

A CYTOMORPHOLOGIC CHARACTERIZATION OF PANC-1 CELLS EXPOSED TO INCREASING GLUCOSE CONCENTRATIONS USING REPEATED MEASURES ANALYSIS TECHNIQUES

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ABSTRACT

Previous studies in our laboratory provided evidence that PANC-1 cells can be manipulated into insulin-producing cells by altering the culture medium with increasing amounts of glucose. However, there is a paucity in the literature regarding cytomorphologic characteristics of PANC-1 cells under normal culture conditions and when challenged with increased amounts of glucose. This experiment evaluated the cellular, nuclear and cytoplasmic characteristics within groups of PANC-1 cells at 24-, 48-, and 72-hours exposed to varying percentages of glucose in media. Initially, cells were grown in flasks with a control medium and then split into four separate groups containing control media or media containing an extra 1%, 2.5%, or 5% extra glucose. Cells from the three cultures were plated (1×10^5 cells/well) and treated with control, 1%, 2.5%, or 5% glucose for 24-, 48-, and 72-hours. Cells and supernatants were harvested, and the cytomorphologic characteristics were compared across all three-time phases. Nominal data were analyzed using non-parametric statistics calculating mean ranks to compare changes within all four groups using the Kruskal-Wallace H statistic. There were statistically significant differences in morphological characteristics within glucose concentration groups at 24-, 48-, and 72-hours ($p<0.05$). The most telling was the stability in ranks observed in the nuclear characteristics at the 2.5% extra glucose concentration. At the 72-hour phase, ranks for the nuclear and other characteristics became more variable, indicating stress and degeneration of the PANC-1 cell populations. This study contributes valuable semi-quantitative data regarding the viability and function of PANC-1 cells over 72-hours with increasing glucose challenge and demonstrates proof of concept that PANC-1 or other insulin-producing cell-lines could be further engineered into useful components in drug delivery and organ-function replacement applications.

Keywords: morphometric analysis, morphometry, repeated measures, PANC-1 cells, cell and tissue engineering

INTRODUCTION

Diabetes is a chronic condition affecting many individuals with 34.1 million diagnosed cases and an estimated 7.3 million undiagnosed cases in the United States. It is the seventh leading cause of death and costs approximately $327 billion/year to treat [1]. Although advances in treatment and technology have revolutionized diabetes management and improved patient outcomes, treatment is still not ideal and requires a great deal of monitoring by the patient and provider [2,3]. Developing a variable-release, drug delivery system containing living cells that could respond to the changing physiological host environment