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## Introduction

An adequate volume of tears is a necessity for a healthy ocular surface and a reduction of tears leads to a greater chance of developing symptoms and signs of ocular dryness.<sup>1</sup> The level or severity of these signs and symptoms vary during the day due to the exposure to different factors, such as air-conditioning, computer work or constant mobile phone browsing, and become more severe at the end of the day.<sup>2</sup> There are several clinical tests used to assess the tear film of the eye. phenol red thread test (PRT) is a quantitative test used to measure the tear volume<sup>3</sup>.

## Objective

The aim of this study was to measure the effect of indoor daily activities on tear volume of normal Saudi population using phenol red thread test.

## Materials & Methods

One hundred twenty-four healthy Saudi adults were enrolled in this prospective cross-sectional study. The age range was from 18 to 37 years. The study protocol was approved by the ethical committee of the college of applied medical sciences and took place at optometry clinics. At the beginning, all participants were asked to complete McMonnies (MQ) dry eye questionnaire (fig.1) in order to exclude dry eye cases (with a cut-off of 14.5). After that, a slit lamp examination (fig.2) was run to exclude cases of any ocular pathology that may affect the study results. Subjects with a long-term contact lens wear, pregnant or menstrual period women, systemic disease that is associated with dry eye, refractive surgery, and ocular medications were excluded from the study.



Fig 1. McMonnies questionnaire (Arabic version).



Fig 2. Slit Lamp Biomicroscopy.

After that, a phenol red thread test (fig.3) was performed and a cut-off point of less than 10 mm was used for dry eye. A total of Six measurements were taken for each eye. 3 measurements in the morning (7:00 am to 9:00 AM) and 3 measurements in the afternoon (1:00 pm to 3:00 pm). The average of the three readings for each period was used in the statistical analysis. The indoor activities include working on computers, attending lectures, reading and browsing mobile phones or portable devices. The temperature remained relatively constant at  $22 \pm 2^{\circ}\text{C}$  inside the building.



Fig 3. Phenol Red Thread Test.

## Statistical Analysis

Statistical analysis was performed with SPSS software (IBM SPSS Statistics version 22). Descriptive statistics were obtained. Paired t-Test was used to compare between morning and afternoon results. The probability values of less than 0.05 were considered statistically significant.

## Results

A total of 124 subjects (66 males and 58 females) were participated in this study with mean age of  $23.65 \pm 4.72$  years. There was a significant difference between PRT readings in the morning and in the afternoon ( $P = 0.00$ ). This difference was a decrease of approximately 3.4 mm in the afternoon readings as shown in Table 1.

	Min	Max	Mean	Std. Deviation
Age	18.00	37.00	23.65	4.72
MQ	.00	12.00	5.20	2.61
Daily activities Hours	4.50	8.00	6.17	.98
Morning's Readings	12.00	30.00	23.30	4.04
Afternoon's Readings	10.00	27.00	19.88	4.14

Table 1. Mean and Standard Deviation of Variables.

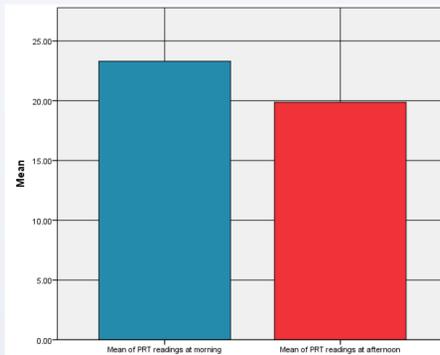


Fig 4. Comparison of PRT readings between the morning and the afternoon sessions.

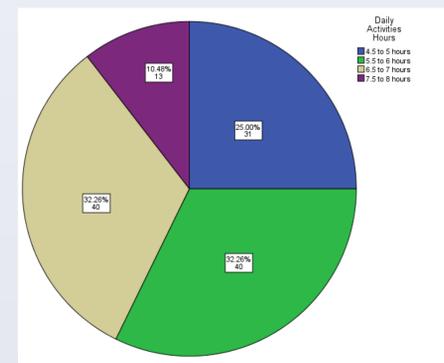


Fig 5. Comparison of Daily activities hours between samples.

## Discussion

The findings of this study demonstrated that there was a significant difference between the mean PRT readings during the same day. A decrease of tear volume by approximately 3.4 mm was observed in the afternoon measurements which is believed to be due to the effect of indoor daily activities on tear volume. These activities include attending lectures, browsing mobile phones, using computers, reading books or attending lab work. There are few studies reported the daily activities effect on the tear volume particularly by using the phenol red thread test which has more advantages over the commonly used Schirmer tear test<sup>4</sup>. The mean values of PRT test were  $23.3 \pm 4.0$  mm and  $19.8 \pm 4.41$  mm in the morning and afternoon, respectively, which are lower than the result of a previous study by Cardona and co-authors who found that there is no significant decreasing in the tear volume after using computer games in normal young subjects.<sup>5</sup> This difference may be attributed to their small sample size which was 25 subjects, and the short playing time of computer games which was 20 minutes only.

Another study measured the tear quantity of normal subjects by using Schirmer tear test in the morning then repeated in the afternoon of the same day.<sup>1</sup> It has been found that there no significant difference among these values, which is contradicted with the present study. This difference may be attributed to the very weak agreement between PRT and Schirmer test.<sup>6</sup>

## Conclusion

This study measured the effect of indoor daily activities on the tear volume. It has been found that activities such as attending lectures, reading notes or attending lab work can decrease the tear volume in normal subjects.

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