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Knowledge and practices regarding sunscreen use among university students: A cross-sectional survey in Jordan

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Abstract

Excessive exposure to unprotected sunlight increases the risk of premature skin aging and cancer. University students can be considered a high-risk group for the short- and long-term adverse effects of ultraviolet (UV) radiation, owing to their intensive exposure to the sun. This study aimed to evaluate university students' knowledge and practice of sunscreen use in Northern Jordan. A cross-sectional study was conducted using a self-administered questionnaire to assess knowledge and practice. The questionnaire was created using Google Forms and was distributed online on different social media platforms. Participants were recruited through convenience sampling and snowball questionnaire distribution. A total of 915 university students participated in this study. The results showed that the students were aware of the different types of skin damage resulting from exposure to sunlight. Female participants and those who took courses on skincare or cosmetics had higher knowledge scores. Participants from faculties unrelated to human health had lower knowledge scores. Most participants used sunscreen (80.1%), and there was a significant association between sunscreen use and sex. Female participants had a higher usage of sunscreen than male participants (90.5% compared to 36.1%, $p < 0.001$). Participants who used sunscreen continuously had a higher average knowledge score (3.0 ± 1.1) than other participants who used sunscreen frequently (2.9 ± 1.1), sometimes (2.6 ± 1.3), or rarely (2.4 ± 1.2), $p < 0.001$. Three-quarters of sunscreen users apply it immediately without renewal. Less than half of sunscreen users apply sunscreen indoors. Pharmacies were still the primary providers of sunscreen products, where most participants bought sunscreen agents (80.8%). In conclusion, the knowledge and practice of sunscreen use among students in Northern Jordan were reasonably acceptable. However, there is a need for awareness campaigns focusing on the importance of sunscreen products. Future awareness campaigns should be directed toward informing students of the need for reapplication and protection against both UVA and UVB radiation.

Keywords: Gender, Jordan, Knowledge, Practices, Sunscreen Use, University Students.

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1. Introduction

Unprotected exposure to sunlight is associated with skin damage and disease [1]. Short-term overexposure to ultraviolet (UV) radiation results in acute injuries such as sunburn and tanning, whereas chronic exposure can lead to skin aging, cancer, and hyperpigmentation [2]. Skin cancer is one of the most prevalent cancers worldwide and most frequently affects individuals with fair skin [3]. Ultraviolet A (UVA) radiation can contribute to skin carcinogenesis by damaging skin DNA [4].

Melanoma induction and sunburn, primarily induced by ultraviolet B (UVB) light, are closely associated [5-7]. Although further research is needed to provide more significant evidence, it has been established that UVA forms cyclobutane pyrimidine dimers (CPDs) that cause mutations in vivo [8]. To prevent skin cancer and other disorders, precautions should be taken to protect the skin from UVB and UVA radiation.

Since they were first made available to the public in 1928, sunscreens have been the cornerstone of sun protection [9]. After it was discovered that salicylates lessened the effects of sunburn, they were utilized as sunscreens for the first time [10]. Many medical professionals have promoted the use of sunscreen products to reduce skin damage caused by UV radiation [7]. The active chemicals in sunscreens block UV rays from penetrating the skin by either reflecting or absorbing them to reduce the harmful effects of UV radiation. Mineral compounds and organic molecules are the active components [11].

In view of international concerns, the Jordanian Ministry of the Environment has drawn special attention to how climate change affects the risk of excessive sun exposure. Increasing temperatures, increasing occurrences of drought, decreasing total yearly precipitation, and accelerated desertification are signs of this reality [12]. This has impacted Jordanians' daily activities. Moreover, university students who walk to class and engage in outdoor activities are exposed to harmful UV radiation.

Studies assessing knowledge, attitudes, and practices regarding sunscreen use are scarce and should be explored. We found only two studies performed in Jordan focusing on this subject but did not investigate university students [13, 14]. However, to the best of our knowledge, the knowledge and practices of Jordanian students regarding sunscreen use have never been evaluated. Therefore, this cross-sectional study is the first in Jordan to shed light on the knowledge and practices of university students in North Jordan (Irbid) regarding sunscreen use. University students were chosen for the investigation because they are in the age range in which sun prevention behaviors have been proven to prevent skin aging and cancer.

2. Material and Methods

2.1. Study Design and Participants

A cross-sectional survey was conducted between 1st October and 1st December 2023 to evaluate the knowledge and attitude of university students in Jordan regarding sunscreen use. Students from different faculties at the universities in Irbid (North Jordan) were enrolled in the study irrespective of their gender, age, religion, ethnicity, or social class. Participation was voluntary, and the study demands were explained to all students. Only students who agreed to participate in the study completed the questionnaire; those who declined or did not complete the questionnaire were excluded. A cover letter at the beginning of the form explained the study objectives and guaranteed the anonymity of the data. Participants who read the cover letter and agreed to participate were allowed to complete Google Forms.

2.2 Data Collection

The questionnaire was developed after a comprehensive and extensive literature review [15, 16]. The questionnaire contained 26 questions divided into three parts. The first part deals with collecting general and demographic information such as gender, university type, level of study, student-faculty ratio, whether it is related to the human health field such as medicine and pharmacy, whether the student has completed a course related to skincare or cosmetics in their curriculum, and sunscreen skin type using the Fitzpatrick scale. Skin types were classified based on the Fitzpatrick skin-type classification, which categorizes skin types according to their response to UV radiation.

In the second part, a series of questions evaluated students' knowledge regarding sun exposure, sunscreen effects, and their impact on skin cancer and premature aging. The third segment included questions evaluating students' attitudes and practices regarding sun exposure and sunscreen use, and whether their knowledge affected their sun protection habits. However, only students who used sunscreen completed the last part of the third segment, which included questions regarding students' behavior in using sunscreen, the frequency of sunscreen application, the type of sunscreen used, its sun protection factor (SPF) value, and the criteria used to select it.

2.3. Ethical Approval

The study protocol was approved by the Institutional Review Board (IRB) committee of Yarmouk University, Irbid, Jordan. The committee supplied the necessary documents to guarantee that human rights, privacy, and confidentiality were protected (reference number: IRB/2023/249, dated 23/7/2023).

2.4. Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows version 23 (IBM Corp., Armonk, N.Y., USA). Categorical data are presented as frequency (%), and continuous data are presented as mean ± SD. Associations between categorical variables were analyzed using the chi-square test ($\chi 2$) or Fisher's exact test. Associations between continuous variables were analyzed using a one-way ANOVA for more than two independent groups. Statistical significance was set at $P \leq 0.05$.

3. Results

In total, 915 students responded to the questionnaire. Most of them were female students, students from government universities, and students from faculties related to human health (pharmacy and medicine). The general characteristics of the participants are presented in Table 1.

Table 1.
General characteristics of the participants, N=915.

Gender	
Male	169 (18.5%)
Female	746 (81.5%)
Type of university	
Government	909 (99.3%)
Private	6 (0.7%)
Specialty	
Faculties related to human health (Pharmacy and medicine)	650 (71.0%)
Faculties not related to human health (Others than pharmacy and medicine)	265 (29.0%)
Took courses related to skincare or cosmetics	
No	430 (47.0%)
Yes	485 (53.0%)
Level of study	
First-year	98 (10.7%)
Second-year	207 (22.6%)
Third-year	107 (11.7%)
Fourth-year	385 (42.1%)
Fifth-year	108 (11.8%)
Sixth-year	4 (0.4%)
Postgraduate education	6 (0.7%)

Participants were aware of the different types of skin damage resulting from exposure to sunlight. Most participants were aware of the tanning effect 785 (85.8%), followed by sunburn 771 (84.3%), pigmentation 718 (78.5%), early wrinkles 595 (65.0%), skin cancer 555 (60.7%), and premature skin aging 530 (57.9%).

Knowledge of the different aspects of sunscreen effects was assessed. Only half of the participants knew the mean SPF abbreviation (54.8%), and that sunscreen protected against skin cancer (57.3%) (Table 2). The scores of all participants for each attribute were calculated, and the lowest scores were for the protective effects of sunscreen on UVA, UVB, and skin cancer (465 and 524, respectively).

Table 2.
Knowledge of the protective effects of sunscreen, N=915.

	Frequency (%)	Score
Does sunscreen prevent sunburn?		786
Yes	786 (85.9%)	
No	60 (6.6%)	
I do not know	69 (7.5%)	
Does sunscreen protect against skin cancer?		524
Yes	524 (57.3%)	
No	145 (15.8%)	
I do not know	246 (26.9%)	
Does sunscreen prevent premature wrinkles?		669
Yes	669 (73.1%)	
No	90 (9.8%)	
I do not know	156 (17.0%)	
Sunscreen should protect from		465
Ultraviolet radiation types A and B (UVA and UVB)	465 (50.8%)	
Ultraviolet radiation type A (UVA) only	127 (13.9%)	
Ultraviolet radiation type B (UVB) only	48 (5.2%)	
I do not know	275 (30.1%)	
Total score		2,444/4=611

The scores of each participant were summed and a total score (full grade=4) was obtained, correct answers were assigned one mark, and wrong answers (including "I do not know" were assigned zero. Possible predictors of knowledge score were assessed using univariate linear regression, and variables with $p < 0.25$ were included in the multivariate linear regression model. Female participants and those who took courses in skincare or cosmetics had higher knowledge scores (*B* = positive). Participants from Faculties unrelated to human health (other than pharmacy and medicine) and private university students had lower knowledge scores (*B* was negative) (Table 3).

Table 3.
Possible predictors of knowledge score, N=915.

	Univariate analysis			Multivariate analysis		
	B	**95% CI**	**P**	***B***	**95% CI**	**P**
Gender						
Male [α]						
Female	0.800	0.594 -01.006	<0.001	0.617	0.439 - 0.794	<0.001
University						
Government [α]						
Private	-2.352	-3.361 - -1.343	<0.001	-1.317	-2.182 - -0.452	0.003
Specialty						
Faculties related to human health (pharmacy and medicine) [α]						
Faculties not related to human health (Others than pharmacy and medicine)	-1.400	-1.55 - -1.243	<0.001	-1.026	-1.234 - -0.817	<0.001
Took courses related to skincare and cosmetics						
No [α]						
Yes	1.053	0.903 - 1.203	<0.001	0.261	0.060 - 0.463	0.011
Level of study						
First-year [α]						
Second-year	0.573	0.290 - 0.857	<0.001	-0.102	-0.375 - 0.171	0.463
Third-year	0.712	0.389 - 1.035	<0.001	0.095	-0.204 - 0.395	0.532
Fourth-year	1.268	1.007 - 1.530	<0.001	0.213	-0.070 - 0.495	0.140
Fifth-year	1.467	1.145 - 1.790	<0.001	0.262	-0.082 - 0.605	0.135
Sixth-year	-0.255	-1.434 - 0.924	0.671	-1.004	-2.060 - 0.053	0.063
Postgraduate education	-.0588	-1.561 - 0.384	0.235	-0.300	-1.177 - 0.577	0.503

Note: [α]: Reference; *B*: Regression coefficient; CI: Confidence interval.

More than two-thirds of the participants (676, 73.9%) had experienced sunburns, and only 34 (3.7%) had skin cancer, either themselves or in a family member.

Based on the Fitzpatrick classification, most participants had Fitzpatrick skin type II (skin that usually burns and tans minimally) (28.3%) and skin type III (skin that sometimes burns mildly, tans uniformly) (22.7%). A few patients had type VI skin (never burned) (7.9%), (Figure 1, A). More than half of the participants spent 1-5 hours of sunlight per day (Figure 1, B).

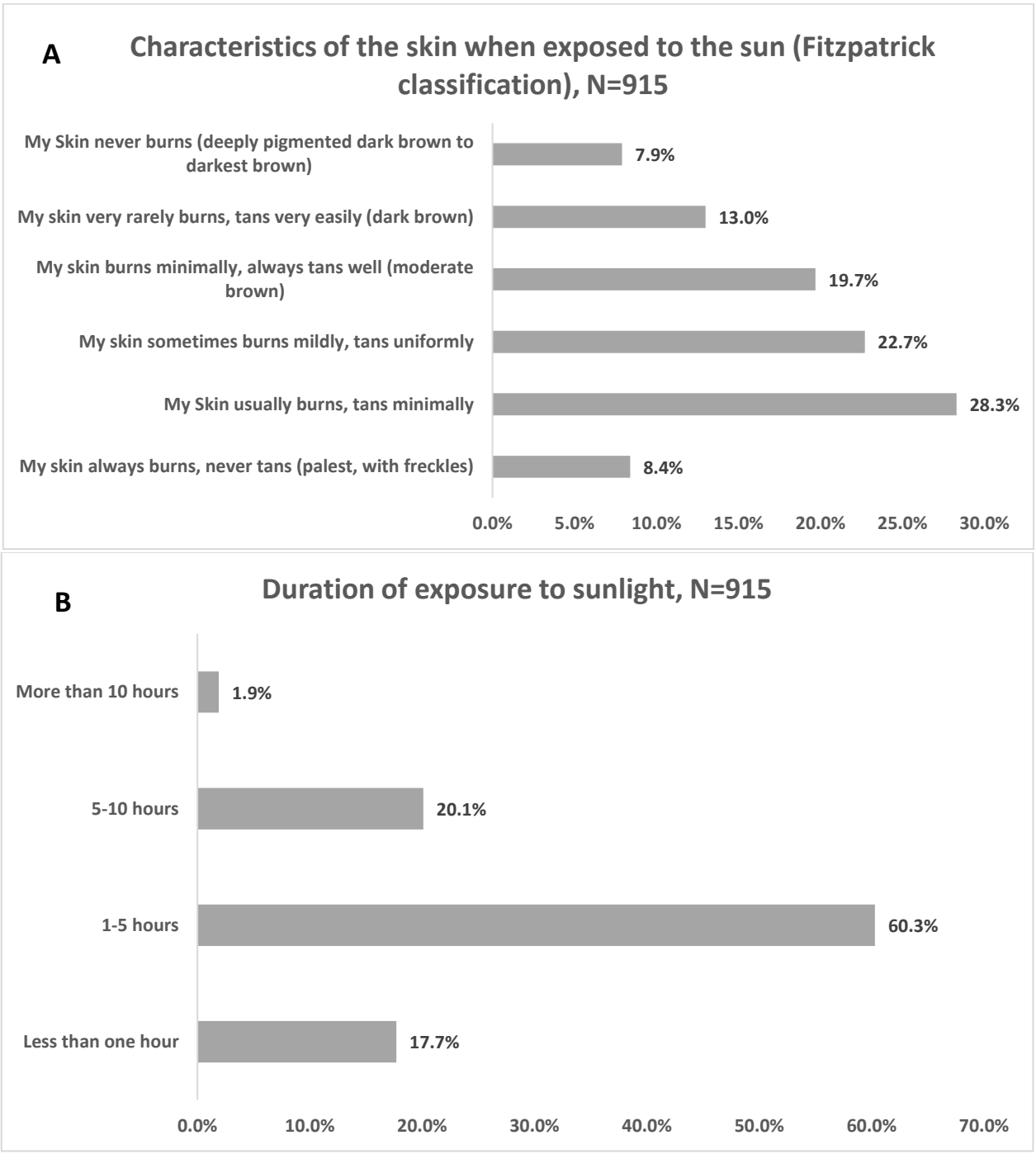

Figure 1.
A: Fitzpatrick classification of skin types after sun exposure; B: Duration of exposure to sunlight.

Fitzpatrick classification:
Type I - Skin always burns, never tans (palest, with freckles)
Type II - Skin usually burns, tans minimally
Type III - Skin sometimes burns mildly, tans uniformly
Type IV - Skin burns minimally, always tans well (moderate brown)
Type V - Skin very rarely burns, tans very easily (dark brown)
Type VI - Skin never burns (deeply pigmented dark brown to darkest brown)

Most participants used sunscreen, 736 (80.1%). There was a significant association between sunscreen use and gender. Female participants had a higher frequency of use than male participants (90.5% vs. 36.1%, $p < 0.001$). Sunscreen users (736 participants) completed the questionnaire, and Google Forms led non-users of sunscreen to leave the survey.

Participants who used sunscreen continuously had a higher average knowledge score (3.0 ± 1.1) than other participants who used sunscreen frequently (2.9 ± 1.1), sometimes (2.6 ± 1.3), or rarely (2.4 ± 1.2), $p < 0.001$. Users of sunscreen products rarely use a product with an SPF lower than 15 and predominantly apply it 15-30 minutes before sun exposure (Table 4)). This finding suggests an important association between adequate knowledge of and adherence to sunscreen products.

Table 4.
Practices of participants who use sunscreen products, N=736.

	Frequency (%)
Do you apply sunscreen every time you go out during the day?	
Always continuously	385 (52.3%)
Frequently (In most cases)	200 (27.2%)
Sometimes	92 (12.5%)
Rarely	59 (8.0%)
When do you wear sunscreen?	
Every day, all year long	372 (50.5%)
On sunny days only	185 (25.1%)
Sometimes, regardless of the weather	179 (24.3%)
Do you reapply sunscreen?	
I put it once and do not renew it.	557 (75.7%)
I renew it every hour	22 (3.0%)
I renew it every few hours	157 (21.3%)
Do you wear sunscreen indoors?	
Yes	319 (43.3%)
Sometimes	119 (16.2%)
No	298 (40.5%)
How do you apply sunscreen?	
Immediately before sun exposure	142 (19.3%)
15 to 30 minutes before exposure	530 (72.0%)
An hour or more before exposure to the sun	56 (7.6%)
During exposure to the sun	8 (1.1%)
What SPF do you use?	
Less than 15	42 (5.7%)
15-30	106 (14.4%)
30-50	205 (27.9%)
Over 50	259 (35.2%)
I don't care about the protection factor	124 (16.8%)
What type of sunscreen product do you use?	
Physical screen	134 (18.2%)
Chemical screen	105 (14.3%)
Mixed physical and chemical	219 (29.8%)
I do not have information about the types of sunscreens	278 (37.8%)

Despite the high prevalence of sunscreen use among the university students in our study, only half of them used sunscreen daily and throughout the year. Three-quarters of sunscreen users use it immediately without renewal. Less than half of sunscreen users used sunscreen indoors (Table 4).

Forgetting to use sunscreen products before sun exposure seems to be the leading reason for not using sunscreen products, followed by high prices and the shiny and greasy feeling it leaves on the skin (Figure 2, A). Additional sun protection methods included avoiding sun exposure during the sun peak hours, and using sunglasses, and long-sleeved clothes to cover the arms (Figure 2, B).

Sunscreen product users (N=736) mainly applied it to their faces (660, 89.7%), hands (339, 46.1%), neck (165, 22.4%), sun-exposed areas (128, 17.4%), and lips (74, 10.1%). The most commonly used formulation was cream (626, 85.1%), followed by aqueous gel (143, 19.4%), mist sprayer (118, 16.0%), sticks (31, 4.2%), and minimal powder (20, 2.7%).

Pharmacists are the main source of information and recommendations for specific sunscreen products. Participants chose sunscreen based primarily on the recommendation of the pharmacist (434, 58.9%), followed by the protection factor SPF of the product (405, 55.0%), recommendations from friends or family members (183, 24.9%), doctors' prescriptions (168, 22.8%), and the recommendation of the merchant (44, 5.9%).

Pharmacies were still the main providers of sunscreen products, and most participants purchased sunscreen agents (595, 80.8%). The next most common sources were local shops (91, 12.4%), followed by online purchasing (77, 10.5%). Few participants did not buy their own sunscreen products (n = 31, 4.2%).

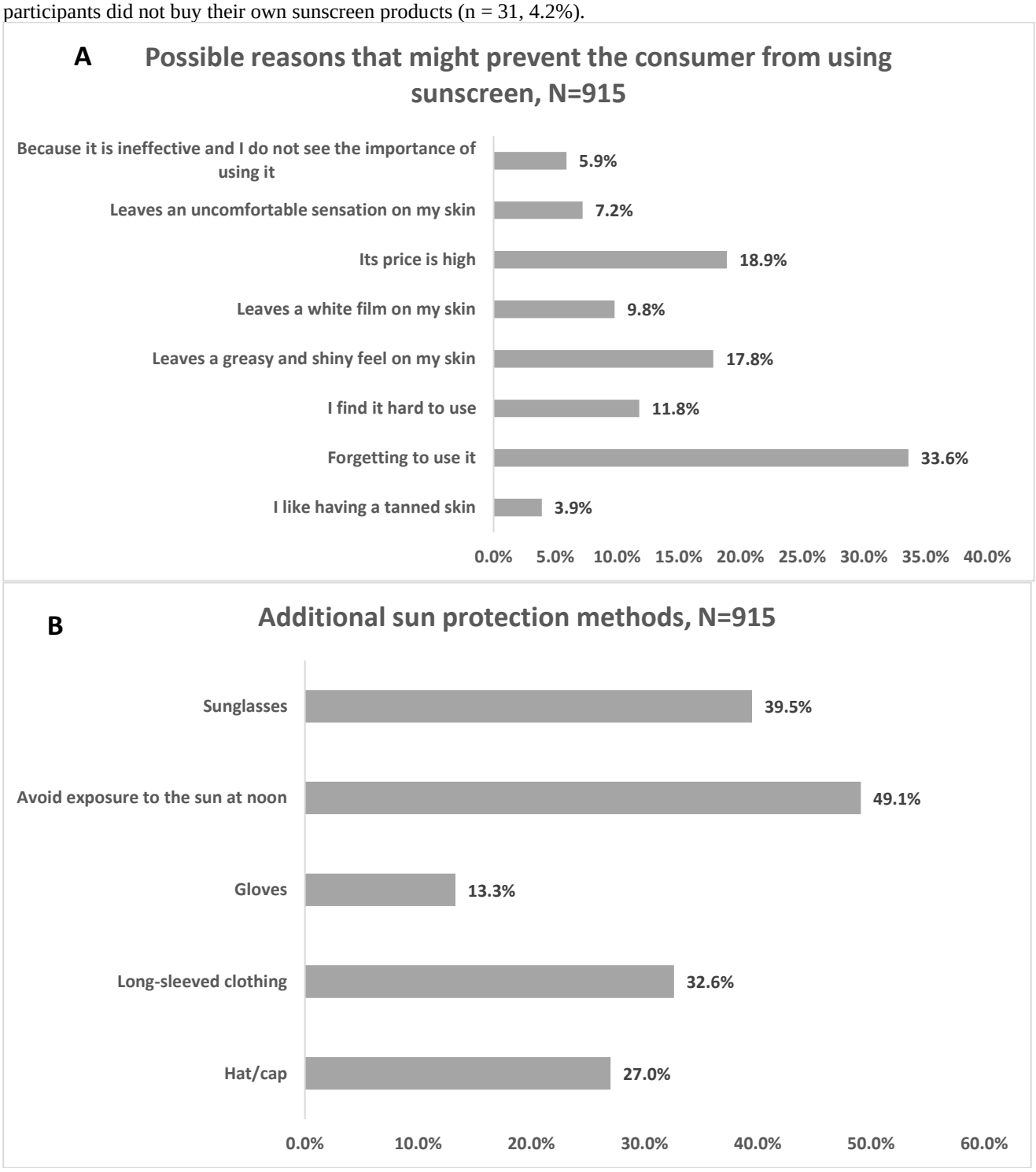

Figure 2.
A: Reasons for not using sunscreen products (participants can choose more than one answer); B: Additional sun-protection methods used by participants (participants can choose more than one answer).

4. Discussion

Sun exposure promotes skin cancer. Therefore, public health authorities worldwide recommend reducing the exposure to sunlight [17]. There is a positive association between early-age sunburn and melanoma risk, as many studies have shown that people who spend their childhood and adolescence in sunny regions of the world have an elevated risk of developing melanoma [18, 19]. Owing to intensive sun exposure and the high rate of sunburn among university students, they can be considered a high-risk group for short- and long-term adverse effects of UV radiation. It has been reported that skin cancer and skin damage risks can be reduced by informed sun protection, especially during youth and early adulthood [20].

Many international studies have been conducted to evaluate people's awareness of sun exposure and sun-protection practices. However, there is limited information regarding this topic in the Middle East, particularly in young populations

[21]. Jordan is a sun-belt country, possessing elevated solar radiation on its surface [22]. There is limited data regarding sunscreen use and sun protection behavior in the Jordanian population. Two studies were performed in Jordan focusing on this subject but did not investigate university students [23, 24]. Therefore, this cross-sectional study is the first in Jordan to assess the knowledge and practices of Jordanian university students regarding sunscreen use. In our study, we investigated whether there were any differences in the health-promoting behaviors of photoprotection among students from different faculties, especially students from faculties related to human health, such as medical and pharmacy schools, and others.

We found that students were aware of the different types of skin damage resulting from exposure to sunlight. However, students had the lowest level of awareness regarding skin cancer and premature skin aging compared to other skin damage resulting from sunlight exposure. A cross-sectional study in Iraq reported that only 47% of university students were aware of the association between sun exposure and skin aging. They were more likely to be aware of the relationship between sun exposure and skin cancer ($P < 0.03$) [21]. However, a previous study from the USA showed that most participants knew that sun exposure increased their risk of developing skin cancer. Nevertheless, only 29% correctly recognized the behaviors required to reduce this risk [25].

Only half of the participants in this study knew that sunscreens should provide a broad spectrum of protection against both UVA and UVB. Similar to our results, most participants from a population of Saudi university students did not know whether the sunscreen they used protected them against both UVA and UVB [24]. An Indonesian study that investigated the behavior of sunscreen use among medical students reported that 83.02% of the respondents knew that for daily use, sunscreen should be a broad-spectrum type of sunscreen without understanding its effects on UVA or UVB [26]. In accordance with other studies, our results showed that only half of the participants knew what SPF meant, indicating a low level of knowledge of the SPF values of sunscreen products [27]. Female participants had higher knowledge scores than male participants. Superior knowledge of females regarding sunscreen has also been reported in many studies from different countries [28, 29].

Students who took courses on skincare products or cosmetics had a higher knowledge score than others, which explains the importance of educational programs at the university to increase knowledge levels and, more importantly, modify younger people's attitudes toward adopting wiser behaviors concerning sun protection [30].

In our study, participants from faculties unrelated to human health (not related to medicine and pharmacy) had a lower knowledge score, which is comparable to the findings of other studies [31].

Fitzpatrick skin classification is helpful in the prediction of skin cancer and photodamage risks, where the pigmentation level is directly related to the protection level. Melanin offers significant defense against sun damage. This sun protection significantly reduces photoaging in skin types IV-V [30]. Based on the Fitzpatrick classification, most participants in our study had Fitzpatrick skin types II and III. It is known that people with Fitzpatrick skin types I–III have lower levels of innate photoprotection due to the low levels of melanin in their skin, which explains the necessity to use sunscreens [32].

The prevalence of sunscreen product use in this study was relatively high compared with that reported in studies from other countries. Comprehensive research on European university students from 13 countries in 2000 revealed that 63% of men and 87% of women use sun protection when sunbathing Peacey, et al. [32]. Jerkegren, et al. [33] revealed that 70% of women and 51% of men among university students in Sweden used sunscreens [33]. However, a study performed in the USA showed that only 5.1% of university students regularly used sunscreens [23]. Another study was conducted among university students in 25 low- and middle-income and emerging economies. The results showed that 57.2% of the students liked sunbathing, but 48.1% only used sunscreen when sunbathing [34].

It is evident that irrespective of students' faculties or their field of specialization, they do not apply sunscreen correctly. Sunscreen reapplication and indoor use should be given special consideration.

There was a significant association between sunscreen use and gender. Female participants had a higher frequency of use than male participants. This finding aligns with those of other studies [15, 16]. This could be explained by the fact that females are more concerned with their appearance than males are. The lower use of sunscreen in men than in women may be attributed to men's tendency to perceive the application of creams and lotions as female-specific behavior.

According to the results of this study, sunscreen product users rarely utilize products with an SPF lower than 15. A similar study performed by Urasaki, et al. [35] in Brazil to investigate university students' sun protection habits revealed that they chose sunscreen with an SPF of 15–30 [35]. Another study from Brazil revealed that 98.2% of university students use sunscreen with an SPF equal to or greater than 15 [36]. Similarly, Polish students from the medical faculty chose to use an SPF of more than 30 [37], while Turkish medical students used sunscreens with an SPF of more than 30 [38].

In our study, sunscreen users applied the product 15-30 minutes before sun exposure, which is recommended for appropriate skin binding [39]. This is consistent with a previous study by Memon, et al. [15], in which almost half of sunscreen users applied it at least 30 minutes before sun exposure [15]. Forgetting to use sunscreen products before sun exposure seems to be the leading reason for not using sunscreen products, followed by high prices and the shiny, greasy feeling it leaves on the skin. In a study conducted by Memon, et al. [15], it was found that half of the students in their sample avoided wearing sunscreens because of the oily feeling left on their skin [15].

Additional sun protection methods and practices utilized by students included avoiding sun exposure during the peak hours of the sun, wearing sunglasses, and using protective clothing, such as long-sleeved clothes, to cover the arms. Similar practices were indicated by another study on Romanian students that assessed their attitudes toward sun protection. It was found that avoiding sun exposure from 10 a.m. to 5 p.m. and wearing sunglasses were the main photoprotection methods [40].

Various dosage forms of sunscreen products have been introduced to facilitate their topical application to the skin. Cream formulations are the most widely available products on the market. Creams are emulsion-based systems that incorporate several ingredients and offer excellent biocompatibility with skin physiology [41]. Aqueous gels may be preferred by people

with oily skin or those prone to acne. Spray usage is easy to apply, particularly in terms of reapplication during the summer. These different dosage forms differ in their usage pattern parameters, such as application area, frequency, and amount of product used [42]. A study in France evaluated the utilization of different dosage forms of sunscreen products. Similar to our findings, the study results showed that 45% of the participants preferred cream products, 27% chose spray products, 18% chose lotion, and 9% chose oil formulations [43].

Participants in our study chose sunscreen based primarily on the pharmacist's recommendation, followed by the SPF of the product. In a study by Novitasari et al. [25], the SPF value of sunscreen was the most important consideration for students when choosing sunscreen (59.12%). Moreover, only 8.81% of students buy sunscreen products based on doctors' recommendations [25].

Most sunscreen users purchase sunscreen products from pharmacies, probably because they anticipate good guidance on sun protection and the type of sunscreen that could be appropriate for their skin [44]. A study in Poland reported that 79.8% of the students who participated in the survey bought their sunscreen products from drugstores, and 44% bought them from pharmacies [16]. Our findings suggest that targeted university-level educational interventions could significantly enhance sunscreen use, particularly among students outside health-related disciplines. Besides knowledge gaps, the pattern of behaviors that are inconsistent, such as sunscreen reapplication, does indicate a venue for further intervention.

Our study has several strengths. This was the first study performed in Jordan to assess the knowledge and practices of Jordanian university students towards sunscreen use, using a relatively large sample size. However, this study has certain limitations, such as the fact that students who are not interested in the subject may not respond to the survey, which does not allow us to explore their knowledge and practices. Future studies should explore larger samples collected from different geographic regions.

5. Conclusion

The knowledge and practice of sunscreen use among students in Northern Jordan are fairly acceptable. Students who do not have skin health courses in their curriculum should be reminded to use sunscreen products and attend skin protection workshops. To change the attitudes and behaviors of these students regarding sun exposure, elective university courses that are mandatory in the student curriculum of all Jordanian universities could be targeted to educate students in the skincare field.

It is critical to increase student knowledge about sun exposure prevention, particularly among students from faculties related to the human health field, such as medicine and pharmacy, especially regarding the correct methods of sunscreen application, to encourage healthy practices among their patients in the future. Future campaigns should emphasize actionable strategies in promoting sunscreen use among university students, such as techniques for reapplication and protection against both UVA and UVB rays.

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