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The mucin 5AC level in medical faculty students with Computer Vision Syndrome (CVS)



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I Gusti Ayu Made Juliari,^{1*} Ratna Sari Dewi,¹ Ni Luh Made Novi Ratnasari,²
Ariesanti Tri Handayani¹

ABSTRACT

Introduction: Prolonged computer use will lead to a group of symptoms such as dryness of eyes, tired, headache and others called Computer Vision Syndrome (CVS). The decrease of Mucin 5 AC (MUC5AC) level could be one of the signs of dry eye disease on persons with CVS.

Objective: The purpose of this study is to describe the Mucin 5AC level in medical faculty students of Udayana University, Bali, Indonesia with CVS.

Method: It is an observational cross-sectional analytic study at Medical Faculty Udayana University on October 2018. Thirty four subject selected by purposive sampling and examined with Schirmer I test, Tear Break Up time (TBUT) test, and Mucin 5AC test. All of the subject then divided into CVS group and non-CVS group. Mucin 5AC

level which less than 186.33 ng/mL categorized as low mucin, while more than 186.33 ng/mL categorized as normal mucin level. Data was analyzed by crosstabulation table and chi-square test with significant value $p < 0.05$.

Result: Most of the students who diagnosed with CVS had lower mucin 5AC levels as much as 77,3% and 33,3% students with CVS had normal mucin 5AC level. This study analyses found there is significant association between level of mucin 5AC with CVS. The students with low level of mucin 5AC had 6,8 higher risk tend to be CVS (OR=6,8; CI 95%= 1,42-32,37; $p=0,012$).

Conclusion: Low level of mucin 5AC has association with the risk of CVS in the medical students with prolonged computer use.

Keywords : Mucin 5AC, Computer Vision Syndrome, Medical Students

Cite this Article: Juliari, I.G.A.M., Dewi, R.S., Ratnasari, N.L.M.N., Handayani, A.T. 2019. The mucin 5AC level in medical faculty students with Computer Vision Syndrome (CVS). *Bali Medical Journal* 8(2): 460-463. DOI:10.15562/bmj.v8i2.1425

¹Ophthalmology Department, Medical Faculty, Universitas Udayana, Sanglah General Hospital, Denpasar

²Medical Faculty, Universitas Udayana, Sanglah General Hospital, Denpasar

INTRODUCTION

Tear layers consist of three layers, which are lipid layer at the outer part, aqueous layer at the middle part and mucin layer at the inner part of the tears. Mucin plays an important role in maintaining ocular surface health. The mucin layer is produced by conjunctival goblet cells, corneal conjunctival epithelial, and lacrimal gland. Disturbance in the mucin production and mucin stability will lead to the Dry Eye Disease (DED) and affects the quality of life.¹

Mucin is a large negativity glycoprotein. Mucin forms the deepest and closest layer to the surface of the cornea and directly interacts with conjunctival glycocalyx, giving a hydrophilic layer to the aqueous layer. The hydrophilic characteristic of mucin helps to distribute aqueous on the ocular surface. Mucin layer also interacts with the lipid layer to reduce the ocular tear surface tension make the layer more stable. In addition the mucin layer can also takes the surface cells of the oculating peels, foreign objects and bacteria through loose mucin tissue that covers the bulbi conjunctival. The mucin layer also lubricates the eyelids when the layer passes through the eyeball.^{2,3,4}

Conjunctival goblet cells responsible for mucin production are located on the apical surface of the

conjunctiva, including interspersed with several layers of stratified epithelium.⁵ Meanwhile, stratified epithelial cells produce trans membrane mucins such as MUC1 and MUC4.⁵ Among all mucin gel, MUC 2, MUC5AC and MUC 19 can be detected in human conjunctival tissue and MUC 5 AC is the most gelatinous mucin found in the eye.^{6,7,8}

Deficiency of secretions and expression of mucin genes in the conjunctival cell was found in disorders of the ocular surface associated with DED. Many studies of the deficiency and disorders of glycosylation Mucin (MUC5AC and MUC 2) that have been reported were found in Sjogren Syndrome and Non Sjogren Syndrome types of DED.⁹ The study by Argüeso et al., 2002 showed that there was a significant decrease in MUC5AC transcription in DED patients' conjunctival due to Sjogren Syndrome than in normal individuals, while decreased in the expression of MUC1 and MUC4 was not found.⁵ The study by Berry et al., 2008 also showed a decrease in MUC5AC levels in DED. MUC16 and MUC5AC are also associated with corneal staining shows if there is ocular surface damage.¹⁰

The widely use of computer in young age will affect ocular surface condition including mucin tear's level. Studies of MUC5AC levels in tears

*Correspondence to:
I Gusti Ayu Made Juliari,
Ophthalmology Department,
Medical Faculty, Universitas
Udayana, Sanglah General Hospital,
Denpasar
arie_mata@yahoo.com

especially at young age have never been reported in Bali and in Indonesia. This makes the researchers investigate the level of MUC5AC at a young age, especially in medical students who frequently use computer and experience symptoms of CVS.

METHODS

This study is an observational cross-sectional analytic study at Medical Faculty Udayana University carried out 34 samples with the permission of ethical clearance from the Health Research Ethics Commission, Faculty of Medicine, Udayana University. The study was conducted in October 2018. Samples were medical student of Medical Faculty Udayana University which collected by purposive sampling after fulfilling the inclusion and exclusion criteria. The inclusion criteria were those Schirmer test result ≥ 15 mm, willing to take part for tears examination, and sign the informed consent. Exclusion criteria were respondents with routine contact lens used, pregnancy or breast feeding, respondents who have treated by LASIK procedure, infected eye, and respondents with history of fluorescein allergy.

All samples were given questionnaire, underwent interviewed, ophthalmology examination, and tears biochemistry examination. The samples were divided into CVS and Non CVS group based on the questionnaire scores that resembles CVS symptoms. Thirty four subject selected by consecutive sampling were examined with Schirmer I test, Tear Break Up time (TBUT) test, and Mucin 5AC test by ELISA procedure.

Tear samples collection were using Schirmer's strip (Tear Flow Diagnostic Test Strip; Rancho Cucamonga, CA) that placed at the temporal canthus of each eye for 5 minutes without anesthetic. The strips were then removed from the eyes, and the amount of wetting in millimeters was recorded by observing the edge of moisture on the printed millimeter marks. Strips were placed on centrifuge tube and run for 5 minutes of 12.000 RPM centrifuge to get the tears and stored in -20°C until all samples collected. ELISA procedure were performed at Biochemistry Laboratory of Udayana University. Data analysis used crosstabulation table and chi-square test. Significance was stated at $p < 0.05$.

RESULTS

The study sample consisted of 34 respondents of Medical Faculty students, Udayana University in period class of 2015-2016. There were 21 CVS samples and 13 Non-CVS samples based on symptoms that recorded from the questionnaire. All the samples examined by Schirmer I test, TBUT, and MUC5AC levels test.

Table 1 shows that the subjects were dominated by female (24 subjects or 70.6%) and 10 subjects (29.4%) were male. The mean age of subjects was 20.09 ± 0.71 years old. Schirmer test examined in both eyes (left and right) and presented in the table 1. The mean value of Schirmer I test result on right eye was 33.47 ± 4.29 mm, while Schirmer I test result on left eye was 33.00 ± 4.25 mm. Tear break up time test also performed in both eyes.

Table 1 Characteristics of Research subject

Variable	Result
Age (year), Mean \pm DS	20.09 \pm 0.71
Sex	
Male	10 (29.4)
Female	24 (70.6)
Schirmer OD (mm), Mean \pm DS	33,47 \pm 4,29
Schirmer OS (mm), Mean \pm DS	33,00 \pm 4.25
TBUT OD (second), Mean \pm DS	11.32 \pm 4.47
TBUT OS (Second), Mean \pm DS	11.29 \pm 4.34
MUC5AC, Mean \pm DS	183.95 \pm 71.99

TBUT: tear break up time; OD: oculi dextra; OS: oculi sinistra; DS : deviation standard

Table 2 Low level of Mucin 5AC as The Risk Factor for CVS

Variable	CVS	Non CVS	OR	CI 95%	P value
Low mucin	17 (77,3%)	5 (22,7%)	6,8	1,42-32,37	0,012*
Normal Mucin	4 (33,3%)	8 (66,7%)			

*significance ($p < 0.05$)

The mean TBUT on the right eye was 11.32 ± 4.47 seconds while the mean of TBUT on left eye was 11.29 ± 4.34 seconds.

The biochemistry feature of the tears calculated by ELISA procedure to measure the mean value of the MUC5AC level in both eye of the samples. Calculation of MUC5AC requires the reagent kit to know the level of MUC5AC. In this research, the mean level of MUC5C was found 183.95 ± 71.99 ng/ml. Characteristics of this research subject can be seen in [table 1](#) as follows:

The samples then grouped into CVS group and non-CVS group. Mucin 5AC levels are grouped into low mucin and normal mucin level. Mucin 5AC level which less than 186.33 ng/mL categorized as low mucin, while more than 186.33 ng/mL categorized as normal mucin level. This study found, 17 samples (77.3 %) with CVS had low mucin 5AC levels and 5 (22.7%) non-CVS samples have low mucin 5AC level. Total of 8 (66.7%) non-CVS samples have normal mucin 5AC level, but only 4 CVS samples (33.3%) have normal mucin 5AC levels.

The Mucin 5AC concentration level and chi-square test result presented in [table 2](#). The statistic test result showed, this is significant correlation between Mucin 5AC level with CVS. The odd ratio result is 6.8 with 1.42 – 32.37 confidence interval, identified as subjects with low mucin levels have a risk 6.8 times greater to experience CVS (OR = 6.8; 95% CI = 1.42-32.37; $p = 0.012$) than subjects with normal mucin 5AC level. The [table 2](#) is listed below:

DISCUSSION

This study found that the research subjects were dominated by female (70.6%) and 10 subjects (29.4%) were male. The proportion of male and female subjects in the medical students of class period 2015-2016 is equivalence. In this study the percentage of samples with CVS was more female (76.2%) than men. Study by Tornqvist et al among professional computer users showed that women had higher risk of acquiring eye symptoms than men.¹⁰

These symptoms could be caused by indoors activities using gadgets in women students may be longer than men students, tendency to stay in cool environment with air conditioner in the room, the use of eye make up that can be have influence on the tears so the possibility of CVS is higher in women students than in men students.

Mean age of the subjects who participated in this study was 20.09 ± 0.71 years old who were

in productive age and many activities in that age group that used computers or video display terminals (VDT). Similar results were found in other Asian population such as in India¹¹ and in Japan.¹²

TBUT values are usually low in cases of evaporative dry eyes. Research by Goto et al. (2008) reported TBUT values of 3.4 ± 2.4 seconds in evaporative dry eye cases.¹³ In this study the mean standard deviation of the right eye TBUT value was $11.32 + 4.47$ second, while the left eye was $11.29 + 4.34$ second. The normal TBUT according Dry Eye Work Shop (DEWS) II in 2017 was 10 seconds.^{13,14} Meanwhile, research conducted by Zhao H et al (2001) reported no association between mucin level 5AC and age or sex in healthy communities.¹⁵

The study by Argueso et al. found that the amount of mucin 5AC in tears that could be detected by ELISA varied between 1-5 to 1-9 ng/per mg of protein in normal subjects.⁵ Zhao et al.¹⁵ found that levels MUC 5AC in humans ranges from undetectable to 200 ng / mL. MUC 5AC levels in tears measured by ELISA around 6.8 ng/mg in normal eye.¹⁵ In this study the mean value with a standard deviation of mucin 5AC levels was 183.95 ± 71.99 ng/ml. The mucin levels in the study sample were still within normal limits but tended to decrease in samples experiencing CVS. Deficiency of the secretions and expression of mucin 5AC genes in the conjunctival epithelium usually found in ocular surface disorder associated with dry eye as a symptom of CVS.^{16,17} A total of 17 samples of this study experienced CVS and had decreased mucin levels and were categorized as low mucin while 4 were normal mucin categories.

This study was conducted in relatively younger age that still have normal Schirmer and TBUT test. The small samples and CVS that assessed by the symptoms only and not resembles the DED were the limitation of this study. But this study can show a prediction that Mucin 5 AC level tend to decrease in young people who frequently use computer more than 4 hours eventough no clinical signs and symptoms of DED were reported.

CONCLUSION

There is significant association between low level of mucin 5AC and the risk of CVS in the medical students with prolonged computer use. Students with low level of mucin 5AC is 6.8 times tend to experience CVS than students with normal mucin 5AC level. Further mucin 5AC study with larger sample size and older age is needed to prove the role mucin 5AC as one of CVS risk factor.

ACKNOWLEDGEMENT

This research was supported by research unit and community service (LITBANG) of medical faculty, Udayana University.

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