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Intra Ocular Pressure Changes in Soldiers during Military March

Ali Makateb [1,*] and Reza Bayat [2]

[1]Imam Reza Hospital ,Department of Ophthalmology, AJA University of Medical Sciences, Tehran, Iran
[2]Department of Ophthalmology, AJA University of Medical Sciences, Tehran, Iran

[*]*Corresponding author*: Imam Reza Hospital ,Department of Ophthalmology, AJA University of Medical Sciences, Tehran, Iran. Email: makatebali@gmail.com

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Abstract

Background: Military activities cannot be classified as pure isometric or pure dynamic exercise. The effects of these activities on intra ocular pressure (IOP) have not been investigated so far.
Objectives: The current study aimed to evaluate the short-term effects of military activities on IOP.
Methods: Following a cross-sectional design, this study was conducted on 44 soldiers in the Islamic Republic of Iran Army. Soldiers' heart rate and IOP were recorded before marching activities at rest, immediately after marching, and 30 minutes after the march. The measurements were repeated in the same process in 3 months. The marching activity was the same for all participants and took 60 minutes.
Results: In total, 44 soldiers were studied, with a mean age of 21.80 ± 1.56 years. The IOP measurements before, immediately after, and 30 minutes after the marching were significantly different. IOP was significantly lower after the march ($P < 0.001$), and 30 minutes after the march, it was increasing gradually. The same results were observed in the IOP measurements 3 months later. We found no association between IOP after marching and heart rates before and after marching. Also, no significant association was observed between IOP and age.
Conclusions: IOP was significantly decreased after marching, but it was transient. The results indicate that the dynamic component in military marches is more prominent than isometric parts.

Keywords: Intra-ocular Pressure, Military March, Glaucoma, Soldiers

1. Background

Healthy eyes and intact vision are important features for soldiers and military personnel. Visual impairments have a significant financial burden on the military health systems. According to recent studies, the prevalence of ocular disorders ranges from 5 to 83% (1-4). Glaucoma is a common eye disorder all around the world and a leading cause of blindness. This disorder is referred to as a group of diseases characterized by progressive optic neuropathy with loss of ganglion cells (5).

In most cases, glaucoma is associated with elevated intraocular pressure (IOP), also known as ocular hypertension, which may be due to over-production of aqueous humor, or reduced outflow of the fluid, or both. The anterior and posterior chambers of the eye are filled with a transparent fluid called aqueous humor, which passively flows out of the eye. Studies have reported that, in most patients, elevated IOP, if not treated, damages the optic nerve (6). Some studies reported that even in glaucoma patients who receive treatment to reduce IOP, the progressive optic neuropathy could not be stopped (7, 8). Therefore, other factors should be considered in the diagnosis and management of glaucoma, one of the most important of which is physical activity (9-12). There are studies that reported dynamic exercises such as walking, running, cycling, and etc., can reduce the IOP transiently, but the mechanism of this reduction is not well understood (13).

On the other hand, isometric exercises are a form of physical activity with no effect on the length of muscles. These exercises are usually accompanied by Valsalva maneuvers, which results in increased intracranial pressure. Recent studies have reported that isometric exercises are associated with increased IOP, which may be caused by the enhanced intracranial pressure (14, 15). Determining the effect of different activities on the IOP is key for preventing future irreversible effects of elevated IOP. Also, a specific type of glaucoma, called pigment dispersion syndrome, which is frequent among young adults, often occurs following physical activities (16). Ocular hypertension and glaucoma are chronic events that damage the optic nerve and gradually cause loss of vision, which is painless (17). Therefore, early diagnosis and prevention of glaucoma are

highly beneficial for patients. Also, prevention of glaucoma morbidities can significantly decline health care expenditures. A recent study reported that the incidence of glaucoma has increased by 75% during recent years in the American armed forces (1).

2. Objectives

Military activities cannot be classified as pure isometric or pure dynamic exercise. The effects of these activities on IOP have not been investigated so far. The current study aimed to evaluate the short-term effects of military activities on IOP.

3. Methods

Following a cross-sectional design, this study was conducted on soldiers in the Islamic Republic of Iran Army. In total, 44 soldiers were selected using the convenience sampling technique. Written informed consent was obtained from all participants. After collecting demographic data, all participants underwent a complete ophthalmology examination. Soldiers' heart rate and IOP were measured and recorded before marching activities (at rest), immediately after the march, and 30 minutes after the march. These measurements were repeated in the same process in 3 months. The marching activity was the same for all participants and, on average, took 60 minutes.

All data were introduced into Statistical Package for Social Sciences, version 22.0 (IBM SPSS Statistics Inc., Chicago, IL, USA) for statistical analysis. Using paired *t*-test, IOP and heart rate were compared before and after the march. Pearson correlation test was used to investigate the association between IOP and heart rate. Statistical significance was considered when P-value < 0.05.

4. Results

A total of 44 soldiers were participated in the present study, with a mean age of 21.80 ± 1.56 years. In the initial ophthalmology examination, no specific disorder was found in any of the soldiers. Recorded IOP measurements are detailed in Table 1. As demonstrated in the table, there were significant differences concerning IOP before, immediately after, and 30 minutes after the march. According to the findings, the IOP was significantly reduced immediately after the march ($P < 0.001$), but it was transient, and 30 minutes after the march, it was increased gradually. Compared to the IOP value immediately after the march, the increase was significant ($P < 0.001$). However, IOP 30 minutes after the march was lower than the initial value of IOP, but this difference was not significant ($P = 0.398$). The same results were observed in the measurements 3 months after the initial measurements. Measured heart rates are demonstrated in Table 2. Statistical analysis revealed no significant difference between heart rate before the march and 30 minutes after the march ($P = 0.096$). Heart rate after the march was significantly higher than before and 30 minutes after the march ($P < 0.001$). The results from the second measurements (i.e. three months after the initial values) are in line with the initial measurements.

No significant difference was observed between the initial measurements and three months later for the IOP. Concerning the heart rate, a significant difference was found between the initial values and those recorded after 3 months. Compared to initial values (i.e. before the march), the heart rate was increased three months after initial measurements ($P < 0.0001$), but the heart rate immediately after the march was significantly lower in the secondary measurements ($P < 0.001$). Pearson correlation analysis revealed no association between IOP after the march and heart rates before and after the march. However, no significant association was found between IOP and age.

5. Discussion

Elevated IOP produces several negative effects on the optic nerve and retina over time. Although elevated IOP is different from glaucoma, it's a known risk factor for developing glaucoma. Studies have reported that isometric exercises will increase the IOP, and dynamic exercises have reduction effects on IOP (18, 19). Military marches are complex activities involving both dynamic and isometric exercises. The present study intended to investigate the effects of the military march on IOP. According to the findings, IOP was significantly declined immediately after the march, but this reduction was not constant and again increased lightly 30 minutes after the march. However, this difference was not significant. Repeated measurements three months later endorsed the conclusions from the initial measurements.

Najmanova et al. reported that IOP was reduced significantly after dynamic exercises like indoor cycling. They reported that after 30 minutes of cycling, IOP was declined and reached the baseline levels after 10 minutes (20). In this study, after 60 minutes of marching, the IOP was decreased, but it gradually enhanced 30 minutes of the march. Hence, it can be concluded that when performing physical activity in longer times, the IOP reaches its baseline value in a longer duration. Rufer et al. reported that declined IOP after 10 minutes of dynamic exercise only lasted for 10 minutes. They also reported a significant difference in IOP compared to before exercise (21). In the same

Table 1. IOP Measurements [a]

	Before March (mmHg)	Right After March (mmHg)	30 Min After March (mmHg)	P-Value
Initial	14.39 ± 1.54	13.14 ± 1.40*	14.29 ± 1.47**	< 0.001
3 months later	14.81 ± 1.61	13.04 ± 2.06*	13.95 ± 1.41**	< 0.001

[a] * Significant changes compared to baseline measurements, ** Significant changes compared to measurements after march

Table 2. Heart Rate Measurements [a]

	Before March (Beats/min)	Right After March (Beats/min)	30 Min After March (Beats/min)	P-Value
Initial	66.34 ± 6.32	119.75 ± 7.09*	64.81 ± 5.06**	< 0.001
3 months later	72.06 ± 7.93	103.68 ± 7.96*	73.93 ± 5.51**	< 0.001

[a] * Significant changes compared to baseline measurements, ** Significant changes compared to measurements after march

vein, Read and Collins also reported similar results, that is, declined IOP after short dynamic activity did not last longer than 10 minutes (22).

Some studies reported exercises that include Valsalva maneuver, or isometric activities increase the IOP (14, 15). Military marches also include activities similar to the Valsalva maneuver and isometric activities such as holding out the rifle or carrying other equipment but also include dynamic activities such as walking and running. In the present study, we only found increased levels of IOP after marching. Hence, it can be speculated that the dynamic component of military marches is more prominent and compensates for the effects of isometric activities.

In the present study, a significant increase in the heart rate was observed 3 months after the initial measurements, which indicates that their adaptation to daily physical activities. Although, the heart rate immediately after the march was lower in the secondary measurements. It can be argued that soldiers became more athletic due to the daily physical activity and marching. In this study, the age group of participants was not diverse enough, and we only investigated young adults. According to the literature review and our knowledge, this is the first study on the effects of military marches on ocular parameters. Further studies should investigate the effects of marching on female soldiers and other age groups.

5.1. Conclusions

Military march is a combination of isometric and dynamic activities. In this study, we found declines in IOP after marching. However, it was transient and gradually increased. The results indicated that the dynamic component in military marches is more prominent than isometric parts.

Footnotes

Authors' Contribution: Study concept and design: A. M; Acquisition of data: R.B; Analysis and interpretation of data: R.B; Drafting of the manuscript: R.B; Critical revision of the manuscript for important intellectual content: A.M; Statistical analysis: R. B; Administrative, technical, and material support; A. M; Study supervision: A. M.

Conflict of Interests: We have no conflict of interest to declare.

Ethical Approval: This study was approved by AJA University of Medical Sciences (Approval ID: IR.AJAUMS.REC.1399.176, Link: ethics.research.ac.ir/ProposalCertificateEn.php?id=168682).

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Informed Consent: After listening to the explanations of the researchers, the soldiers who had informed consent filled the form and entered the study.

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