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EFFECT OF MENSTRUATION ON TEAR PRODUCTION AMONG UNDERGRADUATE STUDENTS OF MADONNA UNIVERSITY, ELELE CAMPUS, RIVERS STATE NIGERIA

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Abstract

Purpose: The menstrual cycle has been reported to influence many other physiological processes in women. This study ascertained the effect of menstruation on oculovisual status with emphasis on tear production among young female undergraduates of Madonna University, Elele Campus Rivers State Nigeria.

Methodology: The study involved 103 female undergraduates with fairly regular menstrual cycle selected through convenience sampling technique. Their age ranged from 16-30 years with a mean age of 20.82 ± 3.205 years and a median age of 20 years. A well-structured interviewer administered questionnaire was used to elicit oculovisual symptoms associated with the menstrual cycle. Schirmer's test strip was used to measure tear volume at pre-determined intervals of the menstrual flow period. External and internal eye examinations were also carried out using the Pen torch and ophthalmoscope respectively. Data collected were analysed using the Statistical Package for Social Sciences (SPSS) version 21 and results were expressed using tables and correlation of variables expressed using Dunnett's multiple comparison test.

Findings: There was a significant increase ($p < 0.05$) in tear production during the first two days of the flow and a slight decrease during the last two days. Comparison of the right and left eyes showed no statistically significant ($p > 0.05$) difference. Variation in tear production associated with menstruation with respect to age showed statistically significant ($p < 0.05$) differences for all age groups except for the right eye of subjects within age group 26–30 years. While 52.4% (n=54) of the ladies have no oculovisual complaint, the most common oculovisual complaint was headache 42.7% (n = 44) followed by blurry vision 2.91 % (n = 3) and excessive tearing 1.94% (n = 2).

Contribution to Knowledge: The study revealed that physiological changes likely resulting from hormonal variation during the menstrual flow influences tear volume and may cause visual discomfort among women within the reproductive age and recommended the need for tear volume assessment and detailed case history prior to management of complaints associated with dry eye and dispensing of contact lenses for pre and post-menopausal women.

Key words: *Hormones, Menstruation, Oculovisual, Schimer's test*

INTRODUCTION

Tears lubricate, nourish and protect the eyes from dust, irritants and infections and also helps in keeping the surface of the eyes optically clear and smooth (Okon, Jurowski & Gon, 2001).By smoothing out irregularities of the Corneal epithelium, the tear film creates an even surface of good optical quality that is re-formed with each blink. The air–tear interface forms the principal refractive surface of the optical system of the eye and provides two-thirds (43 D) of the total refractive power of the eye (John, 2018). The menstrual cycle in women is an integral part of their lives and is confirmed to affect many physiological processes linked to hormonal fluctuations.

Menstruation is the regular and periodic discharge of blood and mucosal tissues from the inner lining of the uterus through the vagina. It is the most visible part of the menstrual cycle often used as a marker between cycles of women within the reproductive age. The menstrual cycle commonly referred to as the period, commences between twelve and fifteen years of age, a point in time known as menarche. However, periods may occasionally start as young as eight years old and still be considered normal. . Menstruation is known to cease following pregnancy, throughout gestation and typically do not resume during the initial months of breast feeding after delivery. Biggs and Demuth (2011) reported that up to 80% of women report having some symptoms prior to menstruation and these may interfere with normal life, therefore qualifying as premenopausal syndrome.

According to Esmaeli, Harvey and Hewlett (2000), the menstrual cycle involves the constant fluctuation in the level of androgens and estrogen. Both androgens and estrogen have known effects on the synthesis and components of the tear film. Sex steroid receptors are present on the Meibomian glands, which are the sebaceous glands on the eyelids responsible for producing the oil component of tears that prevents evaporation. Androgen binding results in synthesis and secretion of lipids from these glands, while estrogens actually cause a decrease in lipid production. For this reason, increased level of estradiol is believed to be a risk factor for dry eye (Suzuki *et al*., 2008).

The imbalances in the composition of tears, may either decrease tear production or encourage excessive tear evaporation. This situation can lead to tear film dysfunction, usually diagnosed as "dry eye" (Fresina & Campos, 2007). Interestingly, in some cases excessive tearing or watering of the eyes can be a symptom of a dry eye condition. This is because when, for whatever reason, there is an inadequacy in the normal tear layer composition, ocular surface irritation occurs resulting in excessive tearing (Coles *et al*., 2008).

Tear production usually varies with variation in the physiological and psychological states of the individual. Such change in state can be caused by events such as illness, pregnancy, depression, excitement, sadness, menstruation and many more. One of the simplest methods of measuring tear production clinically is the Schimmer's test. This involves the use of a consumable filter paper known as the Schimmer's strip placed on the ocular surface with the support of the eyelid. A healthy young person is expected to moisten about 15 mm or more of each paper strip, while elderly persons may wet about 10 mm in 5 minutes. This is so because hypolacrimation (reduced tear production) occurs with aging.

MATERIALS AND METHODS

The Study took place between June – September, 2019 at the senior clinic of the Department of Optometry, Madonna University, Nigeria. It involved a descriptive survey employing the use of a self administered questionnaire to extract the oculovisual complaints of young female undergraduates during menstruation followed by physical experiment to measure the tear volume before and during menstruation of participants. This study which ascertained the effect of menstruation on tear production and oculovisual status involved 103 female subjects, with fairly regular period (flow) within the age of 15 – 30 years conveniently sampled based on the study's inclusion criteria

A comprehensive case history and menstrual history was conducted among volunteers and individuals who did not meet the inclusion criteria were excluded. External examination of the eyes was carried out using the pen torch to rule out any ocular surface and anterior segment abnormalities likely to influence result. Internal examination of the eyes was carried out also using an ophthalmoscope to rule obvious posterior segment abnormalities. With the participants relaxed, Schirmer's test 1 (base-line) was done on the participants using Schirmer's filter paper (strip) without anaesthesia. The strips were folded 5 millimetre (mm) from one end and inserted at the outer one-third of the lower conjunctiva fornix in the both eyes. The participants were asked to keep the eyes closed for 5 minutes. The tear strip was removed after 5 minutes and the amount of wetting was noted from the calibrated tear strips. The length of the moistened area was recorded indicating normal tears production for the given subject in millimetres (mm). The base line test was done before the participants' menstruation started and same procedure was repeated; within the first two days and then the last two days of the menstrual flow. A well structured and validated questionnaire was then given to the participants to note any ocular and/or visual changes observed during the menstrual flow.

Data Analysis

The data obtained from this study was analysed using the Statistical Package for Social Sciences (SPSS) (version 21) Results were presented descriptively in tables. Correlation of variables was done using the Dumett's correlation coefficient of the SPSS (version 21).

Reliability and Validity of Instruments

The questionnaire employed in this study was pre-tested using the test-retest procedure. 20 copies of the instrument were administered to 20 participants and repeated two weeks after on same subjects. The results of the two tests were correlated using the Pearson Moment Correlation

for an appreciable reliability coefficient (0.75). The Ophthalmic instruments (Ophthalmoscope, Pen Torch & Snellen Chart) employed in the study were of international standard and approved by the World Council of Optometrists (WCO) and the Optometrist and dispensing Optician registration Board of Nigeria (ODORBN) for eye care practitioners internationally.

RESULTS

Demographic Profile of Participants

A total of 103 subjects (female undergraduates) were involved in this study to ascertain the effect of menstruation on tear production. Their ages ranged from 16 – 30years with a mean age of 20.82 $\pm$ 3.205 years and a median age of 20years respectively as shown in table 1 below

Table 1: Age distribution of participants

Age group	Frequency(n)	Proportion(%)
16 – 20 years	50	48.54
21 – 25 years	35	33.98
26 – 30 years	18	17.48
Total	103	100

Tear Production before and during Menstruation

Table 2: Tear production before and during menstruation for right eye (RE)

	Baseline RE (mm)	Tear production first two days RE(mm)	Tear production last two days RE (mm)
Number of values	103	103	103
Minimum	19.50	22.00	20.00
25% Percentile	22.00	25.50	23.00
Median	28.00	30.00	26.00
75% Percentile	31.00	33.00	30.50
Maximum	36.00	38.00	35.00

Mean	27.40	29.26	26.82
Std. Deviation	5.014	4.665	4.706
Std. Error of Mean	0.4940	0.4596	0.4637

Table 2 above shows the total number of values, minimum values, 25th percentile values, median values, 75th percentile, maximum values, mean values, standard deviation and standard error of mean for tear production values before and during menstruation for the RE.

Table 3 Tear production before and during menstruation for left eye(LE)

	Baseline LE (mm)	**Tear production first two days LE (mm)**	**Tear production last two days LE (mm)**
Number of values	103	103	103
Minimum	20.00	21.00	20.00
25% Percentile	23.00	23.00	22.00
Median	26.50	29.50	23.00
75% Percentile	30.00	32.00	27.00
Maximum	38.00	37.00	33.00
Mean	26.73	28.34	24.23
Std. Deviation	4.781	4.849	3.261
Std. Error of Mean	0.4711	0.4778	0.3213

Variation in Tear Production before & during Menstruation

Table 4: Mean Variation in tear production before and during menstruation for right and left eyes

Test value comparison	**Mean ±SEM(mm)**	**P-value**
Baseline RE vs. FTD (RE))	1.854±0.6685	0.0008*

Baseline RE vs. LTD (RE)	0.5874±0.6685	0.1342
Baseline LE vs. FTD (LE)	1.617±0.6074	0.0001*
Baseline LE vs. LTD (LE)	2.500±0.6074	0.002*

Comparison was done using Dunnett's multiple comparison (∗ −Indicates an evidence of significant difference),

FTD− First two days

LTD−Last two days

Variation of Tear Production During Menstruation among different age groups.

Table 5: Variation of tear production during menstruation with age

Age Groups	Mean±SEM(mm)	P-value
	Right Eye	
Age 16-20 years		
Baseline (16-20) vs. TP (FTD	1.947±1.022	0.001*
Baseline (16-20) vs. TP (LTD	0.8936±1.022	0.002*
Age 21-25 years		
Baseline (21-25) vs. TP (FTD	0.6364±1.177	0.001*
Baseline (21-25) vs. TP (LTD	0.3939±1.177	0.0007*
Age 26-30 years		
Baseline (26-30) vs. TP (FTD	3.413±1.348	0.004*
Baseline (26-30) vs. TP (LTD	0.2391±1.348	0.421
	Left Eye	
Age 16-20 years		

Baseline (16-20) vs. TP (FTD	3.045±1.046	0.0003*
Baseline (16-20) vs. TP (LTD	182±1.046	0.001*
Age 21-25 years		
Baseline (21-25) vs. TP (FTD	1.439±1.053	0.031*
Baseline (21-25) vs. TP (LTD	2.470±1.053	0.01*
Age 26-30 years		
Baseline (26-30) vs. TP (FTD	0.7917±1.070	0.004*
Baseline (26-30) vs. TP (LTD	3.417±1.070	0.012*

Comparison was done using Dunnett's multiple comparison (∗ −Indicates an evidence of significant difference)

Ocular/Visual Complaint Associated with Menstruation

Table 6: Predominant Oculovisual complaints during menstruation

Oculovisual Complaints	Frequency	Percentage
Head/ ocular aches	44	42.72
Blurry distance & near vision	3	2.91
Tearing/watery eyes	2	1.94
None	54	52.43
Total	103	100

Table 6 shows that while a greater proportion of participants reported relatively symptomless menstrual low, headache, 44 (42.72%) was the most predominant oculovisual complaint associated with menstruation.

DISSCUSSION

The cyclical variation in hormonal levels during the menstrual cycle is associated with transient changes in oculovisual status.. This study observed a significant increase($p < 0.05$) in tear production during the first two days of menstruation, which corresponds to the follicular phase of the menstrual cycle when compared to the tear production recorded before menstruation (base line), which corresponds to the late (luteal) phase of the menstrual cycle as shown in table 4. The variation in tear production before and during the last two days of menstruation was significant($p < 0.05$) for both eyes except for the last two days (LTD) of menstruation which shows no significant difference with the baseline values for the right eye as shown in table 4. However, comparison between the left and right eye showed no statistically significant difference in tear production. This finding agrees with observation from a similar study conducted in Nigeria by Shuaibu and Agoreyo(2016), which reported no significant difference in tear production between the right and left eyes at any time ($p > 0.05$) and partly agrees with findings from a study by Ebeigbe and Ighoroje (2014) which reported an increase in tear production in the follicular phase only. This observation could be attributed to a report by Cavdar *et al.,* (2014) which posited that fluctuations in the level of estrogen produce alterations in ocular surface equilibrium during the menstrual cycle and consequently affect the subjective dry eye symptoms in female patients. However, Tomilinson *et al.*(2001), in their study observed no difference in tear production and stability in the different phases of the menstrual cycle. These differences could be attributed to differences in sample size, sampling techniques and racial constitution of of subjects involved in the different studies.

According to Schaumberg *et al.,* (2001), a major reason for changes in tear production during the menstrual cycle is the effects of estrogen on the lacrimal gland, which is the gland that secrets the aqueous layer of the tear film. Thus it is likely that an increased hormonal influence on the functions of the lacrimal gland caused an increase in tear production, stability and vise-versa. With respect to age groups, the study observed a significant ($p < 0.05$) variation in tear production before and during menstruation in both eyes across all age groups except for the right eye of age 26 – 30 years which showed no significant ($p < 0.05$) difference between the baseline and last two days (LTD) of menstruation as shown in table 5. This study also observed that 54 (52.43%) of the subjects had no oular/ visual discomfort while 49 (47.57%) reported oculovisual discomforts during menstruation with head/ ocular ache being the most predominant complain as shown in table 6.

CONCLUSSION

Hormonal variation associated with the menstrual cycle in women of reproductive age has been linked to different physiological, physical and psychological changes. This study concluded that menstruation which is a component of the menstrual cycle has a significant effect on tear production and other oculovisual functions/ status, with throbbing ocular/ head ache and blurry vision being the most common.

RECOMMENDATIONS

This study recommends a detailed evaluation of women prior refractive error correction particularly for those in need of contact lens prescription. This is so because unlike spectacle lenses, contact lenses are worn directly on the eye surface and in some cases can interrupt the tear layers resulting in ocular surface irritation and tearing. Secondly, this study recommends that prior to any therapeutic intervention for management of dry eye and other ocular/ visual complaints associated with menstrual cycle, a detailed history of the of the patient is required particularly for women within the reproductive age. Lastly, an accurate assessment of the tear volume, employing the Schimmer's test or other appropriate and acceptable methods should be carried prior to commencement of management of complaints associated with dry eye for women within and above the reproductive age.

LEGAL AND ETHICAL CONSIDERATION

Approval for this study was obtained from the Research Ethics Committee of the department of Optometry and the dean of student affairs Madonna University, Elele Campus Rivers State Nigeria. Informed and written consent was obtained from each participant and information obtained was kept confidential and domiciled with the record unit of the senior clinic of the department of Optometry

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CONFLICT OF INTEREST

The researchers hereby declare that there was no conflict of interest in the study and its reported findings

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