CURCA CENTER FOR UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

University at Buffalo
The State University of New York

Effect of Fatty Acids on Prostate Cancer Cell Proliferation & Metabolism

Brenden Bratton and Wilma A. Hofmann, PhD
University at Buffalo, Jacobs School of Medicine & Biomedical Sciences, Department of Physiology & Biophysics

Abstract

The most common cancer diagnosed in men is prostate cancer[1]. Multiple studies analyzing a correlation between weight and the occurrence of cancer demonstrated that obese men have a significantly higher incident of aggressive prostate cancer than men of healthy weight; even though the diagnosis of prostate cancer in both groups is similar[2]. The objective of my proposed project is to analyze the effects of various fatty acids on the metabolic activity of normal prostate cells and prostate cancer cells. To accomplish this, three different prostate cell lines (non-cancer and cancer with varying degrees of invasive ability[4]) will be analyzed in regard to changes in metabolic rate in response to varying concentrations of seven different fatty acids. At the conclusion of this study it is expected that I will have identified the exact type and concentration of fatty acids that affect the growth of each of these cells.

Background

Despite the analysis of the link between obesity and the incident of aggressive prostate cancer, there is a limited understanding of the cellular processes that are involved in this relationship. We are currently analyzing the effect of specific fatty acids that are common in Western diets of overweight and obese men on a variety of cellular functions of normal prostate and prostate cancer cells to gain a better understanding of how dietary fatty acids may contribute to the development of aggressive prostate cancer. Studies on the effect of environmental fatty acids on cells from other cancers showed alterations in lipid metabolism of the cells as well as a change in proliferation in the reactions to these fatty acids. For example, a study on ovarian cancer demonstrated that an increase in the fatty acid concentration in the microenvironment of the cells promotes tumor growth[3].

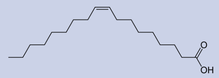
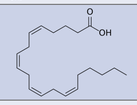
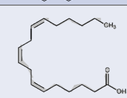
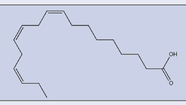
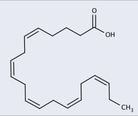
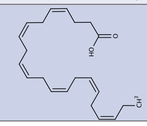
Methods

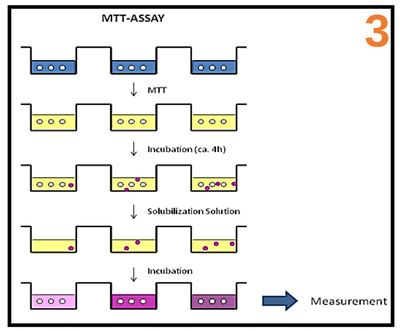
Three different cell lines with different metastatic potentials were tested and maintained in culture for the duration of the experiments: PC3 (high metastatic potential), C4-2 (mid-level metastatic potential), and LNCaP (low metastatic potential). To test the effect of fatty acids on cell metabolism, a pre-determined number of cells were plated in 48-well plates. Twenty-four hours after plating, the growth medium was replaced with medium containing different concentrations of a specific fatty acid ranging from 50μM-400μM to determine the relevant concentration that affects metabolic activity. It is important to note that the cells were treated in an RPMI medium that is free of Fetal Bovine Serum (FBS) in order to eliminate exposure to any other fatty acids. Seventy-two hours after treatment, a (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) tetrazolium assay, or MTT assay, was performed to determine cell viability[5].

University at Buffalo
University Honors College

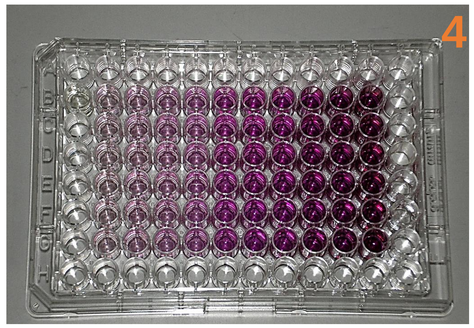
Materials

Cell Lines Used	Metastatic Potential 1
PC3	★★★★★
C4-2	★★★☆☆
LNCaP	★★☆☆☆

Fatty Acids	Structures 2
Oleic Acid (OA) (Monosaturated omega-9)	
Linoleic Acid (LA) (Polyunsaturated omega-6)	
Arachidonic Acid (AA) (Polyunsaturated omega-6)	
γ-Linoleic Acid (GLNA) (Polyunsaturated omega-6)	
α-Linolenic Acid (Polyunsaturated omega-3)	
cis-5,8,11,14,17-Eicosapentaenoic Acid (EPA) (Polyunsaturated omega-3)	
cis-4,7,10,13,16,19-Docosahexaenoic Acid (DHA) (Polyunsaturated omega-3)	



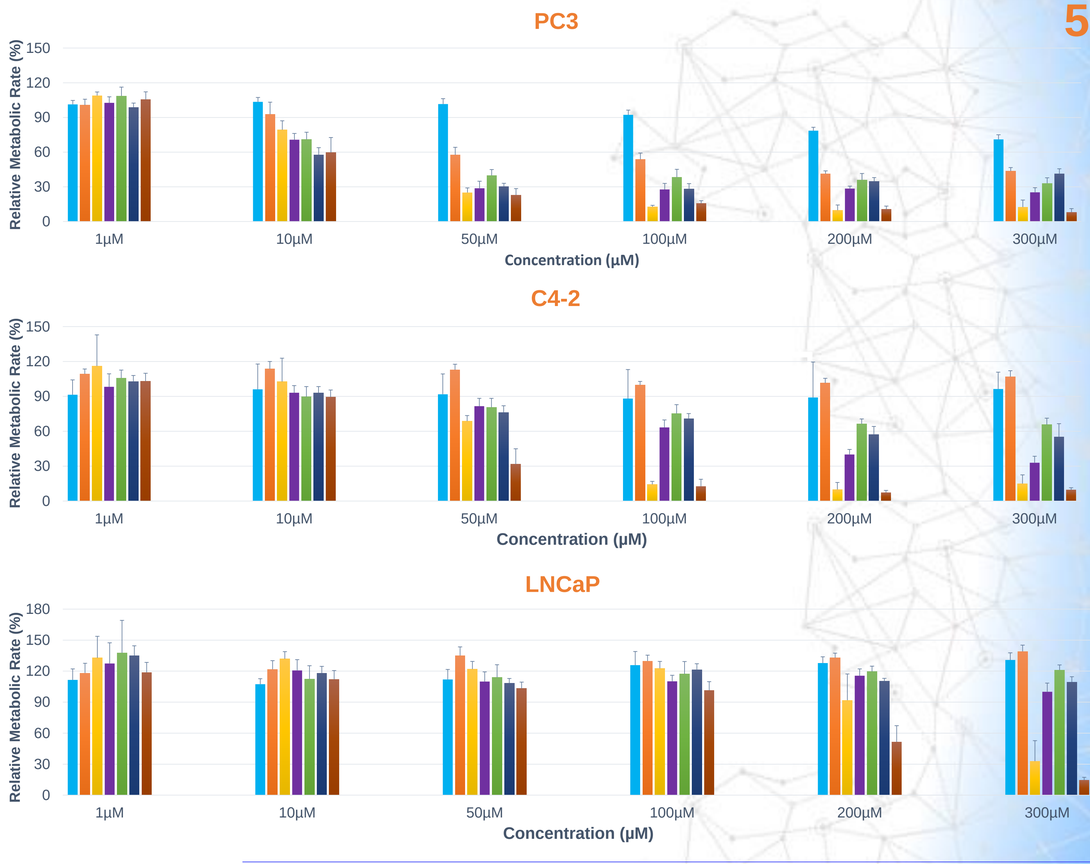
http://2010.igem.org/Team:Freiburg_Bioware/Project/Methods#MTT_Assay



Various. "MTT Assay." *Wikipedia*, Wikimedia Foundation, 17 Feb. 2018, en.wikipedia.org/wiki/MTT_assay.

(**1**) Prostate cancer cell lines analyzed and their metastatic potentials (more stars correspond to a higher metastatic potential). (**2**) The fatty acids used in this study and their structures (color coding is respective to graphs; see Figure 5). (**3**) MTT colorimetric assay procedure. (**4**) Completed MTT Assay showing cell viability (darker wells represent more viable cells). (**5**) Results of experiments graphed to a standard of 100% cellular viability for PC3, C4-2, & LNCaP after 72-Hour incubation.

Results



Conclusions & Future Directions

Upon analysis of our data, we can see an inverse relationship between the relative metabolic rates of the each cell line with increasing concentrations of fatty acids. The higher concentrations of fatty acids have the greatest effect on the metabolic rate of the PC3 cell line, and the least effect on the metabolic rate of LNCaP. The results of this project will contribute to the growing understanding of the effect of fatty acids on prostate cancer cell proliferation in humans. In the future, this can have a great impact on the development of new medications, treatment methods, or preventive measures that will hopefully one day eradicate the disease.

References

1. Berger, Eleni. "What Is Prostate Cancer?" American Cancer Society. American Cancer Society Medical & Editorial Team, 16 Feb. 2016. Web. 17 Feb. 2017.
2. E.H. Allott, E.M. Masko, S.J. Freedland, Obesity and prostate cancer: weighing the evidence, European urology 63 (2013) 800-809.
3. Currie E, Schulze A, Zechner R, Walther TC, Farese RV Jr.. Cellular fatty acid metabolism and cancer. Cell Metab. (2013) ;18(2):153-61
4. Cunningham, D. and You, Z (2015) In vitro and in vivo model systems used in prostate cancer research. J Biol Methods. 2(1): doi:10.14440/jbm.2015.63.
5. Riss, Terry L. "Cell Viability Assays." *Assay Guidance Manual [Internet].* U.S. National Library of Medicine, 01 July 2016. Web. 21 Feb. 2017.