International Journal of Research and Review
Vol.7; Issue: 6; June 2020
Website: www.ijrrjournal.com
E-ISSN: 2349-9788; P-ISSN: 2454-2237

Original Research Article

A Comparative Study of Effect of Glucose on the Lateral Phoria of Myopes and Hyperopes

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ABSTRACT

Phoria is a misalignment of the eyes that only appears when binocular viewing is broken. This study was carried out to compare the effect of glucose on the lateral phoria of myopes and hyperopes. Clinical tests conducted on the subjects include taking their case history, visual acuity, external eye examination, retinoscopy and lateral phoria test. The blood glucose level was measured using the Accu-check glucometer. Subjects with a normal fasting blood glucose level were selected and given 12.5g (females) and 19g (males) of glucose for oral ingestion. The lateral phoria was repeated after 30, 60 and 90 minutes of glucose intake. A total of 50 subjects were used for this study. Twenty-seven were myopes and 23 were hyperopes. Results showed that before glucose intake, the mean phoria value for myopes at distance was0.19 exo. After 30 minutes, the value became 0.19 eso. After 60 minutes, the value was0.37 exo. After 90 minutes, the value became 0.89 exo. The mean near phoria value of the myopes before glucose intake was 3.81 exo. After 30 minutes, the value was 4.74 exo. After 60 minutes, the value was6.44 exo. After 90 minutes, the value was 5.15 exo. The mean distance phoria value of the hyperopes before glucose intake was 0.83 exo. After 30 minutes, the value became 2.35 exo. After 60 minutes, the value was 0.96 exo. After 90 minutes, the value became 0.96 exo. The mean near phoria value of the hyperopes before glucose intake was 3.65 exo. After 30 minutes, the value became 5.61 exo. After 60 minutes, the value was 4.83 exo. The changes in the mean phoria values for myopes and hyperopes at both distance and near were not statistically significant (P>0.05). Further studies on the effect of glucose on other visual functions were recommended.

Keywords: Phoria, Glucose, Myopia, Hyperopia, Exophoria, Esophoria

INTRODUCTION

Glucose**,** also called dextrose is one of a group of carbohydrates known as simple sugars. [1] It is found in fruits and honey and is the major free sugar circulating in the blood of higher animals. [1] It is the source of energy in cell function, and the regulation of its metabolism is of great importance. In energy metabolism, glucose is the most important source of energy in all organisms. Glucose homeostasis is of critical importance to human health due to the central importance of glucose as a source of energy, and the fact that brain tissues do not synthesize it. [2] Thus, maintaining adequate glucose levels in the blood are necessary for survival. On the other hand, inappropriate levels of glucose in the blood are a primary symptom of diabetes, a major degenerative disease in society. [3] Normal glucose homeostasis is primarily maintained by glucagon and insulin. Following the discovery of insulin in the pancreas and its ability to lower blood glucose levels in normal and in diabetic states, a second factor was discovered in the pancreas that could raise glucose levels in animals and it was given the name glucagon. [3] Glucagon thus has a counter regulatory effect on glucose levels in the blood relative to insulin. The interrelated bioactivities of these two hormones are critical to understanding glucose homeostasis in normal and diabetic states. [4]

Phoria is a misalignment of the eyes that only appears when binocular viewing is broken and the two eyes are no longer looking at the same object. [5] The misalignment of the eyes starts to appear when a person is tired, therefore it is not present all of the time. Types of phoria include exophoria (exo), an outward turning of the eye; esophoria (eso), an inward turning of the eye; hyperphoria, an upward turning of the eye; and hypophoria, a downward turning of the eye. [5] Phorias can be caused by a variety of factors. One of the most common causes is having a large amount of hyperopia or farsightedness. When young children have high amounts of farsightedness that is undiagnosed, they struggle to see clearly. [6] To compensate for this, they focus extra hard. Because the focusing system and the eye muscle converging system are linked together, they tend to converge more than normal. This is abnormal and they may develop esotropia. This circumstance describes what is called an accommodative esotropia. [7]

Myopia, also known as short-sightedness is an eye disorder where light focuses in front of, instead of on the retina. This causes distant objects to be blurry while close objects appear normal. Severe near-sightedness is associated with an increased risk of retinal detachment, cataracts, and glaucoma. [8] The underlying cause is believed to be a combination of genetic and environmental factors. Risk factors include doing work that involves focusing on close objects, greater time spent indoors, and a family history of the condition. [5] The underlying mechanism involves the length of the eyeball growing too long or less commonly the lens being too steep. [9] Hyperopia, also known as far-sightedness is a condition of the eye in which light is focused behind, instead of on, the retina. [5] This results in close objects appearing blurry, while far objects may appear normal. As the condition worsens, objects at all distances may become blurry. Symptoms may include headaches and eye strain. People may also experience accommodative dysfunction, binocular dysfunction, amblyopia, and strabismus. [10] Often, hyperopia occurs when the eyeball is too short, or the lens or cornea is flatter than normal. Risk factors include a family history of the condition, diabetes, certain medications, and tumors around the eye. [11] The objective of this study is to compare the effect of glucose on the lateral phoria of myopes and hyperopes.

MATERIALS AND METHODS

This study was a clinical study carried out at the Department of Optometry Teaching Clinic, Federal University of Technology, Owerri, Imo state, Nigeria. An informed consent was gotten from all the subjects who were part of the study. The height and weight of the subjects were recorded. Clinical tests conducted on the subjects include taking their case history, visual acuity, external eye examination, retinoscopy and lateral phoria test. The blood glucose level was measured using the Accu-check glucometer. Subjects with a normal fasting blood glucose level were selected and given 12.5g (females) and 19g (males) of glucose for oral ingestion. The lateral phoria was repeated after 30, 60 and 90 minutes of glucose intake. Data was collected and uploaded into the Statistical Package for Social Sciences (SPSS) version 21 and the one-way ANOVA was used to test the null hypotheses at 0.05% level of significance and 95% confidence interval.

RESULTS

A total of 50 subjects were used for this study. Twenty-seven were myopes and 23 were hyperopes. Table 1 showed the distance phoria values of the myopes before and after glucose intake. Before glucose intake, the minimum, maximum and mean phoria values were 6 exo, 7 eso and 0.19 exo respectively. After 30 minutes, the values became 9 exo, 7 eso and 0.19 eso respectively. After 60 minutes, the values were 6 exo, 7 eso and 0.37 exo respectively. After 90 minutes, the values were 6 exo, 8 eso and 0.89 exo respectively. The changes in the mean phoria values were not statistically significant [P(0.817)>0.05]. Table 2 showed the near phoria values of the myopes before and after glucose intake. Before glucose intake, the minimum, maximum and mean phoria values were 17 exo, 5 eso and 3.81 exo respectively. After 30 minutes, the values became 19 exo, 6 eso and 4.74 exo respectively. After 60 minutes, the values were 19 exo, 5 eso and 6.44 exo respectively. After 90 minutes, the values were 20 exo, 13 eso and 5.15 exo respectively. The changes in the mean phoria values were not statistically significant [P(0.713)>0.05]. Table 3 showed the distance phoria values of the hyperopes before and after glucose intake. Before glucose intake, the minimum, maximum and mean phoria values were 5 exo, 3 eso and 0.83 exo respectively. After 30 minutes, the values became 10 exo, 2 eso and 2.35 exo respectively. After 60 minutes, the values were 5 exo, 3 eso and 0.96 exo respectively. After 90 minutes, the values were 5 exo, 2 eso and 0.96 exo respectively. The changes in the mean phoria values were not statistically significant [P(0.145)>0.05]. Table 4 showed the near phoria values of the hyperopes before and after glucose intake. Before glucose intake, the minimum, maximum and mean phoria values were 11 exo, 6 eso and 3.65 exo respectively. After 30 minutes, the values became 13 exo, 6 eso and 5.61 exo respectively. After 60 minutes, the values were 13 exo, 4 eso and 4.04 exo respectively. After 90 minutes, the values were 13 exo, 7 eso and 4.83 exo respectively. The changes in the mean values were not statistically significant [P(0.623)>0.05].

Table 1: Distance phoria values of myopes before and after glucose intake

Time of Measurement	N	Min	Max	Mean	S.D
Before Glucose Intake	27	6 exo	7 eso	0.19 exo	3.9eso
After 30 minutes	27	9 exo	7 eso	0.19 eso	4.7 eso
After 60 minutes	27	6 exo	7 eso	0.37 exo	3.7 eso
After 90 minutes	27	6 exo	8 eso	0.89 exo	4.1 eso
P = 0.817					

N = number, Min = minimum, Max = maximum. S.D. = standard deviation, eso = esophoria, exo = exophoria

Table 2: Near phoria values of myopes before and after glucose intake

Time of Measurement	N	Min	Max	Mean	S.D
Before Glucose Intake	27	17 exo	5 eso	3.81 exo	7.6 eso
After 30 minutes	27	19 exo	6 eso	4.74 exo	8.5 eso
After 60 minutes	27	19 exo	5 eso	6.44 exo	8.3 eso
After 90 minutes	27	20 exo	13 eso	5.15 exo	9.1 eso
P = 0.713					

N = number, Min = minimum, Max = maximum. S.D. = standard deviation, eso = esophoria, exo = exophoria

Table 3: Distance phoria values of hyperopes before and after glucose intake

Time of Measurement	N	Min	Max	Mean	S.D
Before Glucose Intake	23	5 exo	3 eso	0.83 exo	2.3 eso
After 30 minutes	23	10 exo	2 eso	2.35 exo	3.1 eso
After 60 minutes	23	5 exo	3 eso	0.96 exo	2.3 eso
After 90 minutes	23	5 exo	2 eso	0.96 exo	2.4 eso
P = 0.145					

N = number, Min = minimum, Max = maximum. S.D. = standard deviation, eso = esophoria, exo = exophoria

Table 4: Near phoria values of hyperopes before and after glucose intake

Time of Measurement	N	Min	Max	Mean	S.D
Before Glucose Intake	23	11 exo	6 eso	3.65 exo	5.4 eso
After 30 minutes	23	13 exo	6 eso	5.61 exo	5.7 eso
After 60 minutes	23	13 exo	4 eso	4.04 exo	4.8 eso
After 90 minutes	23	13 exo	7 eso	4.83 exo	5.7 eso
P = 0.623					

N = number, Min = minimum, Max = maximum. S.D. = standard deviation, eso = esophoria, exo = exophoria

DISCUSSION

Phoria is a misalignment of the eyes that only appears when binocular viewing is broken and the two eyes are no longer looking at the same object. The misalignment of the eyes starts to appear when a person is tired, therefore it is not present all of the time. [5] Glucose metabolism is critical to normal physiological functioning. Since glucose is a source of energy to the body and misalignment (phoria) of the eyes starts to appear when a person is tired, this research is done to establish the effect of glucose on lateral phoria among myopes and hyperopes. There were more myopes found among the young adults in this study *which is in consistent with the findings of Adegbehingbe et al* [12] *in his study* to determine the prevalence and pattern of cases of refractive error reported at the eye clinic of the Obafemi Awolowo University Teaching Hospital, Ile-Ife (OAUTH), where they found out that the percentage of patients with myopia is higher than those with hyperopia.

The result of this study revealed that 19g and 12.5g (male and female respectively) of orally administered glucose caused an increase in lateral phoria at far in myopes from exophoric baseline towards esophoric direction after 30minutes.Then it dropped back towards exophoric direction after 60minutes and continued to increase toward exophoric direction after 90minutes while the lateral phoria at near which was exophoric baseline continued to increase towards exophoric direction after 30 and 60 minutes and then dropped after 90minutes. There was an increase in lateral phoria at far in hyperopes from exophoric baseline towards exophoric after 30minutes, it dropped after 60minutes and then continued unaltered after 90minutes while the lateral phoria at near which was in exophoric baseline continued to increase towards exophoric direction after 30minutes, it then dropped after 60minutes and dropped again after 90minutes. The above statement was observed from the mean differences of lateral phoria in both myopes and hyperopes at both far and near.

Though there was changes in lateral phoria after 30, 60 and 90 minutes of glucose administration in both far and near, there was no statistical significant difference between lateral phoria of hyperopic and myopic subjects at both far and near before and after 30, 60 and 90 minutes of oral administration of glucose powder. *Timothy and Chima* [13] *did a study* to determine the effect of sulphadoxine and pyrimethamine on habitual lateral phoria (HLP) and near point of convergence (NPC) in which they found out there was no significant effect of sulphadoxine and pyrimethamine on habitual lateral phoria. Okorieet al [14] carried out a study to determine the relationship between the refractive power and blood glucose changes in alloxan-induced and insulin treatment on a dutch rabbits in which he found out that there was no significant correlation between the hyperopic change in refraction and the hypoglycemic effect of insulin. Similarly, Nwala et al [15] studied the effect of glucose on the amplitude of accommodation of normoglycemic emmetropes where they found out that effect of glucose on amplitude of accommodation was only significant 60 minutes after the intake of glucose. They also found out that the increase in amplitude of accommodation observed was only probably due to water retention or hydropic swelling of the crystalline lens in the presence of glucose resulting in refractive index and optical power of the eye. Nwala et al. [16] reported insignificant effects of loratadine on phoria status of hyperopes. On the other hand, Timothy [17] showed that glucose has a significant effect on tear production because there was a reduction in tear production after 30, 60 and 90 minutes of glucose administration which was more significant in females than in males probably due to hormonal differences.

In conclusion, oral intake of glucose had no significant effect on the distance and near phoria of both myopes and hyperopes.

Further studies on the effect of glucose on other visual functions were recommended.

REFERENCES

1. Kenji K. Cellulose and Cellulose Derivatives, 1st ed. Ikoma: Elsevier Science. 2005; 80-83.
2. Luis GM, Carolina PB, Leticia SC, Aline KS, Tiago SP. Association between Glucose Levels and Intraocular Pressure: Pre- and Postprandial Analysis in Diabetic and Nondiabetic Patients. J Ophthalmol. 2015; 2: 22-23.
3. Ginsberg BH. Factors affecting blood glucose monitoring: sources of errors in measurement. J DiaSci Tech. 2009; 3(4): 903–913.
4. David BW, John PH.Glucose metabolism and the pathophysiology of diabetes mellitus. J ClinBiochem.2014; 15(3): 273-304.
5. Grosvenor T. Primary Care Optometry, 5th ed. Missouri: Elsevier Science. 2007; 85-87.
6. Helveston E. Understanding, detecting, and managing strabismus. J Com Eye Health. 2010; 23: 12–14.
7. Ansons A, Davis H. Diagnosis and Management of Ocular Motility Disorders. 4th ed. London: Blackwell Publisher. 2014; 435-436.
8. Holden B, Sankaridurg P, Smith E, Aller T, Jong M. Myopia, an underrated global challenge to vision: where the current data take us on myopia control. J Ophthal Physio Optics. 2014; 28 (2): 142–46.
9. Pan C, Ramamurthy D, Saw S. Worldwide prevalence and risk factors for myopia. J Ophthal Physio Optics. 2012; 32 (1): 3–16.
10. Moore BD, Augsburger A, Ciner E, Cockrell D, Fern K,Harb E. Optometric Clinical Practice Guideline: Care of the Patient with Hyperopia. J AmOptom Ass. 2008; 56(2): 10–11.
11. Castagno V, Fassa A, Carret M, Vilela M,Meucci R. Hyperopia: a meta-analysis of prevalence and a review of associated factors among school-aged children. J Ophthalmol. 2014; 14: 163-167.
12. *Adegbehingbe BO, Majekodunmi AA, Akinsola FB,Soetan EO.* Pattern of Refractive Errors at Obafemi Awolowo University Teaching Hospital, Ile-Ife, Nigeria. Nig J Ophthalmol. *2003;* 11(2): 76-79.
13. *Timothy CO,Chima OU.* Effects of sulphadoxine and pyrimethamine on phoria and near point of convergence. J Nig Opt Assoc.*2005;* 12: 1-5
14. Okorie ME, Nweke IN, Ahuama OC, Azuamah YC,Unekwe PC. Refractive power and blood glucose changes: studies in alloxan-induced and insulin treated diabetic in Rabbits. J Int Res. 2015; 2:728-729.
15. Nwala OR, Ahuama OC, Ohiri MO,Azuamah YC. Effect of Glucose on the Amplitude of Accommodation of Normoglycemic Emmetropes. Optom Edu. 2015; 5(1): 50-54.
16. Nwala OR, Ahuama OC, Ikoro NC,Azuamah YC. Effect of Loratadine on the lateral phoria of young hyperopes. Int J Res.2014; 1(10): 591-598.
17. Timothy CO. Effects of 0.5% glucose intake on tear production of Normoglycemic Emmetropic Nigerians. J NigOptom Assoc. 2009; 15:12-13.

How to cite this article: Megwas AU, Okolie FU, Nwawume I.C et.al. A comparative study of effect of glucose on the lateral phoria of myopes and hyperopes. International Journal of Research and Review. 2020; 7(6): 476-480.

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