

Student Last Name

Diagnosis of Kidney Disorders Through Urine Testing

Student Name

Mrs. McIntosh-Clodd

SCB 4U1

Date

Student Last Name

Abstract

There are many different types of kidney diseases that people may suffer with for their entire lives. There is a simple way of detecting kidney disease by studying urine samples. Just by determining the glucose and protein levels within a urine sample, one can detect an exact kidney disease. Within this lab, 3 different kidney diseases are found in 3 different urine samples including Diabetes Mellitus, Diabetes Insipidus and Bright's Disease. Sugar and protein levels are revealed by adding Biuret reagent or Benedict's solution to the urine samples. Through research and analyzing results, the causes of these kidney diseases are discovered.

Introduction

The purpose of this study was to determine which samples indicated which disease out of the following: Diabetes Mellitus, Diabetes Insipidus, Bright's disease and the excessive loss of body water while exercising. The detection of certain kidney disorders in different urine samples can be easily discovered by this lab study. With a few drops of Biuret reagent in one trial and Benedict's solution in another, the changed colours of the urine revealed the protein and sugar levels. Biuret reagent can be used to identify proteins (Giuseppe, M..D. et Al 2003). It is made of sodium hydroxide and copper sulfate, which reacts with peptide bonds joining amino acids (Biuret Test, 2010). The solution will turn from blue, to purple or pink if protein is present. Nelson Biology 12 Textbook explains that Benedict's solution is used to identify glucose and other sugars in the urine samples. The percentage of sugar is determined by the colour of the solution, being much more specific than the previous trial. The copper sulfate in Benedict's solution reacts with the reducing sugars to form a colour depending on the amount of sugar (Biuret Test, 2010). Blue indicates no sugar, light green 0.5-1.0% sugar, green to yellow shows 1.0-1.5% orange 1.5-2.0% and red to brown indicates 2.0% and more (Giuseppe, 2003). The purpose of this study was to determine which samples indicated which disease out of the following:

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Diabetes Mellitus, Diabetes Insipidus, Bright's disease and the excessive loss of body water while exercising.

Hypothesis/Prediction

After reading about kidney disease in my textbook, I predict that the samples with the highest glucose level will have Diabetes Mellitus. The blood-sugar level should be higher than 1.0%. Diabetes Insipidus can be indicated by the amount of urine in one sample because sufferers tend to lose about 20L each day. Also I think it could be the lightest coloured urine, because those who have Diabetes Insipidus must have to drink a lot of water to replenish themselves. I believe that the sample with Bright's disease will have a high protein level. Finally, I think that the urine sample that loses a lot of water during exercise is X, the darkest shade of urine, because when one is dehydrated, they lose a lot of water.

Methods and Materials

The necessary materials to perform this experiment were collected and used accordingly. Making sure the materials were clean with no leftover chemicals, 20 drops of urine sample A, W, X, Y and Z were dropped into separate test tubes. To begin the first trial, 10 drops of Benedict's solution. Using a hot water bath, the samples were heated to 80 degrees Celsius and observed for 6 minutes. The colours of the samples were then recorded. Washing each test tube thoroughly and again making sure they were clean with no leftover chemicals, 20 drops of each urine sample was dropped into their labeled tubes. This time, 20 drops of Biuret reagent was added to each test tube and tapped to mix the contents. These colours were also recorded in a chart.

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Results

Table 1. Results Shown After Heating Benedict's Solution and Urine Samples to 80 Degrees Celcius

Sample Blood-Sugar	# of Drops	Minutes Heated	%
A	10	6	Light blue (-)
W	10	6	Orange (1.5-2.0)
X	10	6	Light Blue (-)
Y	10	6	Light Green (0.5-1.0)
Z	10	6	Light Blue (-)

Table 2. Results Shown After 20 Drops of Biuret Reagent Added to Urine Sample and Tapped

Sample Protein?	# of Drops	Minutes Heated	
A	20	0	yes
W	20	0	no
X	20	0	no
Y	20	0	no
Z	20	0	yes

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Table 3. pH Level of Each Sample

pH Level	Sample
A	6
W	7
X	2
Y	8
Z	7

Analysis/Discussion

Through this experiment, the colours of the urine samples helped indicate which sample is which disease. Diabetes Mellitus, is caused by the body being unable to metabolize glucose properly (Wrong Diagnosis, 2010). P. Lemone explains in her medical book that this creates a high level of sugar in the blood, otherwise known as hyperglycemia. With Diabetes, a higher blood-sugar concentration exists than 1.0% (Giuseppe, 2003). When the glucose level is too high, kidneys cannot reabsorb it into the blood (Lemone, 2004). There is an overload on glucose, therefore the excess amounts cannot be filtered by the glomerulus (Giuseppe 2003). The text explains that as a result, the glucose goes through the urinary tract and ends up mixed in with urine. This is considered very abnormal unless suffering with Diabetes Mellitus. The only result indicating a higher blood-sugar level than 1.0% is sample W.

Diabetes Insipidus is a very rare disease caused by anti-diuretic hormone (ADH) producing cells that are destroyed usually by a brain injury or stroke (Lemone, 2004). ADH is the hormone that regulates water

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absorption, so without it one voids a lot of urine. Lemone shows that one's urine with Diabetes Insipidus has a pH level of 8 (Renal Function, 2009). This pH level is found in sample Y.

Bright's disease is caused by "inflammation of nephrons" according to Biology 12. This affects the blood vessels of the glomerulus. Its filters become enflamed and proteins leak through. The reason for this happening is that the inflammation causes permeability of large molecules such as proteins that are normally retained in the blood (Lemone, 2004). The results that were found with protein within the urine was sample Z and sample A.

The final sample left over, being sample X can be proven to be the sample which loses a tremendous amount of body water while exercising. The measurement of the pH as well as the colour of the urine helps identify dehydration. When exercising and feeling the effects of becoming dehydrated, ADH is released causing sodium and water retention within the kidneys (Lemone, 2004). This causes a decrease in urinary output (The Specific Gravity of Urine, 2010). Referring to the article about specific urine gravity, the normal pH level of urine is 6, but when one is dehydrated, the urine becomes more concentrated, lowering the pH level.

According to a Chinese Research Center, some recommended treatments for Diabetes Mellitus is monitoring ones blood sugar, as this is very important when controlling a disease. A glucose level must remain close at all times. Type 1 requires the intake of insulin as well as checking sugar levels at least twice a day, while Type 2 only requires one to self-monitor glucose once or twice a week (Diabetes Treatment, 2010). The learning center states that Synthetic Human Insulin is commonly used by people with diabetes. It is a natural hormone that is produced by the islets of Langerhans in the pancreas, which is secreted when blood-sugar levels are high (Giuseppe, 2003). Those with diabetes do not have enough insulin in their system to manage glucose properly. Some factors one with Diabetes Mellitus should take note of that will change their blood-sugar levels are:

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- Food
- Physical activity (sugar is used as energy)
- Illness (may cause hormones to raise blood sugar levels)
- Alcohol (lowers levels)

A recommended treatment for Diabetes Insipidus can be treated by the tablet or nasal spray known as vasopressin. This is a form of ADH which helps keep water in the system (Diabetes Treatment, 2010).

Conclusion

In conclusion, most of my hypothesizing was correct, but my results required much more detail. This laboratory experiment relates to many people in the world suffering of kidney disease. It is good to know that something this serious can be so easily detected today. This could possibly prevent kidney diseases from occurring if it is caught early enough, or just help one be treated sooner and more effectively. Urine samples can also possibly relieve somebody of their worries about having a kidney disease and assist in a scientists understanding of how exactly they are developed.

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