LONG TIME EFFECT OF EXERCISE ON IN TRAOCULAR PRESSURE IN A NIGERIAN POPULATION

BY

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ABSTRACT

Numerous international studies have indicated that several physiological changes can influence the intraocular pressure (IOP) of subjects. In order to assess visual health status through physiological changes, the effects of rest and exercise on IOP were investigated in a Nigerian community. The research involved 24 healthy normotensive subjects who were made to serve as their own control. They were subjected to exercise for 10 minutes after taken their IOP at rest for an hour. Result immediately after the exercise showed that there was a significant decreases in the mean initial IOP ($P<0.05$). The decrease was relatively sustained for a period of 20 to 40 minutes. At 50 minutes after exercise, slight increase in mean IOP was recorded but was not significant, but after 50 minutes it exceeded baseline value and then stabilized. Recovery time for initials IOP after exercise in this population sample was 50 minutes. This showed that the significant decrease in IOP after exercise could not be sustained; therefore physical exercise alone is not therapeutic in the management of ocular hypertension, Topical anti-glaucoma drugs are therefore advised as the ultimate resort for the management of ocular hypertension.

KEYWORDS: Intraocular pressure, Exercise, Long lasting, Normotensive, Ocular hypertension.

INTRODUCTION

Intraocular pressure (IOP) is the pressure sustained by the aqueous humour within the eye. The aqueous humour is the fluid that fills the anterior chamber of the eye and it is released from the blood in the capillaries of the ciliary processes through the ciliary epithelium into the anterior chamber of the eye. The IOP is controlled primarily by the rate of secretion or rate of drainage of the aqueous humor. Whereby these two factors do not commensurate, there will be build up pressure leading to increased risk of optic nerve damage a pathological condition called glaucoma.

Quigley[1] classified glaucoma as the second leading cause of vision loss worldwide. It affects individuals of all age groups but it is more prevalent after the fourth decade of life. Primary open angle glaucoma (POAG) accounts for over 90% of glaucoma cases[2], and because it is asymptomatic in nature, it can be missed easily on routine eye examination. Clinicians however do not use raised IOP as the only diagnostic tool for POAG, other signs such as presence of field defect and changes in the appearance of the optic disc are now vital in the diagnosis of POAG. Sommer[3] defined POAG as a characteristic form of optic neuropathy related in some degree to level of IOP. It is worth noting that IOP is strongly associated with glaucoma, therefore its reduction remains a means of therapy.

IOP is essential in visual health because it sustains the metabolism of the cornea and lens[4]. It also helps in keeping the eye in shape and contributes to the refractive status of the eye.

Normal IOP is defined the statistical average pressure which normal eye have been found to tolerate over a period of time without damages to their integrity[5]. Generally, the normal range of IOP value is between 13mmHg to 21mmHg. IOP above these values are considered to be pathological[6]

During vigorous exercise, some noticeable physiological changes occur, such as fast breathing, profuse sweating which regulated body temperature, through sensation in the head increased rate of metabolism and increase in the size of capillaries (vasodilatation). Reduced blood flow to the kidney, less glomerular filtration, less urine produced and this reduced excretion prevents dehydration.

The purpose of this study therefore is to evaluate one of the physiological changes that occur in the eye particularly the changes that occur in the intraocular pressure and the duration it takes for the IOP to return to baseline values of normotensive individuals during and after a short-term exercise.

MATERIALS AND METHOD

24 young adults of both sexes were randomly

recruited from the University of Benin, Ugbowo Campus, Benin City, Edo State; for this study. Their age range was between 16 and 26 years with mean age of 19.17±3.24 years. This age group was chosen so as to ensure compliance with the experimental procedure. The experimental groups were made up of 12 males and 12 females.

A Perkins Mk2 hand-held applanation tonometer was used throughout the study to measure the IOP at rest and after the exercise at intervals of 10 minutes until IOP returns to its resting baseline measurement). 2% Novesine and 0.5% sodium fluorescein were used in conjunction with applanation tonometer. A Keeler Ophthalmoscope was used for direct ophthalmoscopy. The internal examination eliminated subjects with ocular pathology. An ergometer bicycle designed by Voiki ski and tennis was used for the exercise. Each subject pedaled for 10 minutes at 20mph.

All the subjects were non alcoholics, without systemic disease, and not on any systemic or topical medication. They had no previous history of ocular or systemic hypertension. They were all made to understand the purpose of the research and were shown the various instruments used. The 24 subjects were made to serve as their own control.

A baseline IOP reading was recorded only in the right eye (RE) of each subject using Perkins applanation tonometer on the first day of the experiments. Three tonometric readings were taken for each eye and average was recorded as the baseline IOP of each subject. On the second day, the IOP readings of the RE were repeated again before exercise to confirm the baseline values; and these values served as the control.

Thereafter the subjects were instructed to pedal the ergometer bicycles for 10 minutes at 20mph. IOP measurement was later recorded for 50 minutes at 10 minutes interval after the exercise. All the data collected were obtained between 10.00 am and 3.30pm; in order to minimize the influence of diurnal variations of IOP.

The first post exercise IOP values were recorded immediately each subject stopped the exercise. Subsequent readings of IOP were taken at 10 minutes interval until IOP returns to baseline values; which occurred in about 50minutes.

Statistical analysis of inter group comparisons were made using one way analysis of variance (ANOVA) and student's T-test confidence level was 95%.

RESULT AND ANALYSIS

The analysis of data and the interpretation of results obtained in this study showed that the mean IOPs at rest for the entire group which was 11.27±1.7mmHg dropped to 9.10±1.54mmHg immediately after exercise, (i.e. 10 minutes post exercise). So there was a significant decrease of 2.17 mmHg in the IOP values after the exercise, which became statistically significant at 10 minutes ($P<0.05$; table 1).

Twenty (20) minutes later after exercise, mean IOP recorded was 9.46±1.47 mmHg. This was also statistically significant ($P<0.05$), with a mean decrease of 1.81mmHg from baseline values.

From 20 minutes after exercise, there was now a remarkable gradual rise in the mean IOP of subject. At 30 minutes, mean IOP recorded was 10.40±1.65mmHg, a decrease of 0.87 mmHg from baseline values. This was statistical insignificant. The trend observed at 40 minutes after exercise was similar to that of 30 minutes. The rise in IOP continued till 50 minutes after the exercise when the IOP values showed a reversal from a decrease to an increase in mean IOP, with a value of 11.50±1.45 mmHg; a mean increase of 0.23 mmHg from baseline value. At 50 minutes post exercise, IOP tends to stabilize (table 1).

For the same group, before they were subjected to exercise, there was no significant change in IOP value throughout the experiment (table 2).

DISCUSSION

Numerous physiologic changes occur with exercise amongst which are increases in plasma osmolarity and blood lactate level, likewise decrease in blood pH level. These have been used to explain the decrease in IOP after exercise[7,8,9.]

During intense exercise, tissues resort to anaerobic respiration and lactic acid is produced. When their lactic acid enters the general circulation, blood lactic acid level rises and this causes an increase in blood osmolarity and a reduction in pH. Increase in blood osmolarity produces a decrease in IOP due to the increased osmotic outflow of water from the eye and vice versa[10.] The decrease in pH due to increased lactate level also lowers the IOP, however, according to Buckingham and Young[11], the mechanism by which this occurs is unclear.

The acute decrease in IOP observed in this study agrees with the finding of other investigators that reported a decrease in IOP following exercise[7,8,12]. Passo et al[12] claimed that exercise conditioning may significantly reduced baseline IOP. This was contrary to the claim of Qureshi et al [13]. The result of this study is also comparable to that of McDaniel et al[14], in terms of the mean reduction in IOP from rest after exercise. In this study a mean decrease of 2.17mmHg was observed, while McDaniel et al[14] reported a mean decrease of 3.40mmHg. The difference in findings might be due to environmental, racial factor or due to the methodology used. This study showed that the effect of exercise on IOP was relatively transient.

Started from 10 minutes of exercise, which agrees with findings of McDaniel et al[14] and Buckingham et al[11]. IOP returned to baseline value by 50 minutes after exercise. This is a slight variation from the study of Buckingham and Young[11], where IOP returned to baseline values 65 minutes after exercise. This variation may be due to the reasons mentioned above.

The decrease in IOP obtained, though significant, but transient, therefore it is not enough to maintain IOP within normal range in patients with glaucoma or ocular hypertension. However, it is possible that daily exercise may help reduce the IOP.

From the findings of this research, it will be expedient to introduce exercise, as a form of therapy in the management of glaucoma, though must be combined with drug regimen in patents undergoing glaucoma treatment.

TABLE 1: MEAN IOP FINDINGS AT REST AND AFTER EXERCISE.

Time (Minutes)	**0**	**10**	**20**	**30**	**40**	**50**	**60**
Mean IOP (mmHg)	11.27	9.10	9.46	10.40	10.60	11.50	11.50
±S.E.M	1.70	1.54	1.47	1.65	1.50	1.45	1.45
Mean differen ce is significant at 0.05 level		$P<0.05$	$P<0.05$	NS	NS	NS	NS
Mean difference		2.17	1.81	0.87	0.77	0.23	0.23

Footnote: No significant change in IOP (NS)

TABLE 2: MEAN IOP FINDINGS AT REST WITHOUT EXERCISE GROUPS B

Time (Minutes)	**0**	**10**	**20**	**30**	**40**	**50**	**60**
Mean IOP (mmHg)	11.27	11.27	11.27	11.27	11.27	11.27	11.27
±S.E.M	1.70	1.70	1.70	1.69	1.70	1.65	1.70
Means different is significant at 0.05 level		NS	NS	NS	NS	NS	NS

Footnote: No significant change in IOP (NS)

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