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Original Article

Understanding the Dangers of Sun Exposure and the Importance of Photoprotection Practices in Public Awareness

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ABSTRACT

The harmful effects of sun exposure on the skin have been known for many years. However, addressing the lack of understanding and increasing awareness of the risks of ultraviolet (UV) radiation can shift the focus from irreversible damage to prevention. This research aimed to assess public awareness and practices regarding the harmful effects of ultraviolet radiation (UVR). An online survey was designed to collect demographic information, protection habits, and levels of awareness. A total of 708 responses were received. The findings revealed some gaps in awareness, though overall knowledge was considered reasonable. It was clear that demographic factors influenced levels of awareness. Use of sunscreen was suboptimal, with nearly one-third (28.5%) of respondents reporting that they did not use it. Consequently, while awareness was satisfactory, there were gaps in knowledge regarding lip protection and cancer risks. Additional education and encouragement are needed to promote better photoprotection practices.

Keywords: Photoprotection, Ultraviolet radiation (UVR), Skin cancer, Lip cancer, Awareness, UVR harmful effects

Introduction

Ultraviolet radiation (UVR) is a type of electromagnetic, non-ionizing radiation with wavelengths ranging from 100-400 nm. Although UVR comes from various sources, the primary source is sunlight. UVR is classified into three types based on its wavelength: UV-A, UV-B, and UV-C. Both UVA and UVB radiation reach the Earth, though in varying degrees [1, 2]. Despite significant absorption of UVR by the environment, cumulative exposure combined with other sources can lead to harmful effects. Extensive research has highlighted the health risks associated with UVR, including both non-cancerous and cancerous effects, which contribute to health and economic burdens. The negative impacts of UVR on human eyes, skin, and autoimmune functions are well-established [3-10]. UVR plays a critical role in the development of cutaneous malignant melanoma, squamous cell carcinoma, basal cell carcinoma, and lip cancer [3, 4]. The risk of UVR-related injuries is influenced by location, with areas such as the eyes, lips, and facial skin being particularly vulnerable. The likelihood of developing cancers on the face and lips is associated with outdoor exposure, occupation, and lifetime sun exposure [11, 12]. Sun exposure varies based on factors like solar zenith angle and season (Backes) [11]. Areas such as the forehead and nose receive the highest levels of radiation, followed by the lips [11, 13]. Consequently, protective measures like wearing hats, sunscreen-infused clothing, lip balms with sunscreen, and regular sunscreen use are recommended [11-14].

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A lack of public knowledge can increase risks and reduce adherence to protective practices. Effective communication can help educate the community and guide individuals towards proper UV protection, which, in turn, supports public health and well-being, ultimately benefiting both quality of life and the economy. Assessing community awareness of UVR is essential for health education. This research seeks to evaluate public knowledge of UVR and examine the influence of demographic factors and photoprotection habits on awareness.

Materials and Methods

This study involved adult volunteers who willingly participated and provided their consent to complete the questionnaires. Each participant answered the questionnaire on their own.
The survey consisted of two sections. The first section gathered demographic details, including occupation, education level, and sun protection practices. The second section assessed participants' awareness and understanding of UVR through a series of questions, using three response options on a Likert scale: agree, disagree, and unsure.

Statistical analysis

The data were gathered, encoded, and inputted for analysis. All statistical procedures were carried out using SPSS. To assess internal consistency, Cronbach's alpha was used. Descriptive statistical methods were applied, including frequency distribution tables, one-way ANOVA, and calculation of P-values. A P-value of 0.05 or lower was regarded as statistically significant.

Results and Discussion

A total of seven hundred and eight participants completed and submitted the questionnaires. The majority of respondents were female (70.9%). The sociodemographic characteristics of the participants are shown in **Figure 1**. Nearly half of the participants (48.5%) reported experiencing sunburn, ranging from occasional to rare occurrences. However, 44.2% of respondents never used sunscreen, 54.8% did not apply lip balm with SPF, and 78.7% did not reapply SPF lip balm **(Figure 2)**.

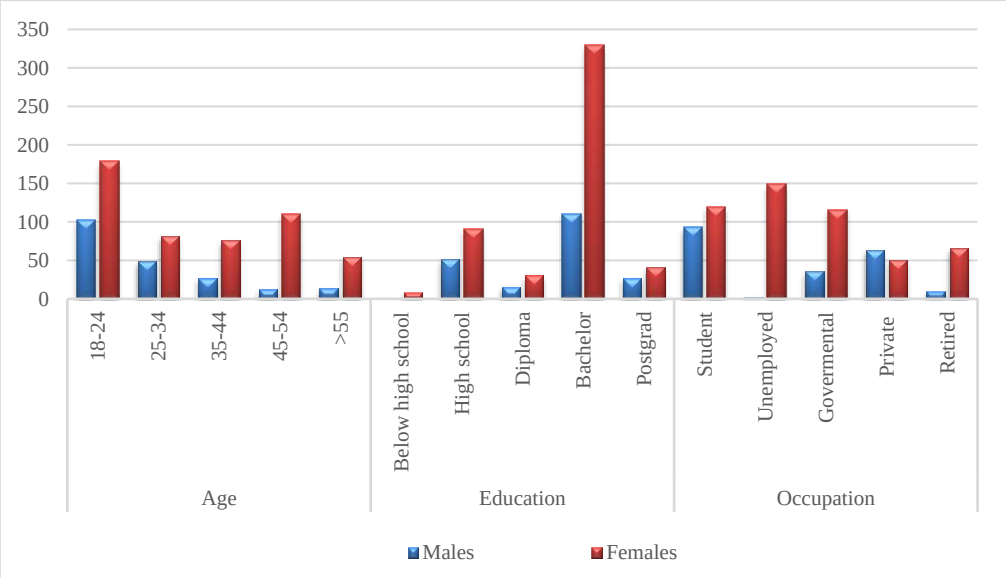

Figure 1. Sociodemographic information and characteristics of the sample participants.

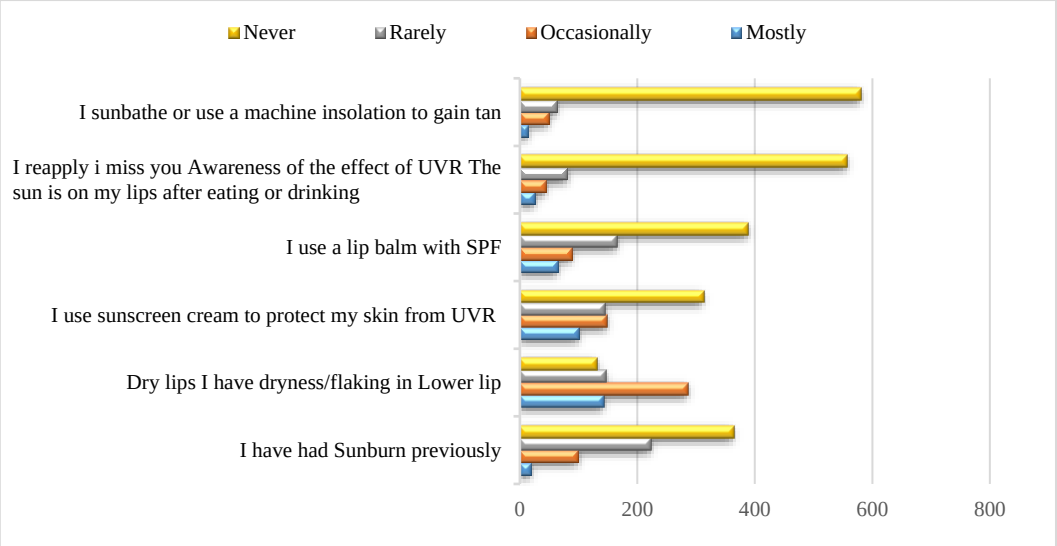

Figure 2. Adherence to UVR protection measures and prior experiences with UVR-related side effects in the sample.

Most of the respondents were aware of UVR, with 61.9% recognizing that its intensity varies by geography and 55.8% acknowledging its seasonal variation. Approximately two-thirds (67.4%) of the participants had the idea that covering the body could reduce the risk of skin cancer, and the same percentage agreed that UVR contributes to skin cancer development. About 67.8% of respondents acknowledged that prolonged sun exposure leads to skin wrinkles, and 75% agreed that it causes skin pigmentation. More than half (61.4%) believed that avoiding afternoon sun exposure could lower the risk of UVR damage, while 80.8% stated that UVR intensity peaks at noon. However, only 30.9% and 35.3% considered excessive sun exposure and alcohol consumption, respectively, to be risk factors for lip cancer. In contrast, more than half (60.1%) of the respondents recognized smoking as a risk factor for lip cancer. Regarding sunscreen use, 47% of participants believed it could reduce the risk of lip cancer, and 68.2% felt it helped protect against skin cancer. Most participants viewed UVR as highly harmful (44.2%) or at least somewhat damaging (40%).

Out of the sample, 202 participants (28.5%) reported never using sun protection. Among them, 22% (n = 156) believed it was unnecessary, 6.6% (n = 47) cited the cost as an important barrier, and 11% (n = 78) claimed a lack of time. The majority, 42.7% (n = 302), admitted to forgetting to use it, while 17.7% (n = 125) preferred alternative measures. Regarding the reasons for using sunscreen, 18.4 % (n = 130) applied it to avoid sunburn, 28.1% (n = 199) used it as a moisturizer, 7.6% (n = 54) sought to reduce skin aging, and only 8.3 % (n = 59) used it to prevent cancer. Meanwhile, 9% (n = 64) mentioned they used it simply because they had heard it was beneficial.

The average awareness score was 1.7269 (SD = 0.47891). An important difference in awareness was found between males (M = 1.9442, SD = 0.50174) and females (M = 1.6378, SD = 0.01962), with a t-value of 8.076, P = 0.000. A one-way ANOVA indicated a statistically important difference in awareness based on occupation, education level, and education at P > 0.05. The analysis also showed that experiencing UVR-related side effects (such as lip peeling, dryness, and sunburn) significantly affected awareness (P > 0.05). Furthermore, adherence to sun protection measures notably influenced the level of awareness **(Table 1)**.

Table 1. Impact of adherence to sun protection practices on awareness of UVR-related side effects

Variable	Sum of square	Df	Mean square	F	Sig.
Application of sunscreen					
Wearing protective clothing such as long pants, long-sleeved shirts, and hats, and using umbrellas when exposed to the sun can help lower the risk of skin cancer.	15.660	3	5.220	7.667	.000
	479.334	704	.681		
	494.994	707			
Prolonged sun exposure over time can cause wrinkles and accelerate premature aging.	36.240	3	12.080	17.584	.000
	483.640	704	.687		
	519.880	707			

Long-term overexposure to sunlight can increase the risk of developing skin cancer.	17.077	3	5.692	7.485	.000
	535.392	704	.761		
	552.469	707			
Prolonged sun exposure can result in skin pigmentation changes over time.	31.805	3	10.602	17.721	.000
	421.156	704	.598		
	452.960	707			
Prolonged sun exposure raises the risk of developing lip cancer.	17.810	3	5.937	7.414	.000
	563.693	704	.801		
	581.503	707			
Staying out of the afternoon sun during summer can lower the risk of damage or cancer to the skin and lips.	13.509	3	4.503	5.678	.001
	558.350	704	.793		
	571.859	707			
Lip balm containing SPF is intended to decrease the risk of damage or the development of lip cancer.	29.981	3	9.994	11.448	.000
	614.573	704	.873		
	644.554	707			
Applying sunscreen to the skin helps minimize the risk of skin damage or cancer.	32.987	3	10.996	15.705	.000
	492.893	704	.700		
	525.880	707			
Application of lip balm with SPF					
The intensity of UVR changes throughout the different seasons of the year.	10.476	3	3.492	3.822	.010
	643.189	704	.914		
	653.665	707			
The intensity of UVR varies with changes in geographic location.	18.888	3	6.296	7.212	.000
	614.585	704	.873		
	633.473	707			
Wearing long pants, long-sleeved shirts, and hats, and using umbrellas to cover the body can help lower the risk of skin cancer.	11.988	3	3.996	5.824	.001
	483.006	704	.686		
	494.994	707			
Extended sun exposure over time can cause wrinkles and contribute to premature aging.	12.092	3	4.031	5.588	.001
	507.788	704	.721		
	519.880	707			
Prolonged sun exposure over time can increase the risk of developing skin cancer.	18.000	3	6.000	7.903	.000
	534.469	704	.759		
	552.469	707			
Extended exposure to sunlight over time can result in changes to skin pigmentation.	14.679	3	4.893	7.860	.000
	438.281	704	.623		
	452.960	707			
Limiting exposure to the afternoon sun during the summer helps reduce the risk of skin or lip damage and cancer.	10.644	3	3.548	4.451	.004
	561.215	704	.797		
	571.859	707			
Lip balm containing SPF is formulated to decrease the likelihood of lip damage or lip cancer.	15.036	3	5.012	5.605	.001
	629.518	704	.894		
	644.554	707			
Applying sunscreen to the skin helps lower the risk of skin damage or cancer.	10.441	3	3.480	4.754	.003
	515.439	704	.732		
	525.880	707			
Re-apply lip balm with SPF					
	8.959	3	2.986	4.325	.005

Wearing long pants, long-sleeved shirts, and hats, and using an umbrella can help reduce the risk of skin cancer.	486.035	704	.690		
	494.994	707			
Continuous overexposure to sunlight can increase the risk of developing skin cancer over time.	6.299	3	2.100	2.706	.044
	546.170	704	.776		
	552.469	707			
Prolonged exposure to sunlight can cause changes in skin pigmentation over time.	8.530	3	2.843	4.504	.004
	444.431	704	.631		
	452.960	707			
Applying sunscreen to the skin aids in minimizing the risk of skin damage or cancer.	6.110	3	2.037	2.759	.041
	519.770	704	.738		
	525.880	707			

The Scheffe post hoc analysis revealed that participants aged 18-24 years and 25-34 years exhibited notably higher awareness of the harmful effects of UVR compared to other age groups, particularly those over 45 years. Individuals with education levels beyond high school, especially those with bachelor's and postgraduate degrees, demonstrated greater awareness of UVR. Students showed significantly higher awareness than unemployed individuals. In terms of sun protection habits, participants with poor adherence to sun protection guidelines, as well as those who rarely or never experienced side effects like sunburn, had lower levels of UVR awareness. Moreover, participants who did not engage in tanning had significantly higher awareness levels **(Table 2)**.

Table 2. The effect of tanning on UVR hazard awareness

Variable	Sum of square	Df	Mean square	F	Sig.
Prolonged sun exposure can result in skin discoloration as time progresses.	11.559	3	3.853	5.336	.001
	508.321	704	.722		
	519.880	707			
Long-term exposure to sunlight can increase the risk of developing skin cancer.	10.108	3	3.369	4.373	.005
	542.361	704	.770		
	552.469	707			
Applying sunscreen on the skin aids in lowering the risk of skin damage or cancer.	8.217	3	2.739	3.725	.011
	517.663	704	.735		
	525.880	707			
How frequently do you expose yourself to the sun to achieve a tan?	137.739	3	45.913	93.610	.000
	345.293	704	.490		
	483.032	707			
What is the duration of your sunbathing sessions?	179.377	3	59.792	37.522	.000
	1121.843	704	1.594		
	1301.220	707			

The health risks associated with UVR are extensively documented in the literature, highlighting their significant contribution to mortality, morbidity, and economic burden. Consequently, raising public awareness about UVR is crucial. This study aimed to assess the level of awareness, identify knowledge gaps, and examine factors influencing it. In line with this, the WHO initiated the INTERSUN program and published several resources to promote awareness [15].

Our findings revealed persistent gaps in sun protection practices. While the risks of UVR are well established, sunscreen usage remains an effective and cost-efficient preventive measure. Comparable findings have been reported among female university students, populations in Qassim, Saudi Arabia, and even South African children and adolescents [16-21]. A lack of awareness is often linked to insufficient knowledge of hazards and the extent of sun exposure [22]. However, some studies have indicated that awareness of risks did not necessarily correlate with better compliance [17, 21, 23]. Additionally, compliance tends to be higher in school settings but decreases during the summer and in stormy conditions [19, 20]. On the other hand, sunscreen use, if not properly managed,

can lead to overexposure to sunlight. Therefore, it is vital to strengthen the dissemination of guidelines and risk information, particularly for at-risk groups such as outdoor workers, those in regions with high UVR exposure, and individuals with knowledge gaps.

In line with other studies, our findings suggest that demographic factors such as age, education, gender, and occupation significantly influence knowledge and awareness of UVR risks [21, 22, 24]. However, unlike some studies, younger participants in our research demonstrated higher levels of awareness and knowledge [21, 22]. Additionally, older individuals and those who were unemployed were less likely to adhere to sun protection guidelines or recognize the associated hazards. Furthermore, higher education levels were positively correlated with better awareness and knowledge. Socioeconomic status has been shown to influence and predict health outcomes in various populations [25, 26].

Our study revealed that only 2.8% of participants had experienced sunburn, a relatively low percentage compared to reports from Brazil, Denmark, and the United States [23, 27, 28]. Similar to findings in the US, sunburns were more common among younger individuals, though this difference was not statistically important. Sunburns can affect all skin types and races, including those with a lower risk of skin cancer. The lower incidence of sunburns in this study may be attributed to the hot climate and long summer, which encourages activities after sunset or indoors.

More than 25% of the participants did not use sun protection. Among those who did, the primary reasons for use were to maintain healthy, hydrated skin and to prevent sunburn, whereas a study by Al Robeea found that the main motivation was to avoid skin discoloration. The most common reason for not using sunscreen in this study was simply forgetting, with other reasons including lack of availability, the cost of sunscreen, and discomfort when applying it to the skin [17, 21].

Conclusion

This study aimed to assess public awareness of UVR and examine the influence of demographic factors and sun protection habits on this awareness. The results showed a moderate level of awareness, but the use of sunscreen was limited. The primary knowledge gaps were related to UVR intensity and its fluctuations, with a particular lack of information concerning lip cancer and its prevention. It is essential to enhance knowledge and awareness, especially among individuals aged over 45 and those with a high school education or lower.

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Conflict of Interest: None

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Ethics Statement: The study proposal was approved by the College of Dentistry Research Center at King Saud University, Riyadh, Saudi Arabia (IRB Approval No. E-21-5788).

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