2]; Mares-Guia, M.[2]; Sogayar, M.C.[1]; Mares-Guia, T.R.[1]

[1], Chemistry Institute, University of São Paulo, Biochemistry Department

[2] Institute of Biological Sciences, Federal University of Minas Gerais, Biochemistry and Immunology Department

Transplantation of human pancreatic islets is a promising alternative therapy for type 1 Diabetes mellitus. However, a faster and more accurate method to assess islet viability prior to transplantation in order to better predict islet functioning is required. We set out to validate a new method, based on microcalorimetry. RINm5F (an insulin-producing tumor cell line), was cultured in the presence of different concentrations of IL1-β (0,5; 3 and 5ng/mL) and TNF-α (5; 30 and 50ng/mL) pro-inflammatory cytokines for 96h and cell metabolism was evaluated by microcalorimetry and compared to the MTT colorimetric assay, in order to determine if microcalorimetry was capable to measure the difference in the metabolic responses. The heat release was lower as higher were the cytokines concentrations. A positive correlation was observed between heat release and MTT metabolism. In another set of experiments, 1,000 human islets were stimulated with either 2.8mM or 20mM glucose and the metabolic response was monitored in the microcalorimeter for 1h. Islets released average heat values of 0.69±0.022 and 1.41±0.125 μcal/islet upon injection of 2.8mM and 20mM glucose, respectively. The glucose stimulation heat index was 2.04±0.17, positively correlating with the insulin secretion index. Heat release was analyzed at different RINm5F cell concentrations. The device was able to properly detect the heat released by cells at cell concentrations between 10^8/mL and 10^3/mL. These data demonstrate that microcalorimetry has the capacity to evaluate the metabolism of RINm5F cells and human islets and can be a helpfully toll to predict islet functioning.

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