INTRODUCTION
Diabetes is a heavily investigated disease as it is very detrimental to a vast majority of the human population. There has been a significant rise in cases of diabetes from 108 million people as of 1980 to 422 million cases as of 2014 [1]. This significant rise is another reason why this disease needs to be studied in order to work towards finding a cure and a solution. However, this disease is very complicated and while there are many resources that are being poured into there is still much work to be done in this field.

There are various types of diabetes and each type has its own specific complications that need to be dealt with separately. Type I diabetes is a specific type of diabetes that occurs as a result of cellular-mediated autoimmune destruction of beta cells of the pancreas. The destruction of these beta cells leads to improper utilization of insulin in the body which leads patients to be dependent on lifelong insulin intake. Type II diabetes on the other hand is a function of a patient who has low insulin sensitivity. While they are capable of developing insulin they aren’t able to properly utilize the insulin in their body. This type of diabetes accounts for about 90 percent of diabetic cases. There is also an additional type of diabetes that is called Gestational diabetes. This type is unique in the case that it only occurs among pregnant mothers. These mothers only develop the diabetes during their pregnancy and once they give birth to their children, the diabetes then disappears.

Another important aspect of diabetes is hyperglycemia as it is a major complication of the disease. Hyperglycemia is defined as high blood sugar in which glucose levels in the blood over accumulate [2]. As an important aspect of diabetes, we investigate the effect of hyperglycemia in our research. More specifically we are interested in seeing the physical effects that occur when hyperglycemia on neonatal kidney development. We are interested in seeing the physical effects that occur when hyperglycemia is introduced to offspring and how that ultimately is detrimental to their kidney development.

HYPOTHESIS
It was hypothesized that a high glucose environment would phenotypically effect kidney development. In order to develop this analysis, diabetic mouse models were utilized in order to simulate the conditions that would imitate the transfer of hyperglycemia from the mother to the offspring. These offspring were then taken from this model and their kidneys were then used for analysis.

METHODS
There were two mouse models that were developed for this study. The first model was developed as the control as it represents normal glucose levels. In this model, a black6 female mouse is crossed with a black6 male mouse in order to develop black6 control offspring. The second model that was used was the high glucose model that depicted hyperglycemia in the mice. In this model an Akita female mouse is crossed with a black6 male mouse in order to develop hyperglycemic offspring. The Akita mouse is a mouse that is genetically modified to develop type I diabetes. It is also beneficial that the kidneys of mice are similar in anatomy and function to human kidneys which makes them ideal for this study.

In order to develop the high glucose model, the blood glucose concentration of the female Akita mouse was routinely checked until it reached an optimal diabetic state which is around 300-400 mg/dl. Once this diabetic state is reached, the female Akita mouse is then crossed with the black6 male mouse. Once the female becomes pregnant, we waited about 19-21 days for the birth of the pups before continuing with our experiment. We then obtained the pups at postnatal day 0 which is equivalent to the day that they are born. We first measured the size and weight of the pups for data analysis. We then harvested the kidneys from the pups which we also sized and
weighed. We then fixed the kidneys in PFA (which is a parafilm mold) and then prepared them for analysis. From this mold, we sectioned the kidneys onto slides for analysis. We then performed immuno-fluorescent staining as well as histology on the slides for phenotypic analysis. From these slides we were then able to analyze and quantify the Jagged-1 positive structures in the kidneys. The Jagged-1 positive structures are depicted in the green areas of Figure 1 such as the epithelial vesicle, comma-shaped body, s-shaped body and future glomerulus.

**Figure 1.** Depiction of the development of the metanephric kidney

**RESULTS**

When looking at the phenotypic results that were obtained from our slides we were able to proceed with various conclusions. We first performed a histology on the slides in order to be able to locate the structures present in the kidney sections themselves. As seen in Figure 2, the structures of the control kidney don’t show an overt difference from the hyperglycemic kidney.

**Figure 2.** Histology images for the control versus high glucose offspring kidneys

However, we then performed an immunofluorescent staining on the slides in order to identify the expression of specific proteins in the kidneys. We tried different protein makers for our staining. We first utilized a Six2 stain which identified the structures in the pink in Figure 1 however, we didn’t observe much differences in the expression or number of structures present with the Six2 protein. When we utilized the Jagged-1 marker we were able to observe an increase in expression of the protein in the high glucose model as see in Figure 3.

**DISCUSSION**

While it seems to be obvious that there is an overexpression of the Jagged1 protein in the high glucose model compared to the control, we still made sure to confirm this by quantifying the data that we obtained. We did this by performing a QPCR which is a quantitative PCR method of measuring various structures. From this method we were able to clearly see that there was a much larger expression of the Jagged1 protein in the high glucose model compared to the control model which was a positive result for our findings.

The reason that we are very concerned with the expression of the Jagged1 protein is that this protein is an integral part of the notch signaling pathway which is integral for the gene expression for kidney development. While we aren’t completely sure of the correlation and relevance of the overexpression of the Jagged1 protein in the notch pathway, we know to a considerable degree that it is related to kidney development.

**CONCLUSION**

We hypothesized that hyperglycemia would have an effect on neonatal kidney development and with our experimental methods we were able to determine that an increase in glucose environment leads to overexpression of Jagged1. Jagged1 is a notch signaling ligand which is very crucial for kidney development. Therefore we are able to see a positive correlation to our hypothesis.

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**REFERENCES**