

Effect of Using Web- Based Health Education Sessions on Smoking Cessation among University Students

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Abstract Smoking is one of the major public health problems worldwide, particularly among young adults. It is a major contributor to the global burden of diseases, including cancer, cardiovascular, and pulmonary diseases, and the harmful effects of smoking on non-smokers. Smoking cessation reduces health risks and improves quality of life for any age. The World Health Organization revealed that implementing tobacco control measures is a public health priority. Web-based interventions are a promising approach to supporting the behavioural health change of young adults who spend a significant proportion of their time using the internet. The study aims to assess the effect of using web-based health education sessions on smoking cessation among university students. **Method:** A quasi-experimental study design was used throughout this study on the World Wide Web (WWW) for globalization. The researchers used convenience sampling techniques to select 120 university students' smokers and purposive sampling techniques to select 15 professional experts to evaluate the web-based health education sessions. The researchers used four self-administered questionnaires for data collection as follows: socio-demographic and economic characteristics of students, knowledge, subjective smoking behaviour, and attitude of students regarding smoking. This study was conducted in four stages: preliminary assessment stage, development stage, implementation stage, and evaluation stage. **Results:** The study revealed that there was a significant improvement in the students' knowledge about smoking after the completion of web-based sessions ($P \leq 0.05$), with a significant reduction in the number of cigarettes consumed per day, with a percent change of 52.01%. The prevalence of smoking abstinence rates has significantly increased from 6.7% after 1-month post-web-based sessions to 25% at 3-month follow-up. There was a significant increase in attitude scores. In addition, all experts reported that the design of the health education sessions was clear and attractive. The students described the sessions as useful and attractive sessions that were uploaded on an accessible and easy-to-navigate website. **Conclusion:** Web-based sessions have been demonstrated as an effective tool for smoking cessation interventions. The developed web-based sessions resulted in improvements in students' knowledge, smoking behaviour, and attitude regarding smoking, so it is recommended to evaluate medium- and long-term smoking cessation follow-up at 6 months and 12 months

Keywords: smoking, smoking cessation, young adults, university students, web-based education

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1. Introduction

Tobacco smoking is one of the main causes of preventable deaths worldwide [1]. Smoking is a global public health problem, with 1.3 billion smokers worldwide. The World Health Organization [2] estimates that 8 million people die annually from the effects of smoking globally, of which 1.2 million deaths are associated with passive smoking. Tobacco smoking leads to detrimental health issues, including cancer, cardiovascular, and pulmonary diseases, along with the harmful effects of smoking on non-smokers. Tobacco-associated diseases and deaths create economic damage due to healthcare

costs and the loss of human capital [3]. In addition to poverty by usurping household expenses from basic needs like food, education, and shelter.

Most of the global mortality burden of tobacco use lies predominantly in low- to middle-income countries. Smoking in Egypt constitutes a public health problem. The WHO STEP-wise approach to surveillance (STEPS survey) [4] showed that 43.4% of males and 0.5% of females are current smokers in Egypt. The growing prevalence and consequences of smoking warrant attention for smoking cessation.

Young adulthood is the period that faces several changes, among which are a higher grade of independence during which smoking develops into regular use and nicotine dependence. Moreover, the tobacco industry

specifically markets to young adults, as is observed for new tobacco products [5]. Therefore, young adults should be a primary target for smoking prevention and cessation programmes [6]. College campuses, and universities in general, are regarded as valuable settings for primary and secondary smoking prevention. As well as smoking cessation efforts targeting young adults and the implementation of smoking control policies, this not only reduces smoking prevalence among students but also reduces staff exposure to passive smoke and cigarette butt littering [7,8].

Smoking cessation is the quickest and most direct way to decrease the smoking rate. It is more cost-effective for health and can be beneficially achieved at any time [9]. Health promotion efforts about the detrimental health effects of smoking use may result in higher levels of knowledge about the harms of smoking, which in turn could increase quit intentions and subsequent quitting among users [10].

New technologies have become an essential tool in daily life and may improve adherence rates [11] due to their easier access, faster feedback, wider reach, and reduced cost. Moreover, web-based interventions promote self-regulation and the perception of self-efficacy. These skills show significant associations with successful results [12]. The benefits of web-based versus traditional face-to-face interventions include fewer constraints regarding time and location, the potential to access a larger target group, and the protection of participant anonymity, thereby reducing possible stigma regarding seeking help [13]. It seems to be a promising approach to supporting behavioural health change, which is becoming increasingly attractive to researchers [14]. Counselling is the role of a nurse to help people focus on a goal or outcome, develop strategies that support self-care, and enable individuals and their families to take responsibility for and participate in decisions about their health. Thus, advising patients to stop smoking is part of a nurse's role. Additionally, a study [15] demonstrated that nurses' interventions could lead to an increase in the number of people who stop smoking or prolong abstinence. In light of what has been mentioned before, the current study was designed and conducted to determine the effect of web-based health education sessions on smoking cessation among university students.

2. Aim of the Study

The study aimed to assess the effect of using web-based health education sessions on smoking cessation among university students.

3. Subjects and Methods

3.1. Study Design

The study design was determined to be quasi-experimental design. The study was conducted on the World Wide Web (WWW) for globalization.

3.2. Subject and Sampling

The study subjects were university students' smokers aged 18 to 25 years; this age is consistent with the National Survey of Drug Use and Health, and this age range has the highest smoking prevalence [16]. The researchers selected participants after being informed of the purpose and the study design according to the following criteria: participants who smoked ≥ 100 cigarettes in their lives and are currently smoking at least 1 cigarette per day on 3 or more days of the week, participants who are willing to quit smoking, and participants who had access to the internet (e.g., e-mail, etc.). Inclusion criteria are based on those used in the National Health Interview Survey and are liberal based on smoking patterns most common in young adults [17,18].

Male students were selected from different academic years at different faculties of Mansoura University. The researchers used convenience sampling techniques to select the university students' smokers according to previous inclusion criteria. Using MedCalc Statistical Software version 14.8.1, a sample size of 100 smokers was required to detect a difference of 22% (from 58% to 80%) as reported by [19] in the intention to quit smoking between the two study phases (pre and post health education sessions), assuming a significance level of 0.05 and 90% study power. The sample size would be further adjusted to account for the 20% expected dropout rate. So, the final sample size of university students' smokers was 120 smokers.

3.3. Process of Interventions

3.3.1. Preliminary Assessment Stage

The researchers started by introducing themselves to the students with a brief orientation about the objectives and sessions of health education. Then she informed students that the participants would be enrolled in web-based health education sessions aimed at promoting smoking cessation for a 6-week period (the web-based sessions recommend 1-2 weeks of preparation prior to quitting) and would receive 1 email per week to engage in the sessions. Eligible individuals after the pre-screen were required to sign a consent form after including the selected criteria. All participants uploaded and completed the pre-online self-administered questionnaires on the Google form.

Pre-test questionnaires explored university students' smokers' socio-demographic characteristics, subjective smoking behaviour, knowledge, and attitude towards smoking. This preliminary assessment showed a poor level of knowledge related to the health hazards of smoking, the health benefits of smoking cessation, controlling cravings to smoke, strategies and tools to quit smoking, nicotine withdrawal symptoms, second-hand smoke, and methods to combat smoking.

The researchers used four self-administered questionnaires for data collection. The first tool consisted of two parts that were used before conducting the health education sessions. The first part was "Students' socio-demographic self-administered structured questionnaire,"

used to assess demographic characteristics of university students' smokers such as age, gender, and residence. The second part was adopted from the Fahmy and El-Sherbini Socio-Economic Scale, 1983. El Gilany, El-Wehady, and El-Wasify modified this tool in 2012. According to the [20] socioeconomic scale, the researchers assessed the socioeconomic level of students as very low, scoring 1–21 points. Low socio-economic levels scored 22–42 points. The middle socio-economic level scored 43–63 points, and the high socio-economic level scored 64+ points and more.

The second tool, the "online subjective smoking behavior assessment questionnaire," consisted of four parts: the first and second parts were used before conducting the health education sessions, and the third and fourth parts were used before and after the 1-month and 3-month follow-up after conducting the health education sessions. The first part was used to assess tobacco smoking status, the student's age of smoking initiation, and the duration of regular smoking. The second part was used to assess nicotine dependence using the Fagerstrom Test for Nicotine Dependence (FTND) scale [21,22], a six-item self-report scale that assesses the degree of physical dependence on nicotine. The nicotine dependence level was estimated and scored as follows in Table 1.

Table 1. The nicotine dependence level scores

Nicotine dependence level	Percentile
Low	0-2
Moderate	3-6
High	7-10

The third part was used to assess quit attempts over the past 30 days using one open-ended question based on epidemiological, policy, and treatment surveys. A quit attempt is often defined as an attempt to stop smoking lasting at least 24 hours [23,24]. And intention to quit smoking (readiness to quit) using a closed-ended question. The fourth part was used to assess period abstinence rates and the frequency and quantity of smoking at specified time periods through three closed-ended questions. Including a 7-day period prevalence of smoking abstinence rates, number of days smoked in the past 30 days and number of cigarettes smoked per day on smoking days during the past 30 days (30-day period prevalence of abstinence). Whereas successful quitting was defined as self-reported 7-day period of tobacco abstinence at follow-up [25].

The third tool, the "online knowledge assessment questionnaire about smoking," was used to assess students' knowledge about smoking (this questionnaire was used pre-, after 1-month, and 3 months after conducting health education sessions). The questionnaire classified students' knowledge regarding the health hazards of smoking, the health benefits of smoking cessation, controlling the cravings to smoke, strategies and tools to quit smoking, nicotine withdrawal symptoms, secondhand smoke, and methods to combat smoking. The total scores were divided into three levels: poor level = less than 50% of total scores; fair level = 50% to less than 65% of total scores; and good level = 65% and more of total scores.

The fourth tool is the "online attitude assessment scale towards smoking" to assess the attitude of university students' smokers towards smoking. This Likert scale was adopted from [26] of attitude: 16 positive items and 10

negative items towards smoking subscales, such as the risk perception of university students' smokers towards dealing with cigarettes (physical and social effects of tobacco smoking, etc.), pre-, after 1-, and 3-month follow-up after conducting health education sessions. This scale consisted of 26 statements requiring a response on a 5-point Likert-rating scale with 5 continuums (strongly agree, agree, neutral, disagree, and strongly disagree). A scoring system was used to quantify university students' smokers' attitudes; 4 marks were given to strongly agree, 3 marks to agree, 2 marks to neutral, 1 mark to disagree, and 0 marks to strongly disagree. If the statements were negative, the scoring system was reversed in the Statistical Product and Service Solutions (SPSS) programme, which made up a total score of 104 marks as follows: positive attitude (it includes 16 items = 64 marks) and negative attitude (it includes 10 items = 40 marks).

3.3.2. Development Stage of the Web-Based Smoking Cessation Health Education Sessions

According to the results of the preliminary assessment of the knowledge and smoking behaviour of students and based on professional experts' opinions, the researchers developed web-based smoking cessation health education sessions using a set of technical and instructional standards and a web-based design team. The researchers and the web-based design team selected a learning platform that provided the participants with access to information, tools, and resources to support educational delivery and management of smoking cessation through the internet. The main screen was designed to show the site map and to provide access to educational sessions, discussions, and links. Post-learning discussion and comments were designed to solicit users' impressions of the learning experience and facilitate the interface. In addition, the main menu continuously appeared on the upper bar so that the user could select a different menu easily.

The navigation of the sessions was sequential, from session 1 to session 7, and no session could be skipped. Within each session, the students had the choice to advance to the next screen, replay the current screen, or go back to the previous screen. The students were afforded as much time as they wanted to process the information on each screen. Then we arranged the content of the sessions into seven modules that covered the following topics: "discussed facts and statistics regarding smoking, including the health risks of smoking, community and economic impact, health risks of second-hand smoke, types of tobacco products, and electronic cigarettes.

Additional modules focused on the health benefits of quitting, nicotine addiction, nicotine withdrawal symptoms, and its management. Key content modules focused on preparing to quit, developing a personal quitting plan, guidance on setting a quit date, management of nicotine cravings, identifying and coping with smoking triggers, and screening questionnaires for nicotine dependence. The researchers reviewed smoking cessation pharmacotherapy products, including nicotine replacement therapy and its proper use, how to stay smoke-free, dealing with lapses, relapses, stress management techniques, and weight management. The content was displayed using texts, graphics, images, video, and audio and uploaded to the website.

3.3.3. Implementation of Web-Based Smoking Cessation Health Education Sessions

All students created an account with a private password, completed the pre-online self-administered questionnaires, and took the time to complete the course in the web-based sessions after logging into the website. The researchers answered all questions raised with feedback through chatting on the website. To promote engagement, weekly email reminders containing a link to the assigned sessions were sent.

3.3.4. Evaluation of Web-Based Health Education Sessions

All students complete the post-online self-administered questionnaires on the Google form using tools II, III, and IV to determine the effect of using the web-based health education sessions. The researchers sent an email with the link to the questionnaire at each data collection point, then sent an email to remind the students 3 days prior to an assessment of the due date of that assessment and an additional email reminder for students who failed to complete their online assessment within 1 week. The data was analyzed at baseline, 1-month post-web-based sessions, and 3-month follow-up.

3.4. Official, Ethical, and Other Technical Issues

3.4.1. Approval and Permissions

The researchers obtained approval from the Research Ethics Committee of the Faculty of Nursing, Mansoura University, to conduct the study.

3.4.2. Informed Consent

The researchers obtained informed consent from the participants at the beginning of the study after an explanation of the study purpose. Then we assured the participants that their identities and responses would be confidential, used only for research purposes; their participation in the study was voluntary; and they had the right to withdraw from the study at any time.

3.4.3. Validity Testing of the Developed Tools

The researchers conducted the pilot study, which is a preliminary study conducted on 10% ($n = 12$ university students' smokers) and excluded from the study. A pilot study uses the results to guide the methodology of the large-scale investigation and determine the feasibility of the study. A jury of five experts in community health nursing tested the content validity, which evaluates how well the designed tools cover all relevant parts of the construct they aim to measure. And tested the face validity, which is about whether a test appears to measure what it's supposed to measure. It is concerned with whether a measure seems clearly relevant, appropriate for what it's assessing, and adequate for its purpose.

These tests were used to evaluate the clarity, applicability, and reliability of the study tools and to estimate the approximate time required for data collection. Also, it helped to determine the obstacles and problems that may arise during the actual collection of data.

Reliability. Cronbach's coefficient alpha was used to test applicability for tools, internal consistency for the attitude scale, and the Fagerström Test for Nicotine Dependence (FTND) scale, and the results were as follows: Reliability for the attitude scale was done using Cronbach's alpha, and the result was 0.879 for 26 questions. [26] found high reliability and internal consistency, with Cronbach's $\alpha = 0.83$ for the scale combining the 31 questions. Reliability for the Fagerström Test for Nicotine Dependence (FTND) scale was done by using Cronbach's alpha, and the result was 0.78 for the current study, whereas [27] found Cronbach's alpha was 0.72. On the basis of the collected information, the researchers made the necessary modifications, added some questions, and clarified or omitted others. Each questionnaire took about 25–30 minutes to fill out.

3.5. Statistical Analysis

The researchers sorted, coded, organized, categorized the data, then transferred it into specially designed formats. The researchers analyzed the data using SPSS (Stands for Statistical Product and Service Solutions) version 20.0. The normality of the data was first tested with a one-sample Kolmogorov-Smirnov test. Descriptive statistics were used in presenting the frequency and percentage. Continuous variables were presented as mean \pm SD (standard deviation) for normally distributed data. A T test was used for comparison between 2 -paired within one group. A chi-square test was used to compare qualitative variables. The threshold of significance is fixed at the 5% level. The results were considered significant at $p \leq 0.05$. The smaller the p-value obtained, the more significant the results. For correlation testing, Pearson correlation coefficients and Spearman correlation coefficients were used to estimate the correlation between the study variables to clarify a positive or negative correlation. The strength of a correlation coefficient was defined as weak if coefficients were below 0.3, moderate if coefficients ranged from 0.3 to 0.5, and strong if coefficients were greater than 0.5 [28,29].

4. Results

Table 2 portrays the distribution of students according to their sociodemographic characteristics. The mean age of students was 20.58 ± 1.64 years. All of them (100%) were males. Regarding their residence, 57.5% of the students were living in rural areas. Regarding socioeconomic status, 65% of students belonged to the middle socioeconomic level.

Table 3 reveals students' tobacco smoking status at baseline. Starting of the study, all students were smoking daily, and 79.2% of students started smoking in the age group ranged from 15 to less than 20 years with a mean of 16.14 (1.83) years. While 66.7% of students started daily regular smoking from 2 to 4 years with a mean of 3.55 (1.57) years. Regarding the Fagerstrom Test for Nicotine Dependence (FTND) at baseline. It was observed that 49.2% and 46.7% of students belonged to low and moderate nicotine dependence levels, respectively, with a mean of 2.97 ± 1.9 .

Table 2. Students' socio-demographic characteristics

Item	n=120	%
Age (Years)	$\bar{X}\pm SD$ (20.58±1.64)	Min-Max (18-25)
Gender		
Male	120	100.0
Residence		
Rural	69	57.5
Urban	51	42.5
Socioeconomic status		
Low	9	7.5
Middle	78	65.0
High	33	27.5

Table 3. Students' tobacco smoking status

Item	n=120	%
Tobacco smoking status (Starting of the study)		
Daily smoking	120	100.0
Age of initiating smoking		
Less than 10 yrs.	1	0.8
10 to less than 15 yrs.	21	17.5
15 to less than 20 yrs.	95	79.2
20-25 yrs.	3	2.5
Mean (SD)	16.14 (1.83)	
Duration of daily regular smoking (years)		
1 to less than 2 years	7	5.8
2 to 4 years	80	66.7
More than 4 years	33	27.5
Mean (SD)	3.55 (1.57)	
Nicotine dependence (FTND)		
Low	59	49.2
Moderate	56	46.7
High	5	4.2
Mean (SD)	2.97 (1.9)	

Table 4 presents the total knowledge-level scores. Poor score level of knowledge was among 99.2% of students with a mean of 13.75±7.93 marks before completion of web-based sessions. However, after 1-month post-web-based sessions, 77.5% of them showed a good score level of knowledge with a mean of 71.35±15.21 marks. Moreover, after a 3-month follow-up, 88.3% of them showed a good score level of knowledge with a mean of 73.95±12.96 marks. The difference was significant between: pre- and after the 1-month posttest; between the pre- and 3-month follow-up; and between the 1-month and 3-month follow-up regarding the previous item.

Table 5 declares the distribution of students regarding period abstinence rates, frequency, and quantity of smoking at specified time periods. It was observed that the 7-day period prevalence smoking abstinence rates, in addition to the 30-day period prevalence smoking abstinence rates, were 6.7% after 1-month post-web-based sessions; however, they increased to 25% after 3-month follow-up post-web-based sessions. There was a statistically significant difference between pre- and after 1-month post-web-based sessions; pre- and 3-month follow-up; and between 1-month and 3-month follow-up post-web-based sessions regarding the previous item. It was observed that the mean number of cigarettes consumed per day was 17.4±5.51 cigarette pre-web-based sessions. After 1-month post-web-based sessions, their consumption reduced to a mean of 12.4±5.54 and 8.35±6.28 cigarettes after 3-month follow-up. The difference was significant between pre- and after the 1-month posttest; between pre- and 3-month follow-up; and between 1-month and 3-month follow-up, regarding the previous item.

Table 4. Comparison of knowledge pre-intervention, after 1-month post-intervention and after 3 months

Knowledge	Pre intervention (n=120)	After 1 month (n=120)	After 3 months (n=120)	Test of significance		
				P1	P2	P3
Health hazards of smoking (31)						
Mean ± SD	3.85±1.54	23.35±6.81	24.24±5.91	t=28.8 p≤.001*	t=33.81 p≤.001*	t=3.5 p=0.001*
Poor	120 (100%)	20 (16.7%)	11 (9.2%)	$\chi^2=171$ P≤.001*	$\chi^2=199$ P≤.001*	$\chi^2=4.6$ P=0.10
Fair	0 (0%)	16 (13.3%)	25 (20.8%)			
Good	0 (0%)	84 (70.0%)	84 (70.0%)			
The health benefits of quitting smoking (17)						
Mean ± SD	2.38±1.63	13.04±4.04	13.78±3.44	t=25.83 p≤.001*	t=31.67 p≤.001*	t=3.49 0.001*
Poor	119 (99.2%)	21 (17.5%)	9 (7.5%)	$\chi^2=164$ P≤.001*	$\chi^2=203$ P≤.001*	$\chi^2=5.5$ P=0.06
Fair	1 (0.8%)	18 (15.0%)	19 (15.8%)			
Good	0 (0%)	81 (67.5%)	92 (76.7%)			
Control the cravings to smoke (9)						
Mean ± SD	0.65±0.84	7.35±1.68	7.60±1.58	t=37.78 p≤.001*	t=40.63 p≤.001*	t=3.11 0.002*
Poor	120 (100%)	7 (5.8%)	6 (5.0%)	$\chi^2=213$ P≤.001*	$\chi^2=217$ P≤.001*	$\chi^2=0.52$ P=0.77
Fair	0 (0%)	14 (11.7%)	11 (9.2%)			
Good	0 (0%)	99 (82.5%)	103 (85.8%)			
Strategies and tools to help quit smoking (6)						
Mean ± SD	0.65±0.89	4.99±1.17	5.17±1.05	t=33.01 p≤.001*	t=37.86 p≤.001*	t=2.78 0.006*
Poor	116 (96.7%)	4 (3.3%)	1 (0.8%)	$\chi^2=209$ P≤.001*	$\chi^2=221$ P≤.001*	$\chi^2=1.92$ P=0.38
Fair	2 (1.7%)	11 (9.2%)	10 (8.3%)			
Good	2 (1.7%)	105 (87.5%)	109 (90.8%)			
Symptoms of nicotine withdrawal (7)						
Mean ± SD	2.02±1.07	5.51±1.47	5.68±1.42	t=22.49 p≤.001*	t=23.73 p≤.001*	t=2.41 0.018*
Poor	110 (91.7%)	15 (12.5%)	12 (10.0%)	$\chi^2=161$ P≤.001*	$\chi^2=174$ P≤.001*	$\chi^2=1.49$ P=0.47
Fair	10 (8.3%)	18 (15.0%)	13 (10.8%)			
Good	0 (0%)	87 (72.5%)	95 (79.2%)			

Dangers of second-hand smoke (15)						
Mean ± SD	2.36±1.05	13.2±2.12	13.45±2.01	t=40.13 p≤.001*	t=40.0 p≤.001*	t=2.09 p=.039*
Poor	117 (97.5%)	0 (0%)	0 (0%)	$\chi^2=231$ P≤.001*	$\chi^2=231$ P≤.001*	$\chi^2=0$ P=1
Fair	3 (2.5%)	8 (6.7%)	8 (6.7%)			
Good	0 (0%)	112 (93.3%)	112 (93.3%)			
Ways to combat smoking (5)						
Mean ± SD	1.83±1.27	3.90±0.85	4.02±0.91	t=13.56 p≤.001*	t=13.83 p≤.001*	t=1.94 p=.054*
Poor	73 (60.8%)	0 (0%)	0 (0%)	$\chi^2=138$ P≤.001*	$\chi^2=139$ P≤.001*	$\chi^2=0$ P=1
Fair	15 (12.5%)	0 (0%)	0 (0%)			
Good	32 (26.7%)	120 (100%)	120 (100%)			
Total knowledge score (90)						
Mean ± SD	13.75±7.93	71.35±15.21	73.95±12.96	t=36.08 P≤.001*	t=41.85 P≤.001*	t=4.11 P≤.001*
Poor	119 (99.2%)	5 (4.2%)	3 (2.5%)	$\chi^2=217$ P≤.001*	$\chi^2=224$ P≤.001*	MC p=.085
Fair	1 (0.8%)	22 (18.3%)	11 (9.2%)			
Good	0 (0.0%)	93 (77.5%)	106 (88.3%)			

χ^2 : chi square test, t: paired t test, MC: Monte Carlo test, *significant p≤0.05

Good = scores 65% and more of total scores. (58.5 marks and more)

Fair= scores 50% to less than 65% of total scores. (45 to less than 58.5)

Poor= scores less than 50% of total scores. (0–less than 45)

P1: compare pre and after 1 m; P2: compare pre and after 3m; and P3: compare after 1m and after 3m.

Table 5. Period abstinence rates, frequency, and quantity of smoking at a specified time Periods

Item	Pre intervention (n=120)	After 1 month (n=120)	After 3 months (n=120)	Test of significance		
				P1	P2	P3
7-day period prevalence of smoking abstinence rates	0 (0%)	8 (6.7%)	30 (25.0%)	$\chi^2=8.3$ 0.004*	$\chi^2=34$ ≤.001*	$\chi^2=15.13$ ≤.001*
Number of days smoked in the past 30 days						
None	0 (0%)	8 (6.7%)	30 (25.0%)	MC ≤.001*	MC ≤.001*	$\chi^2=40.67$ ≤.001*
20-29 days	0 (0%)	33 (27.5%)	2 (1.7%)			
All 30 days	120 (100%)	79 (65.8%)	88 (73.3%)			
Number of cigarettes smoked per day on smoking days during the past 30 days						
Mean ± SD	17.4±5.51	12.4±5.54	8.35±6.28	t=17.1 ≤.001 *	t=11.8 ≤.001 *	t=5.28 ≤.001 *

χ^2 : chi square test, t: paired t test, MC: Monte Carlo test, *significant p≤0.05

P1: compare pre and after 1m; P2: compare pre and after 3m; and P3: compare after 1m and after 3m.

Table 6. Intention to quit smoking and quit attempts over the past 30 days

Item	Pre intervention (n=120)	After 1 month (n=120)	After 3 months (n=120)	Test of significance		
				P1	P2	P3
Intention to quit smoking						
Have no desire to quit	76 (63.3%)	21 (17.5%)	18 (15.0%)	$\chi^2=52.3$ ≤.001*	$\chi^2=58.8$ ≤.001*	$\chi^2=0.27$ 0.599
Will quit in the next 6 months	36 (30.0%)	51 (42.5%)	24 (20.0%)	$\chi^2=4.05$ 0.043*	$\chi^2=3.20$ 0.07	$\chi^2=14.13$ ≤.001*
Intending to quit within the next 30 days	8 (6.7%)	40 (33.3%)	48 (40.0%)	$\chi^2=26.7$ ≤.001*	$\chi^2=32.3$ ≤.001*	$\chi^2=1.15$ 0.283
Number of quit attempts in the past 30 days						
None	120 (100%)	79 (65.8%)	88 (73.3%)	MC ≤.001*	MC ≤.001*	$\chi^2=41.1$ ≤.001*
Once or twice	0 (0%)	16 (13.4%)	2 (1.7%)			
3-5 times	0 (0%)	17 (14.1%)	0 (0%)			
Quitted	0 (0%)	8 (6.7%)	30 (25%)			

χ^2 : chi square test, MC: Monte Carlo test, *significant p≤0.05

P1: compare pre and after 1m; P2: compare pre and after 3m; and P3: compare after 1m and after 3m.

Table 6 shows the distribution of students regarding their intention to quit smoking and quit attempts past 30 days pre-, after 1-month post-intervention, and 3-month follow-up. It was noticed that 63.3% of students had no desire to quit pre-web-based sessions. However, after 1 and 3 months of web-based sessions, the percentage decreased to 17.5% and 15%, respectively. Moreover, 6.7% of students intended to quit within the following 30

days of pre-web-based sessions. After 1-month post-web-based sessions, the percentage increased to 33.3% and 40% after 3-month follow-up post-web-based sessions. Regarding the number of quit attempts over the past 30 days, it was stated that there was a statistically significant difference between pre- and after 1-month post-web-based sessions, between pre- and after 3-month follow-up, and between 1- and 3-month follow-up post-web-based sessions.

Table 7 shows that overall, the total attitude score revealed that there were significant differences between pre- and after 1-month post-web-based sessions; pre- and 3-months follow-up; and between 1-month and 3-months follow-up, with a mean of 55.63±11.23 before completion of web-based sessions compared to 77.42±9.81 after 1-month post-web-based sessions and 78.70±10.25 after 3-months post-web-based sessions.

Table 8 shows that there was a moderately positive correlation between self-reported 7-day period prevalence

abstinence rate at 3-month follow-up and total attitude scores. A weak negative correlation was observed between self-reported 7-day period prevalence abstinence rate at 3-month follow-up and total socioeconomic levels.

Table 9 indicates that there was a strong positive correlation between self-reported 7-day period prevalence abstinence rate at 3-month follow-up and intention to quit. A weak negative correlation was observed between the self-reported 7-day period prevalence abstinence rate at 3-month follow-up and nicotine dependence (FTND).

Table 7. Mean difference between attitude categories and total attitude pre-, after 1 month, and after 3 months

Attitude	Pre intervention (n=120)	After 1 month (n=120)	After 3 months (n=120)	Test of significance		
				P1	P2	P3
Positive points attitude (64 marks)	35.89±7.18	46.63±6.86	47.45±7.09	t=15.51 p≤.001*	t=16.24 p≤.001*	t=4.03 p≤.001*
Negative points attitude (40 marks)	19.74±5.15	30.79±3.71	31.25±3.82	t=22.87 p≤.001*	t=23.95 p≤.001*	t=3.38 p≤.001*
Total attitude score (104 marks)	55.63±11.23	77.42±9.81	78.70±10.25	t=14.79 p≤.001*	t=15.29 p≤.001*	t=4.61 p≤.001*

t: paired t test, *significant p≤0.05,

P1: compare pre and after 1m; P2: compare pre and after 3m; and P3: compare after 1m and after 3m

Table 8. Correlations between self-reported 7-day period prevalence abstinence rate at 3-month follow-up and attitude, socioeconomic level, and age of smoker students

Predictor	7-day PPAR	
	r	P value
Total attitude scores	0.473**	0.000
Socioeconomic status	-0.073	0.430
Age	0.053	0.566

Note. r: for Pearson correlation

r < 0.3 weak correlation

r < 0.3-0.5 moderate correlation

r > 0.5 strong correlation

** Correlation is significant at the 0.01 level (2-tailed)

P value is significant if ≤ 0.05

Table 9. Correlations between self-reported 7-day period prevalence abstinence rate at 3-month follow-up and intention to quit, and nicotine dependence of smokers' students

Predictor	7-day PPAR	
	r	P value
Intention to quit (Readiness to quit)	0.616**	0.000
Nicotine dependence (FTND)	-0.130	0.157

Note. r: for Spearman's rank correlation

r < 0.3 weak correlation

r < 0.3-0.5 moderate correlation

r > 0.5 strong correlation

** Correlation is significant at the 0.01 level (2-tailed)

P value is significant if ≤ 0.05

5. Discussion

Tobacco use is one of the leading risk factors for premature morbidity and mortality worldwide. Smoking among young people is of particular concern. Despite the well-documented health risks associated with tobacco use, many young people continue to smoke or experiment with smoking. The prevalence of smoking among young people is especially troubling, as this age group is undergoing crucial physical and psychological development. The

harmful effects of smoking at this stage of life can have lifelong consequences, including increased risk of chronic disease, impaired cognitive function, and reduced quality of life [30]. In 2019, an estimated 155 million (95% uncertainty interval 150–160) people aged 15–24 years worldwide were tobacco smokers, with a prevalence of 20.1% in males and 4.95% in females [31]. Quitting before the age of 30 can prevent more than 97% of the excess mortality caused by continued smoking. Thus, quitting is critical for young people. Furthermore, young individuals are more open to novel and innovative approaches [32]. According to [33], approximately 66% of the global population had internet access in 2022. As web-based interventions seem to be a promising approach to supporting behavioural health change, the present study was carried out to assess the effect of using web-based health education sessions on smoking cessation among university students.

The findings of the present study showed that the mean age of students was 20.58±1.64 years, with an age range of 18–25 years, and all of them were males. Regarding students' socio-economic level, about two-thirds of them belonged to the middle socio-economic level. This result was consistent with three different studies; the first study was conducted at two Southeastern US universities [34], which revealed that the average age was 21.16 years. The second study, carried out by [35] in the U.S., revealed that the subjects were in the age group of 18–30 young adults. The third study [36] was conducted in the U.S. and reported that the subjects were young adult cigarette smokers (mean age of 21 years). The similarity of these studies clarified the vulnerability of this age group.

Concerning baseline smoking characteristics among students, the present study revealed that, starting with the study, all the studied students were smoking daily. The majority of students started smoking in the age group, which ranged from 15 to less than 20 years, with a mean of 16.14 (1.83) years. Two-thirds of students smoke daily for 2 to 4 years, with a mean of 3.55 (1.57) years. This

may have explained that this age faced numerous changes and challenges, such as self-identity, a desire for experimentation, independence, and freedom. Also, this is a time for trying out new behaviours and establishing lifelong habits, so the teenager may use cigarettes to achieve their identity and establish self-acquisition. This result is consistent with the result of [37], who reported that issues of independence arise when adolescents like to have the chance to make decisions for themselves and to be responsible for their actions as adults; so, they may do things that are risky to their health and have negative effects on their future. This result is also quite similar to the [38] result, which found that American adolescents start smoking around age 10 and peak by age 14 years.

Concerning students' knowledge regarding smoking, the findings of the present study revealed that most students had a poor score of knowledge about smoking prior to intervention. In addition, the present study illustrated that there was a significant improvement in the students' knowledge about smoking with regard to health hazards, the health benefits of quitting smoking, controlling the cravings to smoke, strategies, tools to help quit smoking, symptoms of nicotine withdrawal, dangers of second-hand smoke, and ways to combat smoking. $P < 0.05$ as the following: after 1-month post-web-based sessions, more than three-fourths of students showed good scores of knowledge with a mean of 71.35 ± 15.21 marks. After a 3-month follow-up, the majority of them showed a good score of knowledge with a mean of 73.95 ± 12.96 marks. The difference was significant between the pre- and after the 1-month posttest, between the pre- and 3-month follow-up, and between the 1-month and 3-month follow-up regarding the previous item.

This result clarified that web-based education is effective. Maybe it simplifies the content of smoking through graphics, high-quality pictures, and videos, which help students sustain their interests. In addition, students improved their self-learning and acquired knowledge through web-based learning.

These findings agreed with the [39] result, which indicated that the commonest of the smoking intervention program group and the majority of the control group had unsatisfactory knowledge before the program. During the immediate implementation of the program, all of the study group had a good score of knowledge about smoking, while the majority of the study group had a good score of knowledge after 3 months from the implementation of the program. However, the knowledge of the majority of the control group is still unsatisfactory.

This finding was compatible with [40] findings in Mississippi, who reported that knowledge scores increased significantly ($p < 0.05$) after the smoking cessation educational intervention for pharmacy students and community members. Pharmacy students had significantly greater knowledge score changes (more than half pre-intervention; majority post-intervention; $p < 0.05$) versus community members (more than one third pre-intervention; half post-intervention; $p < 0.05$). In addition, [41] showed that digital education is at least as effective as usual learning in improving health professionals' knowledge and skills for delivering smoking cessation therapy.

While the current result was inconsistent with the [19] result, which revealed that a tailored Web-based

intervention was not successful at significantly increasing the knowledge of Arab university students in Israel, no statistically significant increases in knowledge were seen at 1-month post-study.

The most important finding of the present study is that increased students' knowledge led to changes in their smoking behavior. By highlighting on students smoking behaviour, the findings of this study revealed that there was a significant reduction in the number of cigarettes consumed /day $P < 0.05$ between pre and after 1-month posttest; between pre and 3 months follow up; and between 1 month and 3 months follow up with a mean significantly decreased from 17.4 ± 5.51 cigarette pre web based sessions to 12.4 ± 5.54 after 1-month post web based sessions; and 8.35 ± 6.28 cigarettes after 3-months follow up with a percent change of 52.01% (between pre and 3-months follow up).

Regarding period abstinence rates, the findings of this study revealed that there were significant abstinence rates after 1-month and 3-month follow-up post-web-based sessions ($P < 0.05$), with 7-day period prevalence smoking abstinence rates in addition to 30-day period prevalence smoking abstinence rates having significantly increased from a few numbers after 1-month post-web-based sessions to one fourth after 3-month follow-up post-web-based sessions.

With respect to the intention to quit smoking for non-quit students, the present study found that there was a significant improvement in students' intention to quit ($P < 0.05$) between pre- and 1-month post-web-based sessions, and between pre- and 3-month follow-up, but there was no statistically significant improvement between after 1- and 3-month follow-up ($p > 0.05$). Since less than two-thirds of students had no desire to quit pre-web-based sessions, however, after 1 and 3 months post-web-based sessions, the percentage decreased to less than one fifth. Moreover, a small number of students intended to quit within the following 30 days of pre-web-based sessions. After 1-month post-web-based sessions, the percentage increased to more than one-third and two-fifths after 3-month follow-up post-web-based sessions. These findings agreed with the [34] result, which revealed that at baseline, more than one-fourth were ready to quit in the next 30 days. And this is consistent with the [19] result, which revealed that a tailored Web-based program increased participants' intentions to quit smoking. Participants considered the web-based tool to be an interesting, feasible, and highly acceptable strategy.

Regarding the number of quit attempts in the past 30 days for non-quit students, the present study revealed that there was a statistically significant difference in the number of quit attempts over the past 30 days for non-quit students ($P < 0.001$) since all students didn't try to quit the past 30 days pre-web-based sessions. However, after 1-month post-web-based sessions, the percentage decreased to two-thirds, then increased to less than three-fourths after 3-month follow-up post-web-based sessions.

These results clarify that there was a significant change in students' behaviour after web-based sessions. The possible explanation for this improvement is that university students on university campuses may be particularly responsive to Web-based interventions, given the widespread availability of the internet in these settings

and the increased flexibility of college students' schedules.

These findings correspond with the [42] findings of a systematic review, which concluded that internet interventions are superior to other broad-reach cessation interventions (i.e., print materials), equivalent to other currently recommended treatment modes (telephone and in-person counseling), and have an important role to play in the arsenal of tobacco-dependence treatments. Furthermore, this finding was consistent with the [43] result in Minnesota, which concluded that use of online interactive quitting tools was associated with increased abstinence rates among users, and designs that facilitate the use of these features should be considered.

As well, a study [44] in Michigan, United States, revealed that at 30-day follow-up, the Tobacco Tactics website group showed significantly higher quit rates (more than one fourth) than the telephone quit line group (few numbers) ($p < 0.05$). There were significantly more positive changes in harm reduction measures (quit attempts, number of cigarettes smoked per day) at both 30-day follow-ups in the Tobacco Tactics website group compared to the telephone quit line group ($p < 0.05$). Compared to the telephone quit line group, the Tobacco Tactics website group was able to quit for at least 24 hours: more than two thirds vs. less than one fourth at 30-day follow-up ($P < .001$). Moreover, the website group showed greater reductions in the number of cigarettes smoked per day ($P < .001$ at 30-day follow-up). It was concluded that the Tobacco Tactics website showed higher efficacy and reach than the telephone quit line intervention. Also, subjects in the website group showed significantly less motivation to quit smoking ($P = .042$) compared to those in the telephone quit line group. Less than half vs more than half, respectively, were thinking of quitting within the next 30 days.

The findings of the present study were consistent with the findings of [34], who examined the feasibility, acceptability, and potential effectiveness of an online intervention targeting college smokers, and the findings revealed that in terms of changing smoking behaviour, both conditions showed some promise in increasing cessation rates, with less than one fifth of control (American Cancer Society's Guide to Quitting Smoking Online) and one fifth of intervention condition participants (interactive online intervention) being abstinent at the end of treatment (week 6). This shows trends in smoking cessation favoring the intervention condition. In addition, intervention participants smoked fewer cpd ($p = .05$) at follow-up (week 12) compared to control condition participants. At the end of treatment, the intervention participants less frequently reported having made a quit attempt since baseline (less than half vs. less than two thirds, respectively, $p = .02$). Moreover, both groups showed increases in readiness to quit and recent quit attempts at each follow-up.

In the same line, a systematic review of [45] concluded that the characteristics and effects of internet-based youth smoking prevention and cessation programs vary, but most programs show positive results in youth smoking prevention and cessation in spite of the studies' limitations. Also, a systematic review of [46] concluded that internet-based interventions were found to produce an overall significant improvement across smoking tobacco behaviour

in the long term. These findings were in agreement with the result of [47], which revealed that there was a significant difference in reducing the behaviour of smoking between the intervention (a web-based program) and control groups after the educational intervention.

These rates were similar to quit rates achieved in other Web-based smoking cessation interventions, such as the [48] study in the United States, which showed that abstinence rates were approximately a few numbers for 7-day and 30-day abstinence at 1-month, almost one fifth for 7-day abstinence, and less than one fifth for 30-day abstinence at 3 months. Web-based and electronic health smoking cessation interventions resulted in a higher success rate than usual care [49,50]. Interventions on web-based platforms and mobile apps can deliver effective interventions for various diseases and behavioral disorders [51-53]. A Cochrane review of 28 randomized and quasi-randomized trials on Internet-based interventions for smoking cessation concluded that Internet-based interventions were promising and effective at assisting smoking cessation [54].

On the other hand, these findings were inconsistent with [55] findings in the USA, which examined the effectiveness of an internet-based smoking cessation intervention compared to referral to clinic-based smoking cessation care (control arm). The findings indicated that the reach of the internet intervention and use of smoking cessation aids were significantly greater compared to the control. There were no statistical differences in overall quit rates or cost effectiveness between group referred to clinic-based specialty care or to an internet intervention. At 3 months post-randomization, less than one fifth on the internet-based intervention compared to a few numbers in the control arm. Concluded that electronic and mobile health interventions can improve the reach of available smoking cessation services, and novel interventions that increase the reach of intensive smoking cessation treatment are needed to maximize quit rates.

Contrary to the findings of [56] in Tirgu Mures, Romania, which revealed that ASPIRA, an adapted version of the evidence-based, multimedia ASPIRE web-based program that was originally developed and tested in the United States, may decrease smoking initiation among multi-ethnic adolescents in Central and Eastern Europe, there was no statistically significant effect of the intervention on current tobacco use. [57] reported similar negative results regarding smoking behaviours.

In contrast, [58] results in the Netherlands provided insights into the user experience of a blended treatment for smoking cessation, and the results support the expectation that in a blended treatment, the strengths of one mode of delivery may compensate for the weaknesses of the other. As a practical conclusion, this may mean that the web sessions, supported by the strengths of the F2F sessions, offer an interesting approach for further improving the blended treatment.

With regard to the students' attitude towards smoking, a significant increase in attitude scores was observed between pre- and after 1-month post-web-based sessions, pre- and 3-month follow-up, and between 1-month and 3-month follow-up post-web-based sessions ($P < 0.05$). The mean score of attitude among students had significantly improved from 55.63 ± 11.23 to 77.42 ± 9.81 after 1 month and 78.70 ± 10.25 after 3-month follow-up post-web-based

sessions, with a percent change of 41.47% (between pre- and 3-month follow-up). Since changing young adults' attitudes towards smoking is the first step in the process of preventing addictive behaviours, researchers need to be aware of these factors when designing interventions. These findings agreed with the [47] finding in Kermanshah City, Iran, which revealed that a web-based educational program significantly improved the structures of attitude ($P < 0.001$) in the intervention group compared with the control group. The results of [59,60] studies showed that e-learning led to a negative attitude towards smoking.

6. Conclusion and Recommendations

Web-based sessions have been demonstrated as an effective tool for smoking cessation interventions. The developed web-based sessions resulted in improvements in students' knowledge, smoking behaviour, and attitude regarding smoking, so it is recommended to evaluate medium- and long-term smoking cessation follow-up at 6 months and 12 months.

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