

# Linking Diabetes and Depression Through BDNF and Myeloperoxidase

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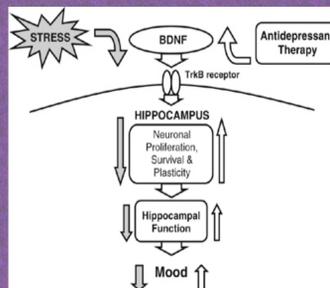
## ABSTRACT

Diabetes-induced depression has become an important point of research as a difference between the rate of depression in diabetics and "healthy" people has become apparent. The point of concern is the idea that diabetics may have a physiological difference that makes them more susceptible to depression. Two biomarkers that have been found to be consistent with depression and diabetes in separate studies are Brain Derived Neurotrophic Factor (BDNF) and Myeloperoxidase (MPO). These will be tested for in participants through two groups, which will consist of a "non-depressed" group and a depressed group according to their responses to the questions of the Beck Depression Inventory Questionnaire (BDIQ), which scores the level of depression. Between both groups, diabetic participants (with an A1C >5.7%) will be dispersed into either group depending on their BDIQ answers. These two groups will be compared for any correlation between the values of BDNF, MPO, A1C, and BDIQ. BDNF and MPO will also be measured through participant's blood samples to look for physiological signs of depression, which may or may not be correlated to the severity of diabetes. This research strives to find a correlation between these two diseases, which may lead to advances in treatment of both diabetics and those with depression.

## INTRODUCTION

BDNF is a protein that acts on neurons, vital in the process of communication in the brain, within the central nervous system (CNS) and the peripheral nervous system (PNS). Its purpose is to support the survival of neurons and stimulate the growth and differentiation of new neurons and synapses in the brain. Depression has been shown to decrease the expression of BDNF, which can lead to atrophy of the hippocampus, a part of the brain thought to regulate emotion, memory, and other functions of the body that we do not voluntarily control. It has also been shown that those who have been diagnosed with diabetes have expressed lower amounts of BDNF and other studies have suggested that BDNF may play a role in insulin resistance, a common issue for those with Type 2 diabetes or adult onset Type 1 diabetes, where cells do not respond correctly to insulin, a hormone that plays a major role in the body's process of blood sugar regulation.

The next biomarker, MPO is an enzyme that is found abundantly in white blood cells, a part of the immune system that is responsible for protecting the body against foreign bodies, and is found to be an important inflammatory enzyme in depression. In various studies it was found that those who were part of the depressed population had significantly higher levels of MPO. It has also been found that higher levels of activation of MPO in adipose tissue has played a part in obesity and insulin resistance, and thus diabetes.

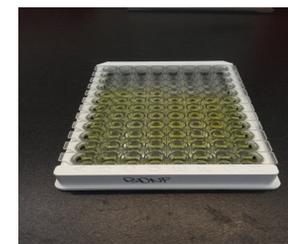
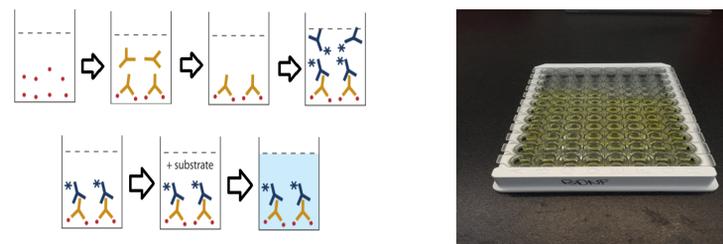


## ACKNOWLEDGEMENTS

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## MATERIALS & METHODS

### BDNF AND MYELOPEROXIDASE ELISA PROCEDURE



**Figure 1.** The wells of the 96 well plate contain an antigen. Antibodies are added and then attach to the antigens in the plate, any unattached antibodies are washed away. A second antibody is added and attaches to the antibody and antigen combination. Another washing step removes any antibody that isn't attached. A substrate is then added to produce a color change.

### HEMOGLOBIN A1C

Hemoglobin A1C is a test that screens for diabetes and pre diabetes in adults. It can also be used to monitor how well blood glucose is being controlled over the span of 2-3 months. Hemoglobin A1C was tested on a Mindray BS-200 using EDTA whole blood.

### BECK DEPRESSION INVENTORY QUESTIONNAIRE

The Beck Depression Inventory Questionnaire was created by Aaron T. Beck and is commonly used by the American Psychological Association (APA) in the diagnosis of the severity of depression. The questionnaire consists of 21 questions designed to pinpoint the key characteristics of depression and rate it on scale of minimal symptoms to severe symptoms of depression.

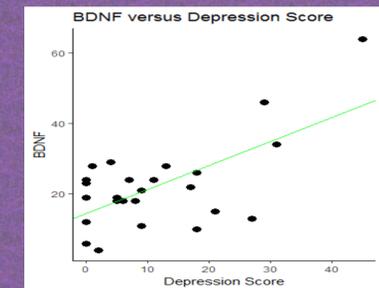
Raw Scores	Depression Severity
0-13	Indicates minimal depression
14-19	Indicates mild depression
20-28	Indicates moderate depression
29-63	Indicates severe depression

## DISCUSSION AND CONCLUSION

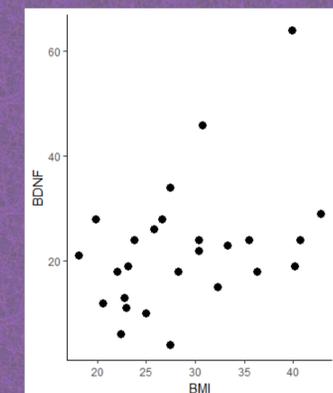
There was no statistical correlation between depression and diabetes through BDNF and MPO. However, there was some statistical correlation between BDNF and depression. From previous research BDNF scores were suppose to decrease as Depression levels increased. We found the exact opposite. It is possible that our sample size was not large enough, as other studies that were able to find a correlation between depression and diabetes through BDNF and MPO had hundreds of participants.

A Fasting Glucose from participants would have provided a better look into how well managed a Diabetic was before entering in as a participant. It may also have been more insightful if more Biomarkers could have been added into the study. With more Biomarkers, other Diabetes and Depression connections may have been able to be forged. Unfortunately, we did not have the funding to add more Biomarkers. As for grouping the participants, it would have been beneficial, in regards to correlations, to break up the Diabetics in the study into Pre-diabetics, Type 1, and Type 2 diabetics. These added groups may have allowed the researchers to see a trend along the increasing severity of diabetes in correlation with the biomarkers.

## RESULTS



**Figure 2.** Linear regression relationship between BDNF and Depression Score. Here the correlation can be seen to be the opposite of what previous research has found. BDNF scores were suppose to decrease as Depression levels increased. Significant p value:  $4.4 \times 10^{-4}$



**Figure 3.** Correlation shown between BDNF and Body Mass Index (BMI). It was predicted that BDNF would be lower in Diabetics which may suggest that BDNF would also decrease as participant BMI increased. This correlation shows that BDNF increased as participant BMI increased. Significant p value: 0.03693

Sample Distribution	
Female	54%
Male	46%
Depressed	27%
Non-Depressed	73%
Diabetes	23%
No-Diabetes	77%
Overweight	58%
Non-Obese	42%
Depression and Diabetes	12%

**Figure 4.** Participant sample size was 26.