EVALUATION OF THE DRY EYE DISEASE PARAMETERS WITH EXPOSURE TO DRY ERASE INK AMONG SCHOOL TEACHERS

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DISCLAIMER

I hereby certify that the work in this dissertation is my own except for the quotations, some figures and summaries which have been duly acknowledged. I declare that I have no financial interest in the instrument and the computer software used in this study.

Date: …...……

Dr Ainul Basirah binti Ibramsah

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ABBREVIATIONS

OSDI	Ocular Surface Disease Index
TBUT	Tear break up time
SPSS	Statistical Product and Service Solutions
ID	Identity / identification
IQR	Interquartile range
SD	Standard deviation
CI	Confidence interval
SE	Standard error
SPM	Sijil Pelajaran Malaysia
DED	Dry eye disease
COVID-19	Coronavirus disease of 2019

ABSTRAK (BAHASA MELAYU)

Objektif: Mengkaji kesan penggunaan dakwat ‘dry-erase’ terhadap parameter permukaan mata merangkumi aspek masa yang diambil untuk lapisan filem air mata hilang integriti (Tear Break up Time (TBUT)), penghasilan air mata daripada kelenjar lakrimal (Schirmer Test), dan markah ‘Ocular Surface Disease Index (OSDI) di kalangan guru sekolah.

Reka bentuk: Analisa secara langsung ini dijalankan daripada Jun 2020 sehingga Disember 2021 melibatkan 116 orang guru sekolah dan 145 orang awam. Hasil yang diambil kira termasuk data demografi, purata jam mengajar dalam masa sehari dan seminggu bagi guru; masa yang diambil untuk lapisan filem air mata hilang integriti (Tear Break up Time (TBUT)), penghasilan air mata daripada kelenjar lakrimal (Schirmer Test), dan markah ‘Ocular Surface Disease Index (OSDI) pada guru sekolah dan orang awam. Penyakit mata kering didefinisikan sebagai skor OSDI melebihi 12 beserta samada hasil bacaan TBUT kurang daripada 10 saat atau ‘Schirmer Test’ kurang daripada enam milimeter dalam lima minit atau kedua-keduanya. Analisis statistik dilakukan dengan menggunakan SPSS versi 26.

Keputusan: Seramai 116 orang guru berusia purata 48.0 tahun dan 145 orang awam berusia purata 42.0 tahun terlibat dalam kajian ini. Terdapat perbezaan purata yang ketara terhadap keputusan OSDI dan TBUT dikalangan guru sekolah dibandingkan dengan orang awam ($p<0.01$). Walaubagaimanapun, tiada perbezaan yang ketara pada keputusan ujian Schirmer. Tiada hubungan yang signifikan antara purata jangka masa mengajar terhadap keputusan TBUT ($p=0.450$) dan keputusan ujian Schirmer ($p=0.327$). Manakala tiada hubungan

signifikan antara skor OSDI dengan keputusan TBUT (p=0.629) dan ujian Schirmer's (p=0.327) di kalangan guru sekolah mahupun orang awam (p=0.225, p=0.840).

Kesimpulan: Penggunaan dakwat 'dry-erase' tidak memberi kesan terhadap integriti permukaan mata dan lapisan filem air mata di kalangan guru sekolah. Walaubagaimanapun, penyakit mata kering di kalangan guru boleh menjejaskan kualiti pekerjaan dan pengajaran di sekolah.

Kata kunci: Dakwat 'dry-erase', guru sekolah, permukaan mata, tear Break-up Time, Schirmers test, Ocular Surface Disease Index (OSDI)

ABSTRACT (ENGLISH)

Objective: To evaluate the effect of dry-erase ink marker usage among school teachers towards the dry eye disease parameters including tear film breakup time (TBUT), Schirmer test and ocular surface disease index(OSDI) score.

Design: A cross-sectional study was conducted from June 2020 to December 2021 involving 116 school teachers and 145 control subjects. Assessment include demographic data, average of hours of teaching in a day and a week for school teachers, TBUT test, Schirmer test and OSDI score among school teachers and control subjects. Dry eye disease was defined as OSDI score more than 12, and either TBUT less than ten seconds or Schirmer test less than 6mm in five minutes or both. Statistical analysis was done using SPSS version 26.

Results: There were 116 school teachers with mean age of 48.0 year-old and 145 control subjects with mean age of 42.0 year-old involved in this study. There was statistically significant difference of OSDI score and TBUT results among school teachers compared with control subjects ($p<0.01$). However, there was no significant difference in Schirmer test results. There was no statistically significant relationship between hours of teaching with the TBUT test ($p=0.450$) and Schirmer test ($p=0.327$). There was no significant relationship of OSDI score with the TBUT test ($p=0.629$) and Schirmer test ($p=0.230$) among school teachers or control group ($p=0.225$, $p=0.840$).

Conclusion: Ocular surface integrity and tear film are not affected by usage of dry-erase ink marker among school teachers. However dry eye among school teachers can affect the quality of work and classroom learning.

Keywords: Dry-erase ink, school teachers , ocular surface, tear Break-up Time, Schirmer's test, Ocular Surface Disease Index (OSDI)

Chapter 1

INTRODUCTION

1 INTRODUCTION

Previously, school teachers write on blackboards using chalk. Chalk produces a lot of dust which accumulates on surfaces and causing irritating respiratory tract symptoms when inhaled. Therefore, almost all schools nowadays substitute the chalkboards with whiteboards.

The whiteboards or dry-erase boards came into use in the late 1980s. By 1990s most of the class rooms were replaced with whiteboards instead of chalkboards (Jayakumari et al, 2016).

Most schools in Malaysia are using whiteboards by year 2010.

1.1.1 Dry-erase ink solvent

Dry-erase ink is a type of ink used in most whiteboard marker pen which contain volatile solvent vehicle that easily vaporizes allowing the mark to dry on the surface. Most whiteboard markers use dry-erase ink which easily vaporizes allowing the mark to dry on the surface of the whiteboard. The solvents used include butanol, diacetone alcohol, ethanol, isopropyl alcohol, methyl isobutyl ketone and 2-butoxy-ethanol. These solvents cause irritation to the eyes, skin and throat, corneal damage, photophobia, dermatitis and many more (Clifford et al, 2000).

Figures below are the example of material safety data sheet of two most used brands of dry-erase markers in Malaysia taken from the products' brochure. Both show highly flammable ingredients consist of mainly alcohol which are irritants to the eye.

Material Safety Data Sheet:
Dry Erase Markers (All Colors Ink)

2. COMPOSITION INFORMATION

INGREDIENT	% OF FORMULA	CAS NO.
Denatured Ethanol	40 - 60 %	64 - 17 - 5
Iso-Propanol	20 - 40 %	67-63-0
Pigments, Resins, Release Agents, Surfactants	15 – 30%	Blend

3. HAZARDS IDENTIFICATION

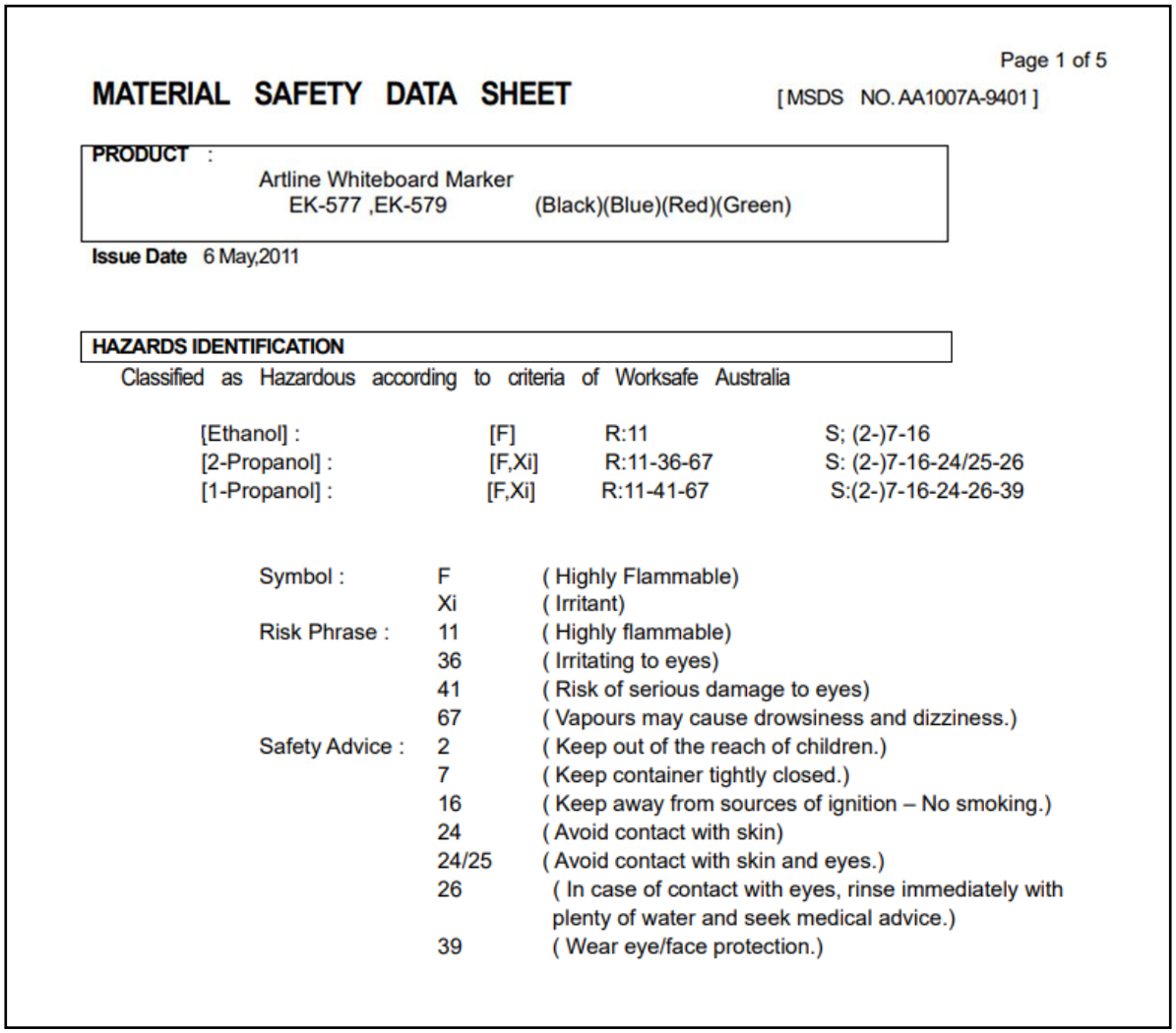
Highly Flammable Irritating to eyes Vapours may cause drowsiness and dizziness.

The product contains volatile alcohol solvent fractions that may be narcotic in high concentrations and degreasant to the skin.

4. HEALTH EFFECTS & FIRST AID

ROUTE	EFFECT	FIRST AID
Oral	Harmful	Give plenty to drink if ingestion is suspected. DO NOT induce vomiting and consult a physician.
Skin Contact	Will degrease skin - can cause irritation	Remove any contaminated clothing. Wash with soap & flowing water for 15 minutes. If irritation continues consult a physician.
Eye Contact	May cause damage	Irrigate with a suitable eye solution or water for ten minutes - obtain medical attention.
Inhalation	Narcotic - avoid inhalation	Remove from exposure - in severe cases obtain medical attention.

Figure 1.1: Material safety data sheet for dry-erase marker Brand A



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MATERIAL SAFETY DATA SHEET [MSDS NO. AA1007A-9401]

PRODUCT :
Artline Whiteboard Marker
EK-577 ,EK-579 (Black)(Blue)(Red)(Green)

Issue Date 6 May,2011

HAZARDS IDENTIFICATION

Classified as Hazardous according to criteria of Worksafe Australia

[Ethanol] :	[F]	R:11	S; (2-)7-16
[2-Propanol] :	[F,Xi]	R:11-36-67	S: (2-)7-16-24/25-26
[1-Propanol] :	[F,Xi]	R:11-41-67	S:(2-)7-16-24-26-39

Symbol :	F	(Highly Flammable)
	Xi	(Irritant)
Risk Phrase :	11	(Highly flammable)
	36	(Irritating to eyes)
	41	(Risk of serious damage to eyes)
	67	(Vapours may cause drowsiness and dizziness.)
Safety Advice :	2	(Keep out of the reach of children.)
	7	(Keep container tightly closed.)
	16	(Keep away from sources of ignition – No smoking.)
	24	(Avoid contact with skin)
	24/25	(Avoid contact with skin and eyes.)
	26	(In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.)
	39	(Wear eye/face protection.)

Figure 1.2: Material safety data sheet for dry-erase marker Brand B

1.1.2 Impact of dry-erase ink solvent on eyes

Four inter-related mechanisms responsible for manifestations of dry eyes are tear instability, tear hyperosmolarity, inflammation and ocular surface damage. Exposure to chemical vapours and solvents disrupts tear film integrity and stability causing higher evaporation.

Pre-corneal tear film structure is altered by a physical process that increases the emission rate of aqua loss resulting in hyperosmolatiry, gland dysfunctions and associated discomfort.

The structural composition of the outermost lipid layer of the pre-corneal tear film is altered by aggressive aerosols and combustion products, that facilitate loss of aqua.

Strong sensory irritating pollutants cause chemesthesis by trigeminal stimulation.

1.1.3 Dry eye disease and prevalence among teachers

Based on Asian Dry Eyes Society, dry eye is defined multifactorial disease characterized by unstable tear film causing a variety of symptoms and/ or visual impairment, potentially accompanied by ocular surface damage (Tsubota et al,2020). Dry eye disease is diagnosed by the combination of symptoms and an unstable tear film. Dry eye symptoms assessed by Ocular Surface Disease Index (OSDI), or McMonnies questionnaire, Women's Health Study Questionnaire, or the recently reported dry eye-related QOL score (DEQS), while unstable tear film characterized by decreased TBUT (Tsubota et al, 2017).

The use of dry-erase ink markers in school also contribute to development of dry eyes (Ghalamkarpour et al, 2020; Samarawickrama et al, 2015). The use of dry-erase ink marker in schools causing detrimental effect on meibomian gland as it results in cell death, atrophy of

acini, hyposecretion of oil and altered gene expression leading to dry eye syndrome (Samarawickrama et al, 2015).

1.1.4 Ocular surface parameters

Ocular surface parameters are parameters that are used to quantify the hydration state of the ocular surface by measuring tears function. Tears is important for ocular surface regularity and maintenance of good vision. The hydration state of the eyes can be disturbed either by the disease itself or side effect of medications that is needed to treat the disease.

Tear break-up time (TBUT) is measured using a fluorescein dye as a standard method. To minimize the effect on the tear volume and TBUT, a small quantity of the dye (less than 2 mL) should be administered with a pipette or wetted fluorescein strip. After the dye is instilled, the subject is instructed to blink three times to ensure adequate mixing of the dye with the tears. The time interval between the last blink and appearance of the first dark spot on the cornea is measured using a stopwatch. The mean value of the three measurements should be used. Cutoff value of less than 5 seconds is used for the diagnosis of dry eye (Tsubota et al, 2017).

Schirmer test primarily measures aqueous tear secretions and useful for determination of aqueous deficient dry eye (Tsubota et al, 2017). The Schirmer test done using dry filter strip that need to be placed temporally in each lower fornix. The average distance at which the paper was wet in both eyes after 5 min recorded as the Schirmer value of the subject (Aragona et al, 2018).

The Ocular Surface Disease Index (OSDI) Questionnaire, is designed to assess the dry eye disease severity in a scale of normal, mild to moderate and severe (Her et al, 2013). It is developed by the Outcomes Research Group at Allergen Inc. It is a 12-item questionnaire designed to provide rapid assessment of the symptoms of ocular irritation consistent with dry eye disease and their impact on vision- related functioning. The questionnaires are subdivided into three groups. The first group contains questions about the ocular symptoms of dry eyes syndrome, the second about the ocular symptoms while watching television or reading a book, and the third group contains the questions about ocular symptoms induced by environmental factors (Figure 3). The OSDI questionnaire is graded on a scale from 0 to 4, where 0 indicates none of the time; 1, some of the time; 2, half of the time; 3, most of the time; 4, all of the time. The total score of OSDI is calculated on the basis of the following formula: OSDI = [(sum of scores for all questions answered) × 100] / [(total number of questions answered) × 4] (Schiffman et al, 2000 & Özcura et al, 2017).

Ocular Surface Disease Index® (OSDI®)[2]

Ask your patient the following 12 questions, and circle the number in the box that best represents each answer. Then, fill in boxes A, B, C, D, and E according to the instructions beside each.

HAVE YOU EXPERIENCED ANY OF THE FOLLOWING *DURING THE LAST WEEK*:

	All of the time	Most of the time	Half of the time	Some of the time	None of the time
1. Eyes that are sensitive to light?	4	3	2	1	0
2. Eyes that feel gritty?	4	3	2	1	0
3. Painful or sore eyes?	4	3	2	1	0
4. Blurred vision?	4	3	2	1	0
5. Poor vision?	4	3	2	1	0

Subtotal score for answers 1 to 5 (A)

HAVE PROBLEMS WITH YOUR EYES LIMITED YOU IN PERFORMING ANY OF THE FOLLOWING *DURING THE LAST WEEK*:

	All of the time	Most of the time	Half of the time	Some of the time	None of the time	
6. Reading?	4	3	2	1	0	N/A
7. Driving at night?	4	3	2	1	0	N/A
8. Working with a computer or bank machine (ATM)?	4	3	2	1	0	N/A
9. Watching TV?	4	3	2	1	0	N/A

Subtotal score for answers 6 to 9 (B)

HAVE YOUR EYES FELT UNCOMFORTABLE IN ANY OF THE FOLLOWING SITUATIONS *DURING THE LAST WEEK*:

	All of the time	Most of the time	Half of the time	Some of the time	None of the time	
10. Windy conditions?	4	3	2	1	0	N/A
11. Places or areas with low humidity (very dry)?	4	3	2	1	0	N/A
12. Areas that are air conditioned?	4	3	2	1	0	N/A

Subtotal score for answers 10 to 12 (C)

ADD SUBTOTALS A, B, AND C TO OBTAIN D (D = SUM OF SCORES FOR ALL QUESTIONS ANSWERED) (D)

TOTAL NUMBER OF QUESTIONS ANSWERED (DO NOT INCLUDE QUESTIONS ANSWERED N/A) (E)

Please turn over the questionnaire to calculate the patient's final OSDI® score.

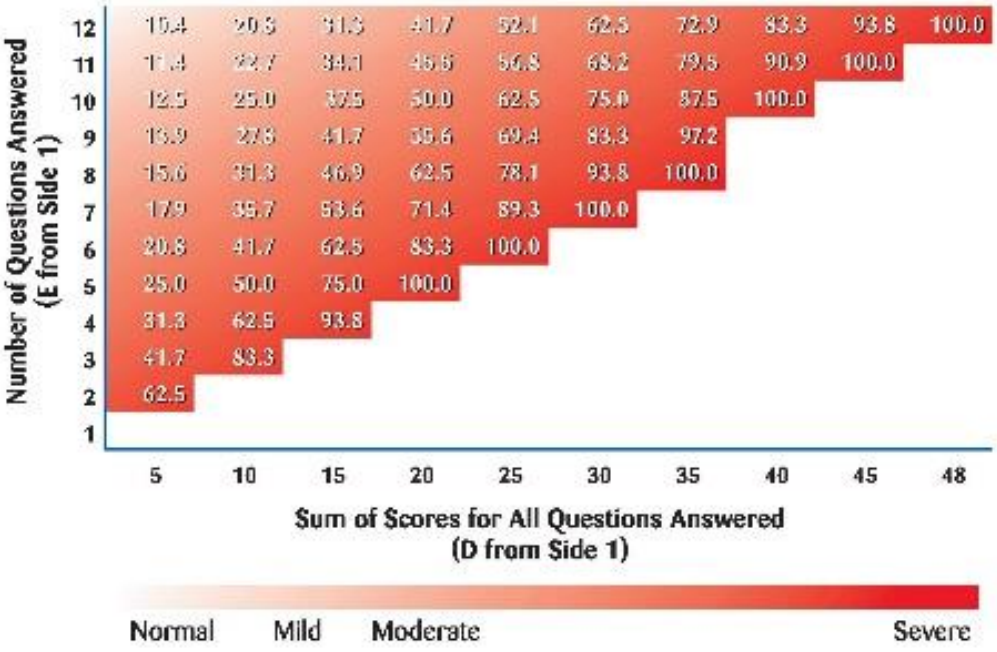
Figure 1.3: Ocular Surface Disease Index (OSDI) Page 1

Evaluating the OSDI® Score[1]

The OSDI® is assessed on a scale of 0 to 100, with higher scores representing greater disability. The index demonstrates sensitivity and specificity in distinguishing between normal subjects and patients with dry eye disease. The OSDI® is a valid and reliable instrument for measuring dry eye disease severity (normal, mild to moderate, and severe) and effect on vision-related function.

Assessing Your Patient's Dry Eye Disease[1,2]

Use your answers D and E from Side 1 to compare the sum of scores for all questions answered (D) and the number of questions answered (E) with the chart below.*
Find where your patient's score would fall. Match the corresponding shade of red to the key below to determine whether your patient's score indicates normal, mild, moderate, or severe dry eye disease.



*values to determine dry eye disease severity calculated using the OSDI® formula:
OSDI® = (sum of scores) x 25 / (# of questions answered)

Patient's Name: _____ **Date:** _____

How long has the patient experienced dry eye? _____

Eye Care Professional's Comments: _____

Reference: 1. Schiffman RM, Christianson MD, Jacobsen G, Hirsch JD, Reis BL. Reliability and validity of the Ocular Surface Disease Index. *Arch Ophthalmol.* 2000;118:615-621. 2. Data on file. Allergan, Inc.

ALLERGAN INSPIRE

Tear and place in patient's chart for follow-up care on next visit.

Figure 1.3: Ocular Surface Disease Index (OSDI) Page 2

1.2 LITERATURE REVIEW

1. Muchemi et al (2018)

To establish the components of vapor produced when different dry erase inks used in secondary schools in Nakuru County evaporate and compare their ability to elicit eye irritation on the teachers. Questionnaires were used to collect data on self-reported eye irritations while chromatography was used to identify the components of the vapors produced by the different brands of ink

The incidence of eye irritation was higher among teacher when the marker pen ink was in use than when it was not in use.

2. Muchemi et al (2018)

This another study done by Muchemi was to establish the safety knowledge, attitude and practices of teachers on use of dry erase ink. Questionnaires were used to collect data on the level of knowledge and attitude of teachers.

The results showed only 0.6% of teachers had good knowledge on safety issues of the dry erase ink while 64.8% had positive attitude towards its use. The teachers had poor safety practices on the use of dry erase ink.

This shows that teachers exposed to potential occupational hazard without realizing it and did not take any preventive measures.

3. Shivling et al (2021)

The aim of study was to investigate the effect of chalk dust towards teacher's health. The study was done in Maharashthra, India comparing 100 teachers and 100 control subjects, using questionnaire and interview.

They found that most of teachers developed throat dryness (15%), followed by eye irritation (10%), and other respiratory problems. This study shows teachers exposed to occupational hazard in schools that are still using chalks. However, in Malaysia majority of schools already switched to whiteboard and dry-erase board

4. Chong E. et al (2010)

Chong investigated subjective health complaints among primary and secondary school teachers in Hong Kong. A total of 1710 questionnaire answered by Hong Kong's school teachers and 78.3% of respondents reported eye problem such as itchy and burning eyes, apart from musculoskeletal problem and fatigue.

However specific cause of eye problem among teachers did not investigated in this study.

5. George S et al (2019)

This study was done to determine tear osmolarity among contact lens user. From the relation of contact lens induced dry eye with occupation of the patient, it was revealed that teachers and computer professionals has higher number of dry eyes compared with other occupations.

Although this study done among contact lens user, it shows that teachers has higher prevalence of dry eye compared with other occupations hence other cause of dry eyes need to be investigated.

6. Maimunah AM et al (2016)

This is a cross sectional study of dry eyes in Malaysia population in relation with sociodemographic, lifestyle and medical factors. Based on the occupation, there was no statistically significant difference of prevalence of dry eyes among occupations with low exposure to wind and sunlight and high exposure to wind and sunlight.

This shows that dry eyes do not necessarily occur more among those with outdoor profession.

Based on these literatures, there are no specific study done to determine prevalence of dry eyes among teachers in Malaysia.

1.3 RATIONALE OF STUDY

This study was conducted to identify potential occupational hazard in school. Exposure to chemical irritants in daily life of a teacher may affect the quality of work. So far there is no study conducted in Malaysia to examine the eye health of teachers and whether they develop dry eyes in view of exposure to chemical irritants every day. Thus, existence of this study will help to elucidate the ocular surface problem in this group of population, identify factors contribute to it and importance of regular eye assessment among them.

Earlier studies on health-related issues among Malaysian teachers focused on mental health (Lee et al, 2020), voice disorders (Moy et al, 2015), and musculoskeletal illnesses (Alias et al, 2020; Zamri et al, 2017). There is limited study regarding eye health in indoor working environment but they were not conducted among teachers (Norback et al, 2017).

The goal of this study is to raise awareness of ocular safety hazards among the general population and authorities. This can be utilised as a model for future policymaking such as limiting the hours of working, replacing the dry erase markers to some alternatives teaching tools and advocating the teachers to have regular eye check-ups in order to achieve the best health status so that teachers can teach in the optimum health state and comfort.

Chapter 2

OBJECTIVES

2.1 RESEARCH OBJECTIVES

2.1.1 General objectives

To evaluate the dry eye disease parameters (OSDI, TBUT, Schirmer) among school teachers that exposed to dry-erase ink marker pen.

2.1.2 Specific objectives

1. To compare Ocular Surface Disease Index (OSDI) questionnaire score, tear breakup time (TBUT) and Schirmer test result among school teachers that exposed to dry- erase ink marker with control group.

2. To determine the relationship of Ocular Surface Disease Index (OSDI) questionnaire score with tear breakup time (TBUT) and Schirmer test result among school teachers that exposed to dry erase ink marker compare with control group.

3. To determine the relationship of hours of teaching with tear breakup time (TBUT) and Schirmer test result among school teachers exposed to dry erase ink

2.2 RESEARCH QUESTION

1. Is there any significant difference between results of Ocular Surface Disease Index (OSDI) score, tear breakup time (TBUT) and Schirmer test result among school teachers exposed to dry erase ink compared to control group?

2. Is there any significant relationship between OSDI score with TBUT and Schirmer test result among school teachers exposed to dry erase ink and control group?

3. Is there any significant relationship between hours of teaching with TBUT and Schirmer test result among school teachers exposed to dry erase ink?

2.3 RESEARCH HYPOTHESIS

1. There is significant difference between results of OSDI score, TBUT and Schirmer test result among school teachers exposed to dry erase ink compared to control group

2. There is significant relationship between OSDI score with TBUT and Schirmer test results among school teachers and control group.

3. There is significant relationship of hours of teaching with TBUT and Schirmer test result among school teachers exposed to dry erase ink.

Chapter 3

RESEARCH METHODOLOGY

3 RESEARCH METHODOLOGY

3.1 STUDY DESIGN

An observational cross sectional study was conducted from June 2020 to December 2021. A total of 116 school teachers were recruited from secondary schools in district Kota Bharu, as well as 145 control subjects. The study population involved all volunteered school teachers who were working during the study period and fulfilled the selection criteria.

3.2 ETHICAL APPROVAL

This study received ethical approval from Human Research Ethics Committee Universiti Sains Malaysia (HREC USM)/ Jawatankuasa Etika Penyelidikan Manusia (JEPeM) USM with the protocol code USM/JEPeM/20030160. (Appendix A)

3.3 FUNDING

This study did not receive any funding from any party.

3.4 SAMPLE SIZE CALCULATION

The sample size was calculated separately for each specific objective

3.4.1 Objective 1

To compare the OSDI score, TBUT and Schirmer test result between school teachers exposed to dry erase ink marker with control group

Sample size was calculated using G Power software version 3.1.9.4. The calculation was done based on t-test two mean formula: difference between two independent means (two groups).

The input parameters were:

Effect Size (f2)	Level of significance (α)	Power of study
0.6	0.05	0.8

Sample size = 45
Actual power= 0.804
Anticipated 20% dropout
Total sample size= 57

3.4.2 Objective 2

To determine the relationship between Ocular Surface Disease Index (OSDI) questionnaire score with tear breakup time (TBUT) and Schirmer test result among school teachers exposed to dry erase ink and control group.

Sample size was calculated using G Power software version 3.1.9.4. The calculation was done based on t-test correlation: point biserial model.

The input parameters were:

Effect Size (f2)	Level of significance (α)	Power of study
0.35	0.05	0.8

Sample size = 59
Actual power= 0.805
Anticipated 20% dropout
Total sample size= 74

3.4.3 Objective 3

To determine the relationship of hours of teaching with tear breakup time (TBUT) and Schirmer test result among school teachers exposed to dry erase ink.

Sample size was calculated using G Power software version 3.1.9.4. The calculation was done based on linear multiple regression.

The input parameters were:

Effect Size (f2)	Level of significance (α)	Power of study	Number of tested predictors
0.15	0.05	0.8	5

Sample size = 55

Actual power= 0.803

Anticipated 20% dropout

Total sample size= 69

SUMMARY:

1) 59 (biggest sample size) x 1.2 (cluster effect)

÷ 0.8 (20% dropout)

= 89 test subjects

= 23 teachers per school (4 schools)

2) For control group: Based on odds ratio with general population = 0.6 [10]

n = (0.6 x 89) + 89

= 142.4

= **143 control subjects**

3.5 SAMPLING METHOD

Multistage randomized sampling method applied. First, schools in Kota Bharu district that using whiteboard with dry-erase marker were randomized. All teachers of the chosen school that fulfil the criteria were recruited. The list of eligible teachers was arranged in ascending order based on their recruit number and was entered into the computer software. Second randomization using simple random sampling generator.

3.6 SELECTION OF THE EYE

Both eyes for each individual were examined in this study. However, only the eye that give the lower value of Schirmer's test and TBUT test were used for data analysis.

3.7 SELECTION CRITERIA

3.7.1 Test Group:

Inclusion criteria

- School teachers aged between 23 – 50
- Minimum duration of working as teacher was at least 6 months
- Pre-school, primary school and secondary school teachers with whiteboard usage

Exclusion criteria

Ocular

- History or evidence of ocular surface disease
- History of significant ocular trauma
- History of recent ocular surgery (within 3 months)
- History of refractive laser procedure
- Contact lens user
- History of eye infection or inflammation within past 3 months
- On regular eye drops due to specific disease (glaucoma, uveitis)

Systemic

- Underlying connective tissue or autoimmune disease
- History of Stevens-Johnson syndrome

3.7.2 Control group:

Inclusion criteria

- Malaysian adults aged between 23 – 50
- Non teacher
- Not exposed to dry erase ink in daily work