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# Effect of Awareness Strategy on Prevention of Digital Eye Strain among Nursing Students in COVID-19 Pandemic Era

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## ABSTRACT

**Background:** Prevention of the new technology followings is a great challenge. Eye health complications become one of the most urgent threats that should be fought. **Aim:** To evaluate the effect of implementing an awareness strategy on prevention of digital eye strain (DES) among nursing students in the era of COVID-19 pandemic. **Setting:** This study was conducted at Faculty of Nursing - Kafr-Elsheikh University. **Research Design:** A quasi experimental design (one group pretest/ posttest) was utilized to conduct this study. **Sampling:** A stratified random sample from the nursing college included 128 students. **Tools:** Three tools were used. **Tool I:** Self-Administered Questionnaire consisted of three parts. 1st part: The socio-demographic data. 2nd part: Digital device use among nursing students; 3rd part: Assessing the nursing students' knowledge regarding DES. **Tool II:** Student reported practice checklist, used for assessing nursing students' practices toward DES preventive measures among students. **Tool III:** Students' DES perception scale. **Results**: A significant difference was found between students' total knowledge scores (19.5%, 77.3%) pre and post- respectively. There was a highly statistical significant improvement toward all DES preventive measures' practices among students post application than pre. DES preventive measures practice scores were (18.8%, 69.5%) pre & post application respectively. A highly significant difference was found between students' positive perception level pre and post- application (18% & 97%) respectively. **Conclusion:** The awareness strategy regarding DES had a highly significant positive effect on improving the nursing students' knowledge, preventive measures' practices and perception regarding DES. **Recommendation:** Developing training programs for all nursing students as a frequent computer and digital devices users as part of education.

**Key Words: Awareness, Strategy, Prevention, Digital Eye Strain, & COVID-19 Pandemic**

## Introduction

Coronavirus disease (COVID-19) pandemic has made major switch in the daily habits all over the world; one of these changes was the increased time used facing the digital screens **(Ganne et al., 2021).** Because of the e-learning approach has become widely used in the current education processes in all teaching institutions upon the period of COVID-19 pandemic **(Chavarría et al., 2020)**.

As the over growth which occurred in the use of technology worldwide, we can notice that; it has been improved very rapidly since the year 2011 from 52% to 77.5% now. The class that were classified and called "the modern users" have become more than the double at this short period of time. Even now we are considering the video display terminal (VDT) as a computer screen. The University candidates are using the digital devices in the study instead of using the classic paper books. Also, they play mobile games and entertain by watching movie films on those digital devices (**The Vision Council, 2018).**

According to **(Bhattacharya et al., 2020)**; the community has an increasing prevalence of Digital Eye Strain (DES) ranging from 22.3% to 39.8%. DES cases among 89.9 % of total students, this high prevalence of DES were observed in the adolescents who are frequently and regularly use the smartphones more than two hours a day.

**The American Optometric Association (AOA), 2019** has defined DES as "complex problems of the eye and vision related to certain unhealthy activities, which had stressed the near vision, and experienced during the use of digital screens **(Noreen et al., 2016).**

DES is a syndrome characterized by many visual disturbance as ocular discomfort related to digital devices use which caused by a range of stresses to the ocular system, including glare, defocus, dysfunction of accommodation, disparity fixation, eye dryness, eye discomfort and fatigue **(Coles et al., 2019)**.

The benefits of using digital devices are so necessary and it was not deniable but on the other hand, it can cause many health hazards if it was used improperly as their users may spend a lot of time (8–12 hours per day). Those screens' harm comes through the short high energy waves which penetrates the eyes and consequently lead to a sort of photochemical change or damage to the cells of the retina, leading to eye dryness to related macular damage. These health hazards include also visual as well as musculoskeletal problems. Common musculoskeletal complains include fingers tingling, cervical stiffness and backache, which are diagnosed as DES **(Aldukhayel et al., 2018 & Özandaç et al., 2021)**.

For reflecting the variety of digital devices linked to potential problems many expressions were describing the same disorder as visual fatigue (VF) and DES. These synonyms may be much better as they are more appropriate for an easy communication with students, as they may consider devices such as tablets and smartphones not computers. By the wide range and the massive growth in using the digital devices or screens, many millions of people of all ages become at a

high risk of developing DES **(Sheppard & Wolffsohn, 2018).**

Furthermore, DES influence negatively on the daily life style, work condition, and family relations **(Iqbal et al., 2018).** DES is a major health complains among students. It has a wide range of eye fatigue complain and vision defect-related symptoms. It has been a recognized as one of the major health problems about 20 years ago.

The university candidates including nursing candidates are studying at those digital screens, leading for spending a long-time reviewing lessons, assignments and researches as well. Many studies highlighted the increased prevalence of developing DES among computer users; especially the nursing students (**Wangsan et al., 2017).**

The preventive measures regarding DES can manage or alleviate the fatality of DES symptoms at least. It can include the management of any refractive errors with the medical glasses, the dry eye can be managed by artificial tears or lubricating eye materials, the regular usage of a properly designed medical glasses facing the digital screen devices and also using the proper filters for such screens (**Alim et al., 2016**).

The preventive measures could be following the interrupted use of digital screen devices, short time using periods could be divided into very short times all over the day, the time of facing not exceed fifteen to twenty minutes, breaks should be taken every two hours at least from the continued time of facing the screens. The surrounded light should be proper, keeping an enough space between the eye and the used screen, a periodic checkup for the ophthalmic condition and improvement or deterioration, and a proper people education and raising awareness is so necessary as well **(Munshi et al., 2017).**

The community Health Nurse (CHN) has an urgently very important role as a health care provider she/he can make change in the DES prevention through enhancing the following the principles of eye safety **(United Nations Children's Fund, 2020**).

The community health nurses can easily make a primary evaluation to the risk factors that may be practiced by the personnel and the possibility of developing DES among the individuals whose they care for. It will be great if the school health nurses have promoted the students' periodic eye checkup to discover any vision problem early, they can make referral to the high risk personnel. In addition to their ability counsel the population who are in need for raising awareness and taking proper decision according to their problem (**Rathore, 2017)**.

CHN can properly change the culture by communication to give an appropriate knowledge matching with each person's exact specification that can make difference in the target group information regarding DES and its safety measures for prevention to enhance the lifestyle to counteract the increase in developing DES related to the widespread of the black side of technology **(Sayed et al., 2020).**

**Significance of the study:**

The prevalence in Egypt regarding DES is 75%, near three quarters of students (71 %), have CVS from males, and from females it was about more than three quarters (78.7%), from the total

students numbers of Kasr Elainy Medical College (**Ahmed et al., 2019).**

DES has been continuously increasing; it can be called as an epidemic disease threatening the whole from its fatal non targeted followings, caused by the misuse of technology. It was evident that; DES may lead to change in the candidates' wellness very bad, decreasing their achievements. Summarizing, the efforts to prevent or even decrease the problem of DES is an urgently crucial for developing a healthy aware society. The available database from the current researches have approved that; there is apparently a lack in DES related knowledge regarding causes, preventive practices and students' perception as well **(He, Zhang & Li, 2021)**.

This was enough to be a strong motive for the researchers to assist in facing that problem, through taking steps toward prevention of DES, and its health consequences, through an awareness programs, in the selected setting at Kafr-Elsheikh University.

## Aim of The study:

The aim of this study was to evaluate the effect of awareness strategy on prevention of DES among nursing students in the COVID-19 pandemic era through:

1- Assessing the nursing students' use of digital devices.
2- Assessing the nursing students' knowledge, practices and perception regarding DES.
3- Developing the awareness strategy based on the students' educational needs.
4- Implementing the awareness strategy for the target group.
5- Evaluating the awareness strategy impact on knowledge and practices and perception of the target group regarding DES.

## Research hypothesis:

The awareness strategy will have a significant positive effect on improving the nursing students' knowledge, preventive measures' practice and perception regarding DES.

## Subjects and Methods

### 1- Technical design:

**Research Design:**

The used design in the current study was the quasi experimental design (one group pretest/ posttest), which was defined as a practical interventional research to examine the effect of the independent variable on the dependent one in a certain targeted sample to attain the desired goal through randomization and comparing the group against itself pre and post the change made or implementation of a certain experiment **(Kholmatova, Kharkova & Grjibovski, 2016).**

**Setting:**

The study was conducted at the Faculty of Nursing- Kafr-Elsheikh University. This faculty was established at the year 2013; it has a single undergraduate program, working with the credit hours system along 4 levels, in which the students study the theoretical and clinical parts of all nursing specialties to be a general nursing graduate.

**Subjects:**

A stratified random sample from the nursing college included male and female students representing 5% (128 students) from the total

students' number at the time of conducting the study which was 2550 students. They were selected according to the following steps: using the Microsoft excel sheets; random selection of 5% from the first level list, 5% from the 2nd level list, 5% from the 3rd level list and 5% from the 4th level list. The students were asked if they have the readiness to participate in the study or not, and an informed consent was taken verbally from each participant.

Regarding sample size; after reviewing the related literature (**Upadhyaya & Joshi, 2014)** which led to consider the level of significance 5%, and power of study 80%, the sample size could be calculated using the following equation: n = $\frac{2(Z\alpha/2 + Z\beta)^2 \times p\,(1-p)}{(d)^2}$. Where p = pooled proportion obtained from previous study; d = expected difference in proportion of events; $Z_{\alpha/2}$ =1.96 (for 5% level of significance) and $Z_{\beta}$ = 0.84 (for 80% power of study). Therefore, n = $\frac{2(1.96 + 0.84)^2 \times (0.95)\,(1-0.95)}{(0.0763)^2}$ =127.9

**Tools for Data Collection:**

**Tool I:** ***Self-Administered Questionnaire:*** It was developed after reviewing the recent relevant literature, and consisted of three parts.

**Part 1:** It was about the socio-demographic data **(**age, gender, students' level, residence, family size, and family income).

**Part 2:** This part was used in the assessment phase pre application of the awareness strategy, and was concerned with; the digital device use among nursing students, containing 6 multiple choice questions (MCQs) such as; (the frequency of digital screen use, the preferred device for online classes, consumed time in using screens before COVID-19 era, consumed time facing the digital device in the COVID-19 era, the used digital device in playing games and following social media, and wearing glasses for refractive error correction.

**Part 3:** Nursing students' knowledge regarding DES: This part was used for the assessment of students' knowledge background about DES pre and post application of the awareness strategy. It was classified into 3 sections; 1st section was (8) yes or no and open ended questions about general knowledge regarding DES such as; meaning of DES, types of devices causing DES. 2nd section was (9) yes or no and MCQs about risk factors of DES such as; are breaks considered important during digital device use, and its frequency. While the 3rd section was (13) yes or no questions about symptoms & health consequences of DES such as; Ocular symptoms, Visual symptoms, and musculoskeletal symptoms, considering yes means that as the student know this information before and no means didn't **(Iqbal et al., 2018 & Ghufran et al., 2020).**

**Regarding scoring system of tool 1:** The responses to each item were considered either (correct or incorrect answer). Weighted scores were assigned to the responses as follows; the correct answer was given (one) while incorrect answer was given (zero). So, the total score of knowledge was (30); and cutoff point was 70% of the total score distributed as the following.

< 70% (<21 from the total score 30) considered unsatisfactory level of knowledge.

≥ 70% (≥ 21 from the total score 30) considered satisfactory level of knowledge.

**Tool II:** Student reported practice checklist, concerned with assessing the nursing students' practices toward DES preventive measures. This checklist was used twice pre and post application of the awareness strategy. It was developed by the researchers and reported by students themselves, it included 13 statements. The responses of each statement were scored as follows; done was given (1) and not done was given (zero). The total checklist score was 13 and the cutoff point was 70% of the total score distributed as the following (**Iqbal et al., 2018 & Ghufran et al., 2020).**

- <70% (< 9.1 from the total score 13) considered unsatisfactory level of practice
- ≥ 70% (≥ 9.1 from the total score 13) considered satisfactory level of practice.

**Tool III:** Students DES perception scale; this scale was used twice pre and post application of the awareness strategy to assess the students' perception regarding developing DES during COVID-19 pandemic. The tool was developed by the researcher and reported by students themselves (**Iqbal et al., 2018 & Ghufran et al., 2020).** The 3 points likert scale was submitted in (13) statements, each statement response was scored as follow; Disagree was given (0), Neutral was given (1) and Agree was given (2). The total scale score was 26 and the cutoff point was 70% of the total score distributed as the following.

- <70% (< 18 from the total score 26) considered negative perception.
- ≥ 70% (≥ 18 from the total score 26) considered positive perception.

**2- <u>Operational Design</u>:**

**A. The preparatory Phase:**

I. Reviewing literature, and theoretical knowledge using books, articles, internet, periodicals to develop tools for data collection and the related awareness strategy knowledge.

**B. Tools Validity and Reliability:**

**Testing validity:** The used tools were examined to identify if it can measure what it should be measured**.** This stage was achieved by 5 experts (jury) from various academic specialties; three professors from public health medicine specialty, and two lecturers from community health nursing specialty at Kafr-Elsheikh University. The experts have reviewed the clarity, relevance, comprehensiveness, simplicity, and minor modifications were done.

**Testing reliability:** Reliability was defined as an overall measurable tool consistency. It was done using Cronbach alpha test. Cronbach alpha test result for the self-administered questionnaire was 0.864, for the student reported practice checklist was 0.879, and for students' DES perception scale was 0.868.

**C. Pilot Study:**

Before performing the actual study data collection, the researchers carried out a pilot study on 10% of the studied sample (13 students) for assessing tools' clarity, language, applicability, and the required time for its data filling, and the feasibility of the research process. The students who participated in this pilot study were excluded from the chief studied group.

**D. Ethical Considerations:**

Approval for starting work in this research was gained from Kafr-Elsheikh Ethical Committee**.** Objectives clarification was done including the aim of the study to the target group before starting. Assuring the target group that; anonymity and confidentiality of data will be strictly maintained. Informing the students that; their participation or withdrawal is completely their right.

**3- <u>Fieldwork:</u>**

It was done through three phases; assessment and planning, implementation, and evaluation phase. The present study was conducted along three months from the first of February to the last of April in the academic year 2020- 2021 during the second semester where hybrid education was followed. The researchers were following the COVID-19 infection control measures all over the period, as keeping a proper space between students, sitting in a proper ventilated place, all attendees were wearing face mask, no shake hands, minimizing the paper handling as possible, instructing students following cough and sneezing etiquette, frequent hand wash and using hand sanitizers as well. The meeting was three days / week Sunday, Tuesday, and Thursday.

**A. Assessment and planning phase:**

- The target group of students was met by the researchers for obtaining the consent after explanation of the aim.
- The questionnaire was distributed to the studied group. The researchers asked them to give comments on the questionnaire items in term of clarity and completeness. Filling in the self-administered questionnaire, including the demographic date and knowledge assessment questionnaire pre application. Each student took about 20 to 25 minutes to complete the sheet.
- Interpretation of the collected information was accurately done for determining the individualized needs to be a base for giving the awareness strategy contents accordingly.

**The overall goal of the awareness strategy:** The awareness strategy aimed to raise the awareness through improving knowledge, reported practice and perception regarding DES among nursing students.

- The awareness strategy planning was achieved by the researchers through covering the following aspects; equipping, acquiring knowledge, applying practice, and determining the suitable place for sessions.
- The teaching sessions were scheduled to be about 6 small groups, 4 sessions to each group, students in each group (20- 25), and the meeting was scheduled 3 days per week.

**Program Development:**

The awareness strategy program content was designed by the researchers based on the baseline results obtained from the need assessment. Also, an extensive review was done for the recent, current, national and international related literature (**Chawla et al., 2019).** The program content was accurately revised by the 5 experts from various academic specialties; two lecturers at community health nursing specialty, and three professors from

the public health medicine specialty at Kafr-Elsheikh University.

**B. Implementation phase:**

- The classroom where the teaching sessions were conducted was quite, had a proper lighting, ventilated well, and had adequate spacing. The duration of each session took 15 to 25 minutes. When starting each session, the significance of the awareness strategy was explained.
- These sessions were conducted for about 6 small groups; each group number ranged between 20 to 25 students. So, the session was repeated for each small group to cover the students in all groups according to the schedule to be sure that all students were given the same content.
- Greeting firstly, motivating students to participate, through oral expressions for reinforcement, identifying the objectives, discussing the subject outline in a simple language then getting feedback and facilitating in the inquires and discussions.
- The researcher encouraged the students' readiness for behavior change through stressing the point of achieving a significant lifestyle.
- Implementation of the whole strategy lasted for a period of 6 weeks divided into 4 sessions the 1st was the preliminary session, 2nd session was for the theory part for each group through power point presentation attached with pictures followed by an open discussion, 3rd session was for application through demonstration and re-demonstration for all small group members at the same time through a role play in which the researchers were observing closely the proper practice of the students, and the 4th session was for the revision and evaluation of the studied group knowledge and practice.

**Teaching methods:** Interactive lectures, group discussions, demonstration and re-demonstration of the preventive measures for each small group. The media used were designed especially for covering all the desired content based on the needs assessment.

**C. Evaluation phase:**

The evaluation phase emphasized on determining the effect of the awareness strategy on the students' knowledge and practice levels regarding the DES preventive measures, and measuring their perception as well, through filling in the used study tools (tool (1) part 1 and part 3, tool 2 and tool 3) 1 month post the awareness strategy application, to be in the same circumstances of conducting the assessment and implementation phases in which the hybrid education was followed.

**Statistical Design:**

Tabulation for all collected data, and statistical analysis were done, using the SPSS (version 20), graphical presentation of the results. Mean, Standard Deviation (SD), for describing the quantitative variables, proportions, percentages Chi-squared test for the qualitative categorical ones. Considering the significant difference at $p \leq 0.05$, while the highly significant difference at $p \leq 0.001$.

## Results

**Table 1:** Shows the mean age of the studied sample was 20.2 ±1.2. (64.1%) were females and (31.3%) of studied sample were from the fourth level. Regarding the residence (65.6 %) was from rural areas. Concerning family size (67.2%) of families had (5-8 members). Concerning family income, (62.5%) reported enough family income.

**Table 2:** Portrays; pre COVID-19 era (78.9%) of studied sample was frequently using smart phones, 71.9% reported that the preferred device for online classes was smart phone, during COVID-19 era, (60.9%) have used other digital screens ≥4 hours a day, (56.3%) have used digital screens ≥4 hours a day for games and social media respectively. In addition, (34.4 %) were wearing glasses to correct refractive error.

**Figure 1:** Represents the students' satisfactory level of knowledge pre and post- strategy application (19.5%, 77.3%) respectively, considering ≥ 70% the satisfactory level.

**Table 3**: Illustrates a highly statistical significant improvement toward all DES preventive measures practices among students post application than pre application at (P≤ 0.001).

**Figure 2**: Highlights a highly statistical significant improvement toward students' DES preventive measures practice pre & post application (18.8%, 69.5%) respectively at (P≤ 0.001).

**Table 4**: Shows a highly statistical significant difference in students' perception level pre and post- application (14.1% & 75.8%) respectively at (P=0.000).

**Table 5:** Illustrates no statistically significant difference between students' knowledge and perception total scores pre-program, while there was a highly statistical significant difference between knowledge and perception total scores post program at (P≤ 0.001).

**Table 6:** Highlights a statistical significant difference between students' knowledge, practice and perception total scores pre and post-application at (P=0.001).

**Table 7:** Highlights a statistically significant positive correlation between students' knowledge, practice and perception total scores.

**Table (1): Frequency and percentage distribution of the students regarding socio-demographic characteristics (n=128).**

| Items | No. | % |
|---|---|---|
| **Age** | | |
| <20 | 33 | 25.8 |
| 20 – 23 | 95 | 74.2 |
| **Mean ±SD** | 20.2 ±1.2 | |
| **Gender** | | |
| Male | 46 | 35.9 |
| Female | 82 | 64.1 |
| **Students' Level** | | |
| 1st | 23 | 18.0 |
| 2nd | 28 | 21.9 |
| 3rd | 37 | 28.9 |
| 4th | 40 | 31.3 |
| **Residence** | | |
| Rural | 84 | 65.6 |
| Urban | 44 | 34.4 |
| **Family size** | | |
| 2:4 | 42 | 32.8 |
| 5:8 | 86 | 67.2 |
| **Family income** | | |
| Enough | 80 | 62.5 |
| Not enough | 48 | 37.5 |

**Table (2): Frequency and percentage distribution of the students regarding the digital device use (n=128).**

| Digital Device use | No. | % |
|---|---|---|
| **The frequency of digital screen use** | | |
| Ordinary computer screen | 18 | 14.1 |
| Laptop | 5 | 3.9 |
| Tablet/ iPad/ note | 4 | 3.1 |
| Smart phone | 101 | 78.9 |
| **The preferred device for online classes** | | |
| Ordinary computer screen | 2 | 1.6 |
| Laptop | 28 | 21.9 |
| Tablet/ iPad/ note | 6 | 4.7 |
| Smart phone | 92 | 71.9 |
| **Duration of digital device use pre Covid19 era** | | |
| 1 – 2 hrs. per day | 58 | 45.3 |
| 3 – 4 hrs. per day | 40 | 31.3 |
| More than 4 hrs. per day | 30 | 23.4 |
| **Duration of digital device use during Covid19 era** | | |
| 1 – 2 hours per day | 32 | 25.0 |
| 3 – 4 hours per day | 18 | 14.1 |
| More than 4 hours per day | 78 | 60.9 |
| **Using digital devices for playing games and following social media** | | |
| 1 – 2 hours per day | 26 | 20.3 |
| 3 – 4 hours per day | 30 | 23.4 |
| More than 4 hours per day | 72 | 56.3 |
| **Wearing glasses to correct refractive error** | | |
| Yes | 44 | 34.4 |
| No | 84 | 65.6 |

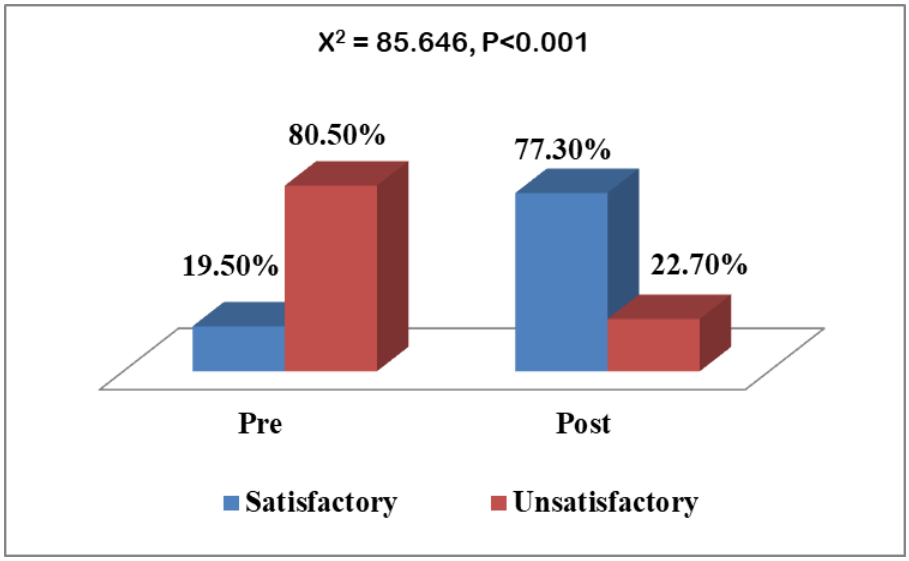


**Figure 1: The students' satisfactory level of knowledge pre and post- awareness strategy application.**

**Table (3): Comparison of the students' reported practices of DES preventive measures pre & post awareness strategy application (n=128).**

| Items | Pre | | Post | | $X^2$ | P |
|---|---|---|---|---|---|---|
| | Done | | Done | | | |
| | No. | % | No. | % | | |
| Taking short break every 20 minutes for 20 seconds and looking at objects at least 20 feet away | 13 | 10.2 | 116 | 90.6 | 165.775 | <0.001** |
| Blinking frequently | 24 | 18.8 | 66 | 51.6 | 30.226 | <0.001** |
| More than arm and forearm length from the eyes and below the level of the eyes | 7 | 5.5 | 86 | 67.2 | 105.395 | <0.001** |
| Using an overhead lighting from ceiling other than a desk lamp or light hitting directly on the eyes | 19 | 14.8 | 92 | 71.9 | 84.760 | <0.001** |
| Avoiding sitting where direct blow of air to the eyes or where light is reflected on the screen | 6 | 4.7 | 44 | 34.4 | 35.889 | <0.001** |
| Using an antiglare screen | 23 | 18 | 96 | 75 | 83.679 | <0.001** |
| Massaging to the eyes | 48 | 37.5 | 119 | 93 | 86.826 | <0.001** |
| Using eye drops | 27 | 21.1 | 76 | 59.4 | 39.003 | <0.001** |
| Getting regular eye exam | 15 | 11.7 | 62 | 48.4 | 41.029 | <0.001** |
| Making text larger. | 42 | 32.8 | 97 | 75.8 | 47.617 | <0.001** |
| Raising the device's refresh rate. | 36 | 28.1 | 105 | 82 | 75.165 | <0.001** |
| Lowering the color temperature of screen | 14 | 10.9 | 86 | 67.2 | 85.070 | <0.001** |
| Putting a humidifier in the room where you often use digital device | 38 | 29.7 | 114 | 89.1 | 55.303 | <0.001** |

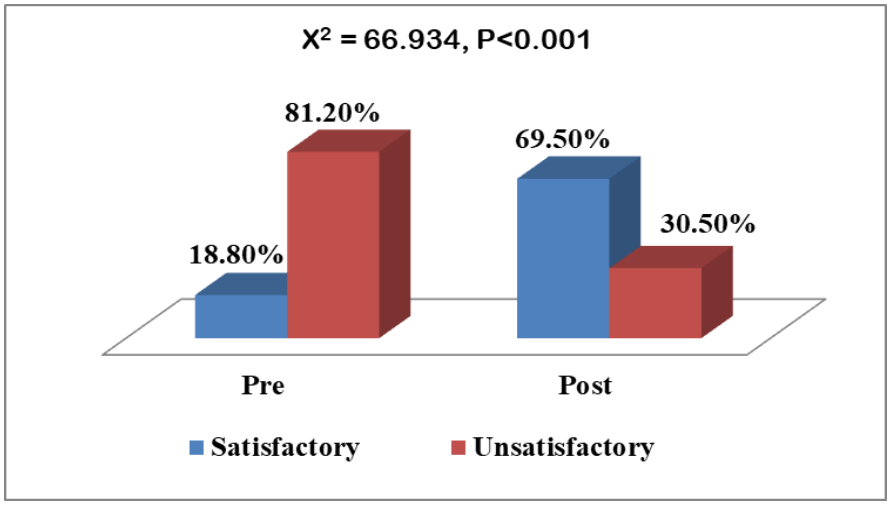


**Figure 2: The students' satisfactory level of practice regarding DES preventive measures pre and post- awareness strategy application.**

**Table (4): Comparison of Students' perception scales regarding developing DES pre and post awareness strategy application (n=128).**

| Students' perception scale | Pre-intervention | | Post-intervention | | $X^2$ | P |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | | |
| Negative perception | 110 | 85.9 | 31 | 24.2 | 98.532 | <0.001** |
| Positive perception | 18 | 14.1 | 97 | 75.8 | | |

**Table (5): Relation between students' knowledge and perception scales pre and post awareness strategy application.**

| Scale | Negative perception | | Positive perception | | $X^2$ | P |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | | |
| **Pre – Intervention** | (n=110) | | (n=18) | | | |
| Unsatisfactory Knowledge (n=103) | 90 | 81.8 | 13 | 72.2 | 0.906 | 0.341 |
| Satisfactory Knowledge (n=25) | 20 | 18.2 | 5 | 27.8 | | |
| **Post – Intervention** | (n=31) | | (n=97) | | | |
| Unsatisfactory Knowledge (n=29) | 20 | 64.5 | 9 | 9.3 | 40.906 | <0.001** |
| Satisfactory Knowledge (n=99) | 11 | 35.5 | 88 | 90.7 | | |

**Table (6): Comparison of the students' knowledge, practices, and perception total scores pre and post awareness strategy application.**

| Total | Pre | Post | t | P |
|---|---|---|---|---|
| | Mean ±SD | Mean ±SD | | |
| Total Knowledge Score | 10.9 ±7.3 | 20.2 ±6.1 | 10.943 | <0.001** |
| Total Practice Score | 5.0 ±2.5 | 8.0 ±3.1 | 8.230 | <0.001** |
| Total Perception Score | 4.8 ±2.8 | 9.2 ±2.8 | 12.250 | <0.001** |

**Table (7): Correlation coefficient between the students' knowledge, practices, and perception total scores post awareness strategy application.**

| Total | | Total knowledge | Total practice | Total perception |
|---|---|---|---|---|
| **Total knowledge** | **r.** **p** | | r=0.260, p=0.003** | r=0.231, p=0.009** |
| **Total practice** | **r.** **p** | r=0.260, p=0.003** | | r=0.473, p<0.001** |
| **Total perception** | **r.** **p** | r=0.231, p=0.009** | r=0.473, p<0.001** | |

****P≤ 0.001 highly significant**

## Discussion:

Computers, digital or smart screens have become a vital part of our lifestyle. This was called the digital devices. Electronic book readers, smartphones, tablets, and computers have significantly increased in recent years and resulted in several ocular symptoms and visual problems related to use, it is already known as DES (**Gammoh, 2021).** Thus, the aim of this study was to evaluate the effect of awareness strategy on prevention of DES among nursing students in the COVID-19 pandemic era.

The current study findings revealed that; near three quarters of the sample were between 20-23 years of age with a mean of 20.2 ±1.2. Near two thirds of studied sample were females and near one third of them were at the fourth level, it was clear that more than two thirds of them were from urban areas. More than two thirds of studied sample have family size ranged between five to eight members. More than two-thirds of the studied sample reported that; their family income was enough. These results may be clarified from researchers' point of view, this is the logic age category for the university candidates, female gender was more than the male because it is a fact that nursing is a job for females more than males, also the enough family income is seeming to be a proper rationale for the availability of the smart digital screens for all family members who study through the online education method.

These findings were supported by **Gammoh, (2021)** in the study entitled "DES among a university students population and its risk factors

in Jordan" in which the author found that; mean age of the participants was 21.5 years, ranging from 18 to 24 years, with more than two thirds of the participants were females. On the other hand, these findings disagreed with **Dessie et al., (2018)** in a study entitled "Computer vision syndrome and associated factors among computer users in Debre Tabor town, northwest Ethiopia" in which the authors concluded that; the participants had average monthly income which was considered not enough for all family members.

**Regarding the digital device use**, the present study findings revealed; about three quarters of the studied sample have used the smart phones frequently and it was their preferred device for the online classes. Less than half of the studied sample were using digital devices pre COVID-19 era from 1 – 2 hours per day, and more than two thirds have used digital devices during COVID-19 era for more than 4 hours per day, more than have of them was using screens for playing games and following social media. Around one third of the studied sample was wearing glasses to correct refract**i**ve error**.** These study findings may be rationalized by the very high attention kept to the prevention of the main threatening problem (COVID-19 pandemic) which was a highly infectious disease and the need of students to follow news, studies, as well as the social media especially during the period of quarantine. This could be highlighting that; the knowledge and awareness of the nursing candidates was in an urgently need for improvement, by the establishing an awareness strategy, as those students have reached the high risk level without any interfering from the families or the responsible persons.

These findings were in agreement with **Ichhpujani et al., (2019)** in the study entitled "Visual implications of digital device use in school children" in which the authors found that; the majority of studied sample used and preferred smartphones and laptops more than the other devices.

Also, these findings were in agreement with **Bogdanici et al., (2017)** in the study entitled "Eyesight quality and computer vision syndrome" in which found that; the participants used digital devices mainly for social networking and college projects. This was also supported by **Iqbal et al., (2018)** in the study entitled "Computer vision syndrome survey among the medical students in Sohag University Hospital" in which the authors found that; majority of medical students used digital screens for 3 hours or more per day. These findings were in agreement with findings of **Alamri, (2018)** in the study entitled "Patterns of digital device usage and its related health effects on elementary and middle school students" in which concluded that; approximately half of respondents spent more than 4 hours daily using digital devices and had 2 or more devices.

**Regarding the students' satisfactory level of knowledge about DES,** the current study findings revealed that; the minority of the students had a satisfactory level of knowledge pre compared to about three quarters post-strategy application. This may be clarified that the poor students' knowledge was because the students' attention to the fact cannot be denied that using smart phones is so

attractive for young adults where the large number of applications that promote communication (such as What's App, Facebook, etc...) and entertainment or even services such as shopping. No consideration was given for the bad consequences of the high frequency use of these devices which already was the most easy and preferable tool to access the internet.

This finding was congruent with **Sanodiya et al., (2019)** in the study entitled "A cross sectional overview of DES: A growing health concern in this digital age in central India" which highlighted that; the minority of the participants were aware of the term DES. This result disagreed with **Dessie et al., (2018)** who found that; from the total study participants, more than half of the participants had adequate knowledge about CVS.

**Concerning the students' reported practice of DES preventive measures**, the present study findings revealed; a statistically significant improvement in practicing all DES preventive measures post application of the awareness strategy than pre. From researchers view; this could highlight the significant effect of the awareness strategy which aimed to promote the healthy practices after proper introducing of the related knowledge, and this was a logical consequence that the behavior changes come after the knowledge acquisition occurs.

This finding was in accordance with **Sanodiya et al., (2019)** in the study entitled "A cross sectional overview of DES: a growing health concern in this digital age in central India" which revealed that; more than half of the participants did not apply preventive measures to avoid DES as using digital screen filters, keeping appropriate distance of viewing digital screen nor following the 20-20-20 rule also never took breaks in between screen time use.

The current study findings showed that; there was a statistically significant improvement toward **DES preventive measures** post application than pre application**.** After implementing the awareness strategy, the matter became different because the application of the DES preventive measures put the light on that; all things must have bad consequences as well as good benefits, and we should keep our health and safety first, also the answer of the students' inquiries regarding symptoms made it sure that their practices were in need for modification. So it was easier for students to follow the right preventive measures after knowing the proper way for its application, and highlighting the bad consequences of its neglecting as well.

This finding was supported by **Hassan et al., (2017)** in the study entitled "Prevalence of CVS amongst the students of Khyber medical university" which revealed that; less than half of the studied group have had a less than 20 minutes, as a regular break, and more than two thirds of them did not use any medical eye glasses, and the majority of the participants did not used to do the voluntary blinking.

This study findings was congruent with **Ghufran et al., (2020)** in the research project "CVS among undergraduate medical students in King Abdulaziz University" which highlighted; taking breaks for five minutes frequently every one hour could decrease the associated CVS

discomfort and there was a significant relation among students who applied the 20-20- 20 rule and the reduction of the DES risk. The recommendation of viewing distance was 20–28 inches by the American Optometric Association.

**Concerning the students' perception toward developing DES**, the current study results showed that; the minority of students were having a positive perception pre-intervention regarding developing DES, while more than three quarters of them developed a positive perception post-application of the awareness strategy with a highly statistical significant difference at (P <0.001). This study finding was in contrast with **Chisale et al., (2018)** in the study entitled "Knowledge, attitude, perception and knowledge and practice of prevention practices of CVS among Mzuzu University academic staff" which found that; the majority of the participants agreed that any person may be in the danger of suffering from CVS and the awareness could prevent its developing.

As regards the **relation between the students' knowledge and perception,** the current study findings showed; a statistically significant relation between students' total knowledge and total perception post the awareness strategy application at (P <0.001). This result was supported by **Ranasinghe et al., (2016)** in the study entitled "CVS among computer office workers in a developing country" which revealed that; there was a significant relation between knowledge and perception of the participants regarding developing CVS.

**Concerning the comparison of mean between the students' knowledge, practices, and perception total scores,** the current study findings showed; a statistically significant difference between students' total scores of knowledge, practices, and perception pre and post awareness strategy application at (P <0.001)**.** This finding was supporting the research hypothesis as the awareness strategy had changed positively the students' knowledge, practice, as well as perception, through emphasizing on the related knowledge and being to the point, repeating the related knowledge and demonstrating the preventive measures practices in a very simple role play, was easy to be retained in the students' memory.

This point of view was supported by **Reed & Oslund, (2018)** in the study entitled "School Librarians as Co-Teachers of Literacy: Librarian Perceptions and Knowledge in the Context of the Literacy Instruction Role" in which the authors concluded that; participants experienced statistically significant knowledge gains as well as that caused an increase in the acceptance of an enhanced role in literacy instruction. This study finding was in agreement with **Chisale et al., (2018)** in their study which revealed that; there was a significant relation between knowledge, practice and perception scores of the participants**.**

**Regarding the correlation between the students' knowledge, practice and perception pre and post** the awareness strategy application, this study finding revealed that; there was a statistically significant positive correlation between students' knowledge, practice and perception total scores. From the researchers' point of view, the perception was always attached and

following the knowledge and practice, as the perception of something could be easily defined as the way in which something is regarded, understood, or interpreted.

This study finding was in agreement with **Chisale et al., (2018)** in the study which revealed that; there was a significant relation between knowledge, practice and perception scores of the participants.

The existing study proved the significance of developing and implementing an awareness strategy regarding knowledge, practice, and perception of DES, as it was helping the studied students in modifying their health habits.

**Conclusion:**

**Based on the findings of the present study, it was concluded that:**

The awareness strategy regarding DES had a highly significant positive effect on improving the nursing students' knowledge, preventive measures' practices and perception regarding DES. There was a significant difference between students' knowledge, preventive measures' practices and perception total scores regarding DES pre and post application, and a significant positive correlation was found between students' knowledge, preventive measures' practices and perception regarding DES, these findings has strongly supported the research hypothesis.

**Recommendations:**

**From the findings of the existent study, the following suggestions were proposed for further research and practice:**

1. Developing training programs for all computer users' as part of the nurses' health education role including the evidence-based knowledge through awareness campaigns.
2. Utilizing the preventive measures regarding developing DES as safety instructions of the digital devices use by the manufacturing companies.
3. Further researches are recommended to study the factors affecting students' compliance regarding following the preventive measures for preventing DES.
4. Using the study findings as a basis for further training efforts based on the identified knowledge background and practice gaps to meet needs.

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