

# THE EFFECT OF A 'SOCIAL' DOSE OF ALCOHOL ON THE CENTRAL RETINAL SENSITIVITY AND FIXATION STABILITY

Measured with the scanning laser ophthalmoscope

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## Abstract

*Purpose:* To evaluate the effect of a 'social' dose of alcohol on the central retinal sensitivity and fixation stability, measured with microperimetry using scanning laser ophthalmoscopy (SLO).

*Patients and methods:* Eighteen subjects, nine males and nine females, were given alcohol in a 'social' dose, corresponding to 40 ml wine/70 kg/30 minutes. Alcohol level, visual acuity (VA), and contrast sensitivity were examined, and central retinal sensitivity and fixation stability were measured with SLO before and after alcohol intake.

*Results:* There were no statistically significant differences in VA, central retinal sensitivity or contrast sensitivity before and after alcohol intake. A significant difference in fixation stability was found before and after alcohol intake. There was no difference between males and females regarding the instability in fixation. Fixation stability was more affected by alcohol in six of the subjects than in the others.

*Conclusions:* The central retinal sensitivity was not consistently affected by a small dose of alcohol. In contrast, the fixation stability significantly deteriorated, and a horizontal instability could be seen. No correlation was found between alcohol level and fixation instability, and the decrease could not be explained by the well-known sex difference in alcohol tolerance, thus the reason for this inter-individual difference could not be determined in the current study. Further investigations are needed to evaluate the relevance of fixation stability for visual function and the reasons for the inter-individual difference in alcohol tolerance.

## Introduction

Alcohol in the form of ethanol has been used by man for centuries and perceived mainly as a stimulant. However, it is well known that alcohol is also an intoxicant and is actually a depressant. Alcohol affects the body and the central nervous system in many ways. Many different reactions occur during and after intake, *e.g.*, pulse increase and reaction and balance decrease<sup>1</sup>.

Vision is affected by alcohol. Several studies during the 20th century show that the

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visual field (VF) decreases with increasing alcohol levels in the blood<sup>2-4</sup>. The ability to accommodate and converge<sup>2</sup>, light sensitivity<sup>4</sup> and light adaptation<sup>5</sup> decrease. In contrast to other functions, visual acuity (VA), binocular function and the color vision are not affected by alcohol in low blood concentrations<sup>2</sup>. Adams and Brown found no effect of alcohol on the central VF<sup>6</sup>, while Zulauf *et al.* found a retinal sensitivity<sup>7</sup>. Both studies reported decreased fixation stability<sup>6,7</sup>.

The aim of the present study was to evaluate the effect of a 'social' dose of alcohol on central retinal sensitivity and fixation stability, measured with microperimetry using the scanning laser ophthalmoscope (SLO).

## Methods and subjects

Eighteen subjects, nine males and nine females, median age 24.1 years (range 22-28), were recruited for the study among the personnel at St. Erik's Eye Hospital. The inclusion criteria were absence of any disorder and medication and a corrected VA of at least 0.8. One eye of each subject, selected randomly, was used. All subjects freely volunteered to participate in the study after the procedure and aim had been explained to them. All examinations were performed by the one of the authors (FK).

Alcohol was given to the subjects in the form of red wine in an amount of 40 ml per 70 kg body weight (median 38.8 ml) consumed during a 30-minute period. This corresponds to two glasses of wine, which can be regarded as a 'social' dose assumed not to cause any significant intoxication. Alcohol levels were measured in percent with a Lion alcohol detector 45, 60 and 75 minutes after the start of intake. VA was measured with a Snellen chart at a distance of 5 m before and at the presumed peak alcohol level (Rydberg U, personal communication), *i.e.*, 60 minutes after the start of alcohol intake. All subjects used their usual corrective lenses during the tests. Contrast sensitivity was measured with the LH test at a test distance of 50 cm, measuring VA at four contrast levels, 10%, 5%, 3% and 1.5%. These tests were performed before and 65 minutes after alcohol intake.

Microperimetry was performed with the Rodenstock SLO-101<sup>8-10</sup>, using a previously published method<sup>11,12</sup>. The confocal SLO with graphics capabilities allows the investigator to determine the retinal location of the visual stimulus directly on the retina in real time. The SLO obtains retinal images continuously with an infrared laser (780 nm) and displays graphics (*e.g.*, lines, letters, words) onto the retina with a modulated visible helium-neon laser (633 nm). The SLO provides a 32×22° image of the fundus with a minimum resolution of four minutes of arc (20 μm) for measurement and positioning of targets. This examination was performed before and 70 minutes after alcohol intake. The measurements were performed from the very center of the fixation point (the presumed center of macula) and 10° from fixation in eight meridians, 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°, respectively. The size of the stimuli was 7×7 minutes of arc. The stimulus intensities were 0dB and 10dB on a background of 10 cd/m<sup>2</sup>. For each stimulus presented to the subject, the computer registered the exact location of fixation. The median fixation point was calculated from the x and y coordinates of each registered fixation point stored in the computer.

Statistical analyses were made using Student's *t* test. A *p* value of less than 0.05 was regarded as significant.

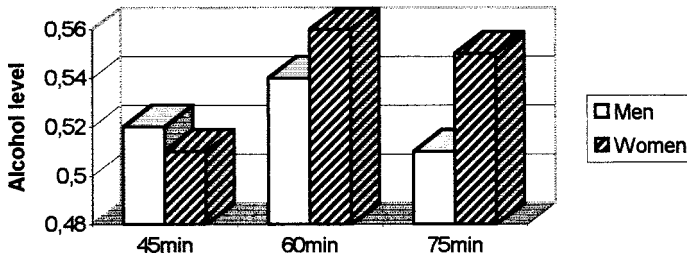


Fig. 1. Alcohol level in males ( $n=9$ ) and females ( $n=9$ ) during the test.

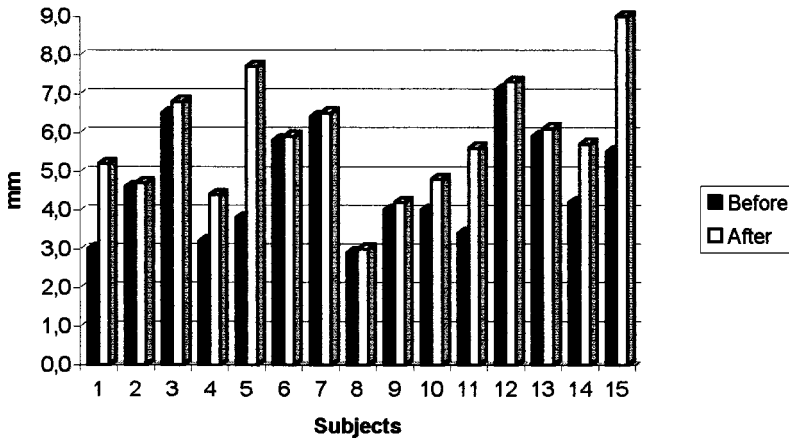


Fig. 2. Fixation in mm from fixation mark before and after alcohol intake.

**Results**

The median blood concentrations of alcohol at the times of measurement are shown in Figure 1. After 45 and 60 minutes, the concentration of alcohol in the blood in males and females was not significantly different, but after 75 minutes the females had 0.04% higher values than the males. (For a comparison it should be noted that the limit for driving a motor-vehicle in Sweden is equal to or less than 0.2%<sup>13</sup>.)

There were no statistically significant differences in mean VA before and after alcohol intake in the studied group, or between males and females ( $p=0.2089$ ). Eight male subjects had stable VA during the test. In one of the male subjects, the VA decreased from 1.3 to 1.0 after alcohol intake. In five of the female subjects, the VA was stable, three showed improvement (from 1.3 to 1.6, 1.6 to 2.0, and 0.8 to 1.0, respectively) and one deterioration (from 1.6 to 1.3).

Mean fixation stability was significantly reduced 70 minutes after alcohol intake ( $p=0.0068$ ) ( $n=15$ , data from three subjects were lost due to computer error). The difference was pronounced in six of the subjects and very small in the remaining nine (Fig. 2). There were no significant differences between males and females regarding the fixation instability ( $p=0.8906$ ). No correlation between alcohol level and fixation instability was observed.

No statistical differences were found between males and females with regard to central

retinal sensitivity and contrast sensitivity or between measurements before and after alcohol intake ( $p=0.1669$ ).

## Discussion

Central retinal sensitivity was not consistently affected by a small dose of alcohol. In contrast, fixation stability deteriorated significantly ( $p=0.0068$ ), and a horizontal instability could be seen, corresponding to the previously described positional alcohol nystagmus phase <sup>15</sup>. Alcohol-induced nystagmus has been described earlier<sup>16</sup>, but not at such low alcohol blood levels.

In six of the subjects, fixation stability was more affected by the alcohol than in the remaining nine. No correlation was found between alcohol level and fixation instability, and the decrease could not be explained by the well-known sex difference in alcohol tolerance, thus the reason for this inter-individual difference could not be determined by the current study. Further investigations are needed to evaluate the relevance of fixation stability for visual function and the reasons for the inter-individual difference in alcohol tolerance.

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