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The Correlation Between the Glucose Level and Stress Level Among Medical Laboratory Science Students

JACOB S. BORONG
ORCID No. 0000-0002-7070-480X
borongjacob@yahoo.com

MARX JOLIAN S. DANN
ORCID No. 0000-0002-7760-8570
Marx_Mj15@yahoo.com

ENER HANK B. MICABALO
ORCID No. 0000-0002-9195-4250
Ener_hank@yahoo.com

YLAH KLARA SHEMIDAH C. PADILLA
ORCID No. 0000-0003-4093-7482
Ykscpadilla1@gmail.com

JEE EMMANUEL T. PARCON
ORCID No. 0000-0002-9531-0292
Enriquegil03@yahoo.com

TERESITA MAE A. ROMANILLOS
ORCID No. 0000-0002-3656-6626
Tamy_roman02@yahoo.com

Liceo de Cagayan University
Cagayan de Oro City, Philippines

ABSTRACT

The point of conducting this study was to know how stress levels affect the body's glucose levels especially among 3rd year Medical Laboratory Science students in Liceo de Cagayan University, and to determine how stress can pose a risk to the health of the students, and how they could deal with the stress they get from school. The study aimed to know the correlation between the glucose level and stress level among the 3rd year Medical Laboratory Science students. The researchers used the descriptive research design with diagnostic laboratory procedures. In the study, the researchers did not only determine the profile of the subjects and stress level, but they also determined the subjects' blood glucose level. The findings reveal that majority of the students were most prone to stress before and during the exam. In terms of glucose level, the results showed that more of the respondents have normal glucose level. There is a significant relationship between the stress level and glucose level of the respondents before the exam but there is no significant relationship between the stress level and glucose level of the respondents after the exam.

Keywords: Glucose, Stress level, Medical Laboratory Science students

INTRODUCTION

Modern life is full of frustrations, deadlines, demands, and pressure which causes stress to people, young or old. Everyone has his/her fair share of stressful events and circumstances already by the time they reach the certain age of maturity. As early as a day old, a baby has already experienced stress in so many ways. Take for example, when a baby cries that is already stress. However, just like other illnesses or diseases, stress is one of the body's ways of telling you that something is wrong. "Stress is simply a reaction to a stimulus that disturbs the physical or mental equilibrium of the body," says Paul Hiljich in Psychology Today. When there is too much pressure from home, school, or work, the body takes the initiative in letting one know that he or she had enough for today—that one needs to rest.

The way a person responds to a situation may also be a type of stress. Part of the response to that certain situation is physiological, and this affects the physical state. When faced with a challenge or a threat, the adrenal medulla releases two hormones, the epinephrine, and norepinephrine. These are the body's so-called

"Fight-or-Flight" hormones (Russel, Hertz, Mcmillan, Biology the Dynamic Science 3rd edition). If one is upstairs at home and a fire starts, the faster he can get himself and his family out the more likely they are all to survive. If a person needs to save somebody's life during that fire, by lifting a heavy weight that has fallen on him, he will need the hormones in the body to be activated to give him that extra strength he might just need to save his family - that extra push. During these situations, the body produces larger amounts of the chemicals cortisol, epinephrine, and norepinephrine, which trigger a higher heart rate, heightened muscle preparedness, sweating, and alertness.

Stress is a normal part of life, and such producers of stress as physical exercise, various emotional states, and creative activities are usually considered healthy (Burchfield, n.d.). Prolonged and unwanted stress, however, can have undesirable effects on mental and physical health although reactions to such pressure can vary among various individuals.

Stress is one of the common problems among people nowadays. There are studies which say that stress is one of the main reasons why people have a certain disease. Moreover, it seems that each and every disease bottoms down to one common cause—stress. One of the most common diseases associated with stress is diabetes. Most people have had that bad habit of stress eating, which obviously poses a risk to their health. Every day, people encounter so many events that may cause stress. According to Diabetes Education Online (2015), when a person experiences stress, the body responds by preparing itself and ensures that enough sugar or energy is stored and available for consumption. The insulin levels fall while the glucagon and epinephrine (adrenaline) levels rise thereby increasing the amount of glucose released from the liver. At the same time, growth hormone and cortisol levels rise, this increase of the said hormones causes body tissues (muscle and fat) to be less sensitive to insulin. As a result, more glucose is available in the blood stream.

Raising blood sugar is important in stressful situations, as the body is told to get its fuel (glucose) levels up in preparation for a lot of physical and mental activity. This is the reason why people tend to get hungry after stressful events. Scientists have studied the effects of stress on glucose levels in animals and people. Diabetic mice under physical or mental stress have elevated glucose levels. The effects in people with Type 1 diabetes are more mixed. While most people's glucose levels go up with mental stress, others' glucose levels can go down. In people with type 2 diabetes, mental stress often raises blood glucose levels. Physical stress, such as illness or injury, causes higher blood glucose levels in people with either type of diabetes (ADA 1995-2015).

The point of conducting this study is to know how stress levels affect the body's glucose levels especially among paramedical students in Liceo de Cagayan University and to help determine how stress can pose a risk to the health of the paramedical students of Liceo de Cagayan University, and how they could deal with the stress they get from school.

FRAMEWORK

This study is anchored on the Health Belief Model. The Health Belief Model (HBM) is one of the most widely used conceptual frameworks for understanding health behavior. The Health Belief Model is a framework for motivating people to take positive health actions that use the desire to avoid a negative health consequence as the prime motivation. For example, if a student is aware that stress will increase his or her blood glucose level, then he or she has to learn how to manage stress.

According to Lazarus & Folkman (1984), "stress is a mental or physical phenomenon formed through one's cognitive appraisal of the stimulation and is a result of one's interaction with the environment. The existence of stress depends on the existence of the stressor." Feng (1992) and Volpe (2000) defined stressor as "anything that challenges an individual's adaptability or stimulates an individual's body or mentality.

Stress is the body's way of responding to any excessive demand. It is caused by both good and bad experiences. When people feel stressed by something going on around them, the bodies react by releasing chemicals into the blood. The chemicals give more energy and strength, which can be favorable if stress is caused by physical danger.

However, it can be a bad thing if the stress is in response to something emotional and there is no outlet for this extra energy and strength. Stress can also affect both body and mind. People under great amounts of stress can become tired, sick, and unable to concentrate or think clearly. Sometimes, they even suffer mental breakdowns (Alan Lee et al., 2010).

Over the last decade, an abundance of evidence has emerged demonstrating a close link between stress and glucose (Kathryn E. Wellen et. al., Gokhan s. Hotamisligil et. al.,2012). Glucose is a simple sugar that is an important energy source in living organisms and is a component of many carbohydrates. While on the other hand stress is a state of mental or emotional strain or tension resulting from adverse or very demanding circumstances. Stress can affect how

quickly glucose returns to normal after a meal. The glucose remain high for a few minutes, but once their glucose finally began to drop, it took 15 minutes to return to normal (Kordella, Terri et. al. 2014).

The evidence supporting a relationship between stress and glucose has been inconsistent. Perceived stress predicted incident abnormal glucose metabolism in women but not in men, after multivariate adjustment. Life events had shown an inconsistent relationship with abnormal glucose metabolism (William, Magliano, Tapp, Oldenburg, Jonathan et al. n.d.).

As such, understanding the relationship between stress and metabolism is important. Several psychological factors have been linked to glucose dysregulation. Psychological factors such as anger, are associated both perceived stress or negative affect (Barefoot et. al., 2011; Bhumenthal et al., 2010) and higher glucose levels. Recently, researchers found the relationship of glucose with life stress has a negative effect, but few studies have examined positive characteristics that may buffer relationships of chronic stress with metabolic dysregulation. The stress model is enduring uncontrollable influences such as genetic traits and properties acquired through experience. These include gender, psychological dispositions and comorbid disease status that can increase one risk for disease in persons free from stress Stress has long been considered an important factor in Type 2 diabetes. However, it is only recently that research has demonstrated that stress may play a role in the onset of Type 2 diabetes in individuals predisposed to diabetes and in blood glucose control in people with established diabetes. Simple stress management techniques can have a significant impact on long-term blood glucose control and can constitute a useful tool in the regulation of this common condition (Surwit et al., 2002).

In this study, the researchers tried to find out if the stress levels of Medical Laboratory Science students will also have an effect on their blood glucose levels

OBJECTIVES OF THE STUDY

The main goal of this study was to determine the relationship between the stress level and glucose level of 3rd year Medical Laboratory Science students. Specifically, it aimed to: (1) determine the profile of the subjects in terms of age and gender; (2) determine the stress level of the subjects before and during a stressful situation (midterm examination); (3) determine the glucose level of the subjects before and during a stressful situation (midterm examination); and (4) determine the relationship between the stress level and glucose level of the subjects.

METHODOLOGY

The researchers used the descriptive research design with diagnostic laboratory procedures. In the study, the researchers did not only determine the profile of the subjects and stress level, but they also determined the the subjects' blood glucose level.

The Medical Laboratory Science students were the researchers' target specifically those on the higher levels who are suitable to participate in the said study. The study focused on third year Medical Laboratory Science students. The sample size was determined using the Slovin's formula. Out of the total population of 106 students, a sample size of 44 was determined.

The researchers used an interview guide questionnaire. Part 1 solicited personal information, and Part 2 determined the stress level of the subjects. In determining the stress level, the researchers adopted the questionnaire from the International Stress Management Association UK.

In collecting the blood samples from the subjects, the licensed medical technologists from the diagnostic center utilized the following: 3ml syringe and anticoagulated tube. The other materials will be: tourniquet, cotton, and plaster

To ensure the quality of the research output, the researchers employed the following research protocol:

1. The researchers sought approval from the adviser after careful assessment and review of the manuscript for the thesis.
2. The dean of the College of Medical Laboratory Science approved the schedule for the defense of the thesis proposal after thorough assessment and review of the final manuscript.
3. The director of the RPO thoroughly assessed and reviewed the thesis proposal for quality assurance and quality control before approval was made.
4. The researchers accomplished the Research Ethics Application form from the university ethical board in compliance with the ethical standards.
5. The researchers wrote letters and secured permission from the heads of office to allow them to conduct the study.
6. The researchers also secured the respondents' consent to participate in the study. Moreover, the respondents were assured that all their responses are to be treated with utmost confidentiality.
7. The Registered Medical Technologist used Proper Protective Equipment (PPE) in conducting the experimental study.

8. Provision of the final manuscript. The researchers provided the adviser the final copy or the manuscript for assessment and review of the quality and relevance of the paper.

Once the researchers have been given permission to conduct the study, they administered the questionnaire to the subjects/participants to determine their profile and stress level. The nature and scope of the study were explained thoroughly to the participants.

The questionnaires were then retrieved, tabulated, and were subjected to statistical analysis. The researchers then informed the subjects of the schedule for blood sample collection in the Liceo Medical Diagnostic Laboratory.

The blood samples collected have undergone some examinations and diagnosis performed by a registered medical technologist. The results were then recorded for further analysis of the study.

To determine the profile of the subject/participants, frequency counts and percentage distribution was used for this study. Pearson Correlation Coefficient was used to determine the correlation between the stress level and glucose level of the participants

RESULTS AND DISCUSSION

Table 1. Profile of the Respondents

PARAMETER	FREQUENCY	PERCENTAGE
Age (years)		
18	5	11
19	33	75
20-23	6	14
TOTAL	**44**	**100**
Gender		
Male	7	16
Female	37	84
TOTAL	**44**	**100**

Table 1 shows the gender and age profile of the respondents who were selected to participate in the said research study. As shown in the table above, a majority of the respondents are 19 years of age, which constitutes about 75% of the entire respondent population. The remaining 25% of the respondent population constitutes of the respondents who are 18 and 20-23 years of age. Of the 44 respondents, 37 are females which make up about 84% of the entire

respondent population. Moreover, the seven male respondents make up for the remaining 16% of the total respondents' population. The findings imply that females comprise the majority of the students who take up Medical Laboratory Science.

Table 2. Stress Level of the Respondents

Stress Level	Description	Frequency (Before Exam)	Percentage (Before Exam)	Frequency (During Exam)	Percentage (During Exam)
4 points or less	Least likely to suffer from stress-related illness	1	2	1	2
5 - 13 points	More likely to experience stress related ill health either mental, physical or both.	10	23	11	25
14 points or more	Most prone to stress showing a great many traits or characteristics that are creating un-healthy behaviors.	33	75	32	73
Total		44	100	44	100

Table 2 shows the frequency and the percentage of the stress level of the respondents before and during the exam. The table reveals that before the examination, only one respondent was least likely to suffer from stress-related illness which constitutes about 2% of the respondent population, 10 respondents were more likely to experience stress related ill health either mental, physical or both which make up about 23% of the respondent population, and remaining 33 respondents are most prone to stress showing a great traits or characteristics that are creating unhealthy behaviors which constitute the remaining 75% of the entire respondent population.. Then during the examination, only 1 respondent remained to be least likely to suffer from stress-related illness which still constitutes about 2% of the respondent population, 11 respondents were then more likely to experience stress related ill health either mental, physical or both which has increased than by one before examination which now make up for about 25% of the respondent population, and the remaining 32 respondents are most prone to stress showing great traits or characteristics that are creating unhealthy behaviors which have decreased by one before examination now only constitutes about 73% of the entire respondent population.

It can be observed in the table presented above that majority of the respondents were experiencing a great amount of stress before the examinations than during the test. This is due to the fact that the students are more likely to experience stress before the exams because of their preparations for the upcoming examinations. It is during this time that the students are spending so much time on studying, thus the source of stress. The remaining respondents did not experience as much stress as the majority of the respondents. The variation in the respondents' stress level is caused by their different coping mechanisms which affect the way they respond to such stressful encounters. This is mainly because of the many different things that can cause stress. From physical to emotional. Moreover, the results obtained above are affected by many factors, both internal and external. Internal Stress is worrying for no reason at all. It is one of the most important kinds of stress to understand and manage. This often happens when a person worries about things and can't control or put it in situations which will cause stress (Alan Lee et al., 2010). Moreover, one of the most concrete examples of this kind of stress is the stress we get from school.

Table 3. Glucose Level of the Respondents

Glucose level	Definition	Frequency (Before Exam)	Percentage	Frequency (During Exam)	Percentage
Below 70	Below Normal	9	20	1	2
70 – 110	Normal	35	80	42	96
Above 110	Above Normal	0	0	1	2
Total		44	100	44	100

Table 3 shows the glucose level of the subjects before and during the exam. The data reveal that most of the respondents' glucose level fall within the normal range before and during the examination. Before the examination, only nine respondents have glucose levels which are below the normal range, and the remaining thirty-five respondents' glucose level lies within the normal range, and there wasn't any respondent who had an increased glucose level. During the examination, only one respondent had a glucose level which is below the normal range, forty-two of the respondents' glucose level fall within the normal range, and only one respondent had an elevated glucose level.

As shown in the table above, most of the respondents' glucose level results are normalized during the exam compared to their glucose level results before the examination. The body needs higher levels of glucose for consumption during

stressful events. In line with this, the body tends to increase the levels of glucose in the bloodstream. Most of the respondents' glucose level are within the normal range and only a very few are below or above the normal range. As cited by Kordella et al,. (2014) the slight variation in some of the respondents' glucose level is caused by various factors which include the time or duration of their fasting, recent food intake, and the stress they are experiencing. Stress can affect how quickly glucose returns to normal after a meal. The glucose remains high for a few minutes, but once their glucose finally began to drop, it took 15 minutes to be stable and be back to normal (Kordella, et al. 2014). The evidence supporting a relationship between stress and glucose has been inconsistent.

Table 4. Test of Relationship between the Stress Level and Glucose Level of the Respondents before the Exam

Hypothesis	Level of Significance	P-value	Result	Decision
H_0: There is no significant relationship between the stress level and glucose level of the respondents before exam.	$\alpha = 0.10$	0.065	$p < \alpha$	Reject H_0

Table 4 is a test of relationship between stress level and glucose level of the respondents before exam. It shows in Table 4 that the null hypothesis is rejected at the level of significance equal to 0.10. This implies that the glucose level of the respondents is affected by the stress level of the respondents before the exam. hence, there is a significant relationship between the stress level and glucose level of the respondents before the midterm exam.

Table 5. Test of Relationship between Stress Level and Glucose Level of the Respondents during the Exam

Hypothesis	Level of Significance	P-value and correlation value	Result	Decision
H_0: There is no significant relationship between the stress level and glucose level of the respondents during exam.	$\alpha = 0.10$	0.975	$p > \alpha$	Fail to Reject H_0

Table 5 is a test of the relationship between stress level and glucose level of the respondents after the exam. It is shown in Table 5 that the null hypothesis could not be rejected at the level of significance equal to 0.10. Thus, there is no significant relationship between the stress level and glucose level of the respondents after the exam.

According to Diabetes Education Online (2015), when a person experiences stress, the body responds by preparing itself and ensures that enough sugar or energy is stored and available for consumption. The insulin levels fall while the glucagon and epinephrine (adrenaline) levels rise thereby increasing the amount of glucose released from the liver. At the same time, growth hormone and cortisol levels rise, this increase of the said hormones causes body tissues (muscle and fat) to be less sensitive to insulin. As a result, more glucose is available in the blood stream. The evidence supporting a relationship between stress and glucose has been inconsistent. The study of William et al., (n.d.) examined the effects of stress on abnormal glucose metabolism, using a population-based sample. Obesity and lifestyle study and perceived stress and stressful life events were measured baseline. The primary outcome was the development of abnormal glucose metabolism. Perceived stress predicted incident abnormal glucose metabolism in women but not in men, after multivariate adjustment. Life events had shown an inconsistent relationship with abnormal glucose metabolism (William et al., n.d.).

CONCLUSION

During stressful events, the body increases the blood glucose level in the circulation but subsequently decreases since the uptake of glucose will also increase. Therefore, the glucose level of the respondents is inversely proportional to their stress level. However, there are many other factors which affect the respondents' glucose level that includes the hours of fasting, their age, their ways to cope up with stress, and their body's metabolic functions.

RECOMMENDATIONS

Based on the findings of the study, the following are recommendations are made:

1. Conduct a comparative study of the hormones responsible for glucose elevation and diet.

2. An identical study should be made focusing in hormones that affect the stress levels.

3. Conduct a study which specifies the other possible causes of glucose elevation besides stress.

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APPENDICES

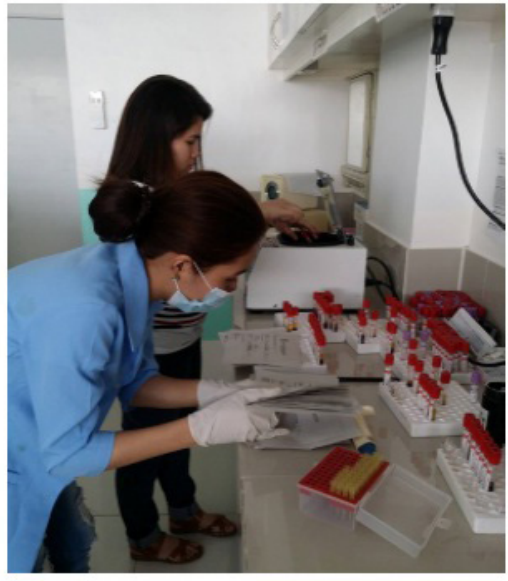

Plate 1. The Medical Technologist as She Arranges the Data Sheets

Plate 2. The Clotted Blood Specimens Being Prepared for Centrifugation

Plate 3. The Medical Technologist As She Extracts the Serum from the Sample

Plate 4. The Spectrophotometer Used to Determine the Blood Glucose Level