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Public Awareness of Sun Exposure Risks and Photoprotection for Preventing Pigmentary Skin Disorders in Saudi Arabia

Salim A. Algaadi[1*], Sara A. Almarshad[2], Haneen N. Abanmi[3], Rana A. Alharfi[4] and Sharifah H. Almasoud[5]
[1]Department of Medical Specialties (Dermatology Unit), College of Medicine, Majmaah University, Al-Majmaah 11952, Saudi Arabia
[2-5]College of Medicine, Majmaah University, Al-Majmaah, Saudi Arabia

*Corresponding author: Salim A. Alqaadi (e-mail: s.algaadi@mu.edu.sa).

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Abstract **Background:** Excessive sun exposure is a key risk factor for pigmentary skin disorders, especially in high-UV regions like Saudi Arabia. Despite increasing awareness, gaps remain between knowledge and protective behaviors. To assess public knowledge, practices and awareness regarding sun exposure and photoprotection and their association with sociodemographic factors. **Methods:** A cross-sectional online survey was conducted among 305 adults in Saudi Arabia. The questionnaire evaluated knowledge, practices, barriers and awareness. Data were analyzed using descriptive statistics and non-parametric tests, with $p<0.05$ considered significant. **Results:** Most participants recognized the risks of sun exposure (93.8%) and peak harmful hours (78.4%). However, only 27.2% consistently used sunscreen despite good awareness. SPF ≥50 use was reported by 51.8% and 76.7% used multiple protection methods. Misconceptions and inconsistent practices were common. Significant associations were observed between knowledge and sociodemographic factors. Positive correlations were found between knowledge, awareness and practices ($p<0.01$). **Conclusion:** Although awareness is generally good, a gap persists between knowledge and consistent sun protection practices. Targeted education and public health interventions are needed to improve photoprotection behaviors.

Key Words Sunlight Exposure, Sun Protection Methods, Skin Pigmentation Issues, Melasma, Public Knowledge, Saudi Arabia

INTRODUCTION

UVR is a primary environmental factor from sunlight, categorized into UVA, UVB and UVC based on wavelength [1,2]. While the ozone layer blocks UVC, both UVA and UVB reach the Earth's surface and affect the skin. UVB is primarily absorbed by the epidermis, causing sunburn and DNA damage, whereas UVA penetrates deeper into the dermis, contributing to long-term issues like photoaging and pigmentary changes [1,2]. Visible light, particularly in the blue-violet spectrum, also exacerbates pigmentation disorders, especially melasma in darker skin types [3,4]. Hormonal factors can also play a role [3,4].

The Effects of UVR

Cumulative UVR exposure accelerates the degradation of collagen and elastin, leading to wrinkles and hyperpigmentation and significantly raises the risk of skin cancers, including BCC, SCC and melanoma [5]. Both UVB and UVA contribute to cancer development through distinct but overlapping pathways; UVB causes mutations in the p53 tumor suppressor gene, while UVA induces oxidative stress [5].

Photoprotection & Challenges

Universal photoprotection is recommended and includes avoiding peak sun hours, wearing protective clothing and applying broad-spectrum sunscreen [6-8]. However, sunscreen use is often suboptimal. People commonly apply inadequate amounts, miss critical areas and fail to reapply after activities like swimming [9]. The WHO advises reapplying every two hours but individuals often apply only 25-50% of the recommended quantity, significantly reducing effectiveness [9].

Recent Advances and Gaps

Enhanced sunscreens now contain antioxidants and botanical agents that neutralize Reactive Oxygen Species

(ROS) and offer additional defense against inflammation and pigmentation [10-13]. Despite these advancements, public awareness remains insufficient, particularly in high-irradiance regions like Saudi Arabia [14]. A study in Jazan Province found that while women and those with higher education levels have better knowledge, misconceptions and cosmetic concerns hinder consistent use [14].

This study, therefore, aims to identify these knowledge gaps and promote evidence-based sun protection behaviors, particularly in Saudi Arabia regions with a high UV index, to reduce the incidence of pigmentary disorders and UV-induced skin damage. (Paraphrased).

METHODS

Study Population

This was a cross-sectional study conducted to assess public awareness of sun exposure risks and photoprotection for preventing pigmentary skin disorders in Saudi Arabia. The study targeted all parts of the Kingdom of Saudi Arabia (central, eastern, western, northern and southern regions). The study population consisted of individuals residing in Saudi Arabia, including both Saudi citizens and expatriates. The sample included individuals of different age groups, genders and occupational backgrounds, with a focus on those frequently exposed to sunlight or at risk of developing pigmentary skin disorders.

The sample size was calculated using the following formula:

$$n = Z^2 P(1-P)/d^2$$

$$(1.96)^{2*}(0.5)(1-0.5)/(0.05)^2 = 384$$

Where:

n = The sample size

Z = The statistic corresponding to level of confidence = 1.96

P = Expected prevalence (that could be obtained from similar studies or a pilot study conducted by the researchers) = 0.5

d = Precision (corresponding to effect size) = 0.05

Data Collection

The study took approximately 6 months for data collection, analysis and report writing. The research team used an online, semi-structured, self-administered questionnaire to gather data. The survey, created with (Google Forms), its link was distributed through social media platforms, specifically WhatsApp and Facebook groups obtained from friends, acquaintances and relatives. The distribution included males and females over the age of 18 with different educational backgrounds. The data were collected through a pre-tested and pre-designed online questionnaire. The participants' responses were numbered sequentially for each question (1, 2, 3, etc.). Part of the questionnaire included demographic data of the participants and the other part included questions related to their awareness of sun exposure risks and photoprotection for preventing pigmentary skin disorders.

Statistical Analysis

The collected data were checked for completeness and coded in an Excel sheet. The data were analyzed using IBM SPSS Statistics for Windows, Version 27.0 (Released 2020; IBM Corp., Armonk, New York, United States). A descriptive statistical analysis was conducted for all of the variables. Continuous variables were presented as a median and interquartile range, while categorical variables were expressed as numbers and percentages. Analysis of variance (ANOVA) was test the significant difference at $P<0.05$ among knowledge, barrires and misconcepts and awareness. Since the data do not follow a normal distribution, the researcher used nonparametric tests such as the Mann-Whitney test and the Kruskal-Willis test to test the extent to which the study dimensions differ according to demographic variables. In addition the correlation coefficient among knowledge, barrires and misconcepts and awareness was processed using Correlation Spearman's test at $p<0.05$ [15].

Inclusion and Exclusion Criteria

Inclusion: All males and females aged 18 and above living in Saudi Arabia.

Exclusion

Individuals under 18 years old and those who did not reside in Saudi Arabia.

Ethical Considerations

Informed consent was obtained from all subjects. Ethics approval was obtained from the ethics committee of Majmaah University. Data were kept confidential and used only for the sole purpose of this study.

RESULTS

Socio-Demography and Sample Characteristics

The descriptive statistical analyst to the participants' sociodemographic data showed that of 500 questionnaires 305(61.0%) are responded (Table 1). The majority of the participants are; female (275: 90.2%). Of 305 participants, aged 18-35 years 175(57.4%). in the university degree and secondary school levels (195: 63.9% and 76: 24.9%), students (103: 33.8%) followed by and unemployed (87: 28.5%) and office workers (76: 24.9%). Of 305 participants and live in the northern of Saudi Arabia (188: 61.6%).

Knowledge of Sun Exposure and Skin Health (Paraphrased)

From Table 2 the descriptive statistical analysis indicated that of the 305 participants 289(93.8%) know that skin pigmentation issues like melasma and hyperpigmentation

Table 1: Data and Samples Characteristics

Characteristics	Count (N = 305)	Percentage
Gender type		
Female	275	90.2
Male	30	9.8
Age category		
18-24	104	34.1
25-34	71	23.3
35-44	64	21.0
45-54	47	15.4
>55	19	6.2
Highest level of education		
No formal education	6	2.0
Primary school	3	1.0
Secondary school	76	24.9
University degree	195	63.9
Postgraduate degree	25	8.2
Occupation		
Student	103	33.8
Healthcare professional	12	3.9
Office worker	76	24.9
Outdoor worker	27	8.9
Unemployed	87	28.5
Region of Saudi Arabia do you live in		
Central	188	61.6
Eastern	16	5.2
Western	29	9.5
Southern	14	4.6
Northern	58	19.0

can be brought on by exposure to the sun. A 251(82.3%) recorded variety of the primary consequences of prolonged exposure to sunlight ranging from skin darkening or pigmentation, sunburn, premature aging and vitamin D deficiency. A 263(86.2%) know that the sun is essential for maintaining good health as it helps the body produce vitamin D. A 180 (59%) reported that stay out in the sun a period ranged between 10-30 minutes without protection is safe and 239(78.4%) reported that 12-3 pm is the worst time of day to be exposed to the sun. A 271(88.9%) recorded that the attributes; spending time outdoors without sun protection, having fair or light-colored skin, having a history of sunburns, living in a hot or sunny climate and taking certain medications that increase sun sensitivity raise the possibility of solar damage. A 173(57.4%) believe that sunscreen should be worn every day, even on overcast day. A112(36.7%) and 87(28.5%) think that exposure to the sun only damages the skin or can affect skin and other bodily parts, respectively. A 99(32.5%) have never experienced any issues while 98(32.1%) have developed pigmentation issues (melasma, dark spots). Eighty three (27.2%) participants always use sunscreen outside, while 112(36.7). A 158(51.8%) uses SPF 50 or higher for sun protection. A 234 (76.7%) use different protection techniques as sunscreen, sunglasses, staying in the shade, wearing protective clothes and avoiding outdoor activities during peak sun hours. A 120(39.3%) obtain the sun protection information from social media and 110(36.1%) from Healthcare professionals (doctors, dermatologists). A 183(60.0%) chooses the sunscreen purchase based on different criteria the most important criteria are based on dermatologist recommendation (56:18.4%) and SPF level (38:12.5%). A 98(32.2%) and 91(29.8%) always just buy based on brand or SPF and always check the ingredients before buying, respectively. A 212(69.5%) believe that sunscreen should be combined with other protective measures. More than half (168: 55.1%) of the respondents believed that sunscreen reduces the negative consequences of sun exposure but does not eliminate risks. A 114(37.4%) are trust sunscreen products, while 77(25.2%) shunned sunscreen because they are worried about chemicals in sunscreen. A 112(36.7%) forget to apply it, 62 (20.3%) have many reasons as they feel uncomfortable on their skin, forget to apply and prefer natural sun protection, prefer natural sun protection (e.g., shade, clothing).

Barriers and Misconceptions (Paraphrased)

For barriers and misconceptions characters, 205(67.2%) participants don't believe that sun protection is just necessary for those with lighter skin and 225(73.8%) think that those with light and dark skin need sun protection (Table 3). Of the 305 participants, 205(67.2%) believed that sun exposure is harmful year-round. In addition, 226(74.1%) think that UV rays can still penetrate windows and shade, while 39(12.7%) believed that shade or glass completely blocks UV rays. A 69(22.6%) believed that one application of sunscreen is enough to provide adequate protection throughout the day while the majority of them believed that sunscreen should be

Table 2: Descriptive Analysis of the Knowledge of Sun Exposure and Skin Health Characters of the Participants

Characters	No.	Percentage
Do you know that skin pigmentation issues like melasma and hyperpigmentation can be brought on by exposure to the sun?		
Yes	286	93.8
No	7	2.3
Not sure	12	3.9
In your opinion, what are the primary consequences of prolonged exposure to sunlight? (Select all that apply)		
Skin darkening or pigmentation	30	9.8
Sunburn	12	3.9
Skin cancer	9	3
Premature aging (wrinkles, fine lines)	3	1
Vitamin D deficiency	0	0
Other: _____	251	82.3
Do you think that being in the sun is essential for maintaining good health? 180		
Yes, it helps the body produce vitamin D	263	86.2
No, sun exposure is harmful	13	4.3
I'm not sure	29	9.5
How long is it safe to be out in the sun without protection, in your opinion?		
Less than 10 minutes	91	29.8
10-30 minutes	180	59
30-60 minutes	6	2
More than 1 hour	4	1.3
Not sure	24	7.9
In your opinion, when is the worst time of day to be exposed to the sun?		
6 AM - 9 AM	20	6.6
9 AM - 12 PM	21	6.9
12 PM - 3 PM	239	78.4
3 PM - 6 PM	15	4.9
Sun exposure is equally harmful throughout the day	10	3.3
Which elements, in your opinion, raise the possibility of solar damage? (Select all that apply)		
Spending time outdoors without sun protection	15	4.9
Having fair or light-colored skin	4	1.3
Having a history of sunburns	7	2.3
Living in a hot or sunny climate	8	2.6
Taking certain medications that increase sun sensitivity	0	0
All of the above	271	88.9
Do you believe that sunscreen should be worn every day, even on overcast days?		
Yes	175	57.4
No	93	30.5
Not sure	37	12.1
Do you think that exposure to the sun only damages the skin or can it also affect other bodily parts?		
Only affects the skin	87	28.5
Affects both skin and internal organs	112	36.7
Not sure	106	34.8
Have you ever had any health problems or skin diseases brought on by too much sun exposure?		
Yes, I have had sunburns	58	19
Yes, I have developed pigmentation issues (melasma, dark spots)	98	32.1
Yes, I have experienced premature skin aging	4	1.3
Yes, I have had eye-related problems due to sun exposure	15	4.9
No, I have never experienced any issues	99	32.5
Not sure	31	10.2
How frequently do you use sunscreen outside?		
Always us	83	27.2
Sometimes	112	36.7
Rarely	48	15.7
Never	62	20.3
Which Sun Protection Factor or SPF, do you typically use?		
SPF 15 or lower	23	7.5
SPF 30	40	13.1
SPF 50 or higher	158	51.8
I don't use sunscreen	84	27.5
Which of these sun protection techniques do you frequently follow? (Select all that apply) A		
Wearing a hat or cap	12	3.9
Using sunscreen	12	3.9
Wearing sunglasses	3	1
Staying in the shade	20	6.6
Wearing protective clothing (long sleeves, pants)	2	0.7
Avoiding outdoor activities during peak sun hours	22	7.2
Others	234	76.7

Table 2: Continue

Characters	No.	Percentage
Where do you often find sun protection information?		
Social media	120	39.3
Healthcare professionals (doctors, dermatologists)	110	36.1
Schools/universities	18	5.9
Friends and family	28	9.2
TV/radio/newspapers	11	3.6
I don't receive any information	18	5.9
How do you choose a sunscreen to purchase? (Select all that apply)		
Based on SPF level	38	12.5
Based on brand reputation	7	2.3
Dermatologist recommendation	56	18.4
Influencer or social media recommendations	9	3
Price and affordability	4	1.3
Availability in stores	8	2.6
Others	183	60
Do you look at sunscreen's components before buying it?		
Yes, I always check the ingredients	91	29.8
Sometimes, if I am concerned about skin sensitivity	50	16.4
No, I just buy based on brand or SPF	98	32.2
I do not use sunscreen	66	21.6
Do you believe that applying sunscreen may take the place of other sun protection techniques like wearing sunglasses or a hat?		
Yes, sunscreen alone is enough	48	15.7
No, sunscreen should be combined with other protective measures	212	69.5
Not sure	45	14.8
Do you believe that all of the negative consequences of sun exposure can be avoided by using sunscreen?		
Yes, it completely protects against sun damage	76	24.9
No, it reduces but does not eliminate risks	168	55.1
Not sure	61	20
Have you ever shunned sunscreen because you were worried about its effects or safety?		
Yes, I am worried about chemicals in sunscreen	77	25.2
Yes, I have experienced skin irritation from sunscreen	38	12.5
No, I trust sunscreen products	114	37.4
I do not use sunscreen	76	24.9
What is the biggest reason you do not use sunscreen?		
I don't think it's necessary	25	8.2
It is too expensive	29	9.5
It feels uncomfortable on my skin	34	11.1
I forget to apply it	112	36.7
I prefer natural sun protection (e.g., shade, clothing)	43	14.1
Most of the other	62	20.3

reapplied regularly. A 187(61.3%) believed that they can still get enough vitamin D with using sunscreen. A 192(63.0%) participants think that tanning increases sun damage and skin cancer risk, while low count (34: 11.1%) believed that tanning protects the skin from future sunburn. Hundred and thirty seven (44.9%) participants believe that conventional sunscreen is more effective and 108(35.4%) don't shore but 60(19.7%) believed that SPF-containing moisturizers or makeup offer the same degree of sun protection as conventional sunscreen. A 116(38.0%) of 305 participants think that using SPF as SPF 50+ provides all-day protection, while 96(31.5%) believed that sunscreen should still be reapplied regularly and 93(30.5%) are not shore. A 172(56.4%) believed that sunburn in not the only indication of UV damage but damage can occur without visible sunburn. A 17.0 and 14.8% of the participants received advice that they don't need for use sunscreen every day from friends/family and social media represents, while, 208(68.2%) know that sunscreen is important. A 58.7% believed that sunscreen should be used daily. A 198(64.9%) and 32 (10.5%) are motivated to use sunscreen more frequently especially doctors or dermatologist recommendations, more public awareness campaigns (27: 8.9%) and more affordable sunscreen options (22: 7.2%).

Recommendations and Awareness (Paraphrased)

The results of the descriptive statistical analysis in Table 4 showed that 288(94.4%) of the sample believe that Saudi Arabia should launch more sun protection awareness campaigns. Two hundred and forty of all participants represent 78.7% chose different strategies to raise awareness as social media campaigns (13.4%), education programs, advertisements on TV and radio, free distribution of sunscreen samples and awareness programs in hospitals and clinics. Of 305 participants, 274 (89.8%) are interested

Table 3: Descriptive Analysis of the Barriers and Misconceptions Characters of the Participants

Characters	Count	Percentage
Do you believe that sun protection is just necessary for those with lighter skin?		
Yes	56	18.4
No	205	67.2
Not sure	44	14.4
Do you think that darker-skinned people don't need to put sunscreen?		
Yes, darker skin is naturally protected	39	12.8
No, everyone needs sun protection	225	73.8
Not sure	40	13.1
Do you believe that exposure to the sun is just bad in the summer?		
Yes, sun exposure is only a problem in summer	56	18.4
No, sun exposure is harmful year-round	205	67.2
Not sure	44	14.4
Do you think that you are fully protected from sun harm by keeping in the shade or inside a vehicle or building?		
Yes, shade or glass completely blocks UV rays	39	12.7
No, UV rays can still penetrate windows and shad e	226	74.1
Not sure	40	13.1
Do you believe that only one morning application of sunscreen provides adequate protection throughout the day?		
Yes, one application is enough	69	22.6
No, sunscreen should be reapplied regularly	176	57.7
Not sure	60	19.7
Do you believe that using sunscreen can lead to a lack of vitamin D?		
Yes, it prevents the body from absorbing vitamin D	38	12.5
No, you can still get enough vitamin D with sunscreen	187	61.3
Not sure	80	26.2
Do you think tanning is a good technique to shield your skin from the sun?		
Yes, tanning protects the skin from future sunburns	34	11.1
No, tanning increases sun damage and skin cancer risk	192	63
Not sure	79	25.9
Do you believe that SPF-containing moisturizers or makeup offer the same degree of sun protection as conventional sunscreen?		
Yes, it is enough for sun protection	60	19.7
No, regular sunscreen is more effective	137	44.9
Not sure	108	35.4
Do you think that using a sunscreen with a high SPF (such as SPF 50+) eliminates the need for frequent reapplications?		
Yes, high SPF provides all-day protection	116	38
No, sunscreen should still be reapplied regularly	96	31.5
Not sure	93	30.5
Do you believe that the only indication of UV damage is sunburn?		
Yes, if I don't get sunburned, my skin is fine	62	20.3
No, sun damage can occur without visible sunburn	172	56.4
Not sure	71	23.3
Have you ever been advised that you don't need for use sunscreen every day?		
Yes, I have heard this from friends/family	52	17
Yes, I have seen this on social media	45	14.8
No, I have always known sunscreen is important	208	68.2
Do you believe that using sunscreen is solely appropriate for outdoor activities or the beach?		
Yes, I only use sunscreen for these activities	85	27.9
No, sunscreen should be used daily	179	58.7
Not sure	41	13.4
What would motivate you to use sunscreen more frequently? (Select all that apply)		
More affordable sunscreen options	22	7.2
Better education about sun exposure risks	11	3.6
Easier-to-use sunscreen products (e.g., sprays, lightweight formulas)	15	4.9
Doctor or dermatologist recommendations	32	10.5
More public awareness campaigns	27	8.9
Others	198	64.9

receiving more information about sun protection and skin health. A 191 (62.7%) of participants reported that Saudi Arabians need more awareness about the dangers of sun exposure and the significance of sun protection. Most of the participants (201: 65.9%) have never received formal sun protection course but 57(18.7%) and 47(15.4%) received formal course through a healthcare professional or learned in the school/university, respectively. The majority of participants represented by 150(50%) felt that public awareness initiatives about sun protection should be take place in schools and universities, hospitals and clinics, social media platforms shopping malls and public places. A 242(79.3%) of the participants believe that greater public education regarding sun protection should come from dermatologists and other medical professionals through providing more guidance. One hundred and seventy seven

Table 4: Descriptive Analysis of the Recommendations and Awareness Characters of the Participants

Characters	Count	Percentage
Do you believe Saudi Arabia should launch more sun protection awareness campaigns?		
Yes	288	94.4
No	17	5.6
In your opinion, what strategies would work best to raise awareness about sun protection? (Select all that apply)		
Social media campaigns	41	13.4
Educational programs in schools/universities	4	1.3
Advertisements on TV and radio	4	1.3
Free distribution of sunscreen samples	8	2.6
Awareness programs in hospitals and clinics	8	2.6
Others	240	78.7
Would you be interested in receiving more information about sun protection and skin health?		
Yes	274	89.8
No	31	10.2
Are Saudi Arabians sufficiently aware of the dangers of exposure to the sun and the significance of sun protection, in your opinion?		
Yes, awareness is sufficient	73	23.9
No, more awareness is needed	191	62.7
Not sure	41	13.4
Have you ever attended a formal sun protection course, such as one offered by a school, university or medical facility?		
Yes, I learned about it in school/university	47	15.4
Yes, a healthcare professional educated me	57	18.7
No, I have never received formal education on this topic	201	65.9
Where should public awareness initiatives about sun protection take place, in your opinion? (Select all that apply)		
Schools and universities	25	8.2
Hospitals and clinics	4	2.3
Social media platforms (Instagram, TikTok, Twitter, etc.)	28	9.2
TV and radio advertisements	4	1.3
Shopping malls and public places	2	7
Others	239	78.3
Would you be in favor of laws mandating that sunscreen labels have more thorough usage guidelines and health precautions?		
Yes, this would help people use sunscreen correctly		
No, I don't think it's necessary	253	83.0
Not sure	24	7.9
Do you believe that greater public education regarding sun protection should come from dermatologists and other medical professionals?		
Yes, they should provide more guidance	242	79.3
No, awareness should come from other sources	23	10.5
Not sure	31	10.2
Would you use a mobile pp that offers individualized sun protection advice as well as daily UV index alerts?		
Yes, that would be helpful	177	58.0
No, I wouldn't use it	48	15.7
Maybe, if it is user-friendly	80	26.2
Would you take part in a nationwide initiative to encourage sun protection practices, like "Sunscreen Day"?		
Yes, I would support such initiatives	147	48.2
No, I am not interested	62	20.3
Maybe, if there were incentives (e.g., free sunscreen samples)	68	31.5

(58.0%) showed that mobile applications is helpful as it offers individualized sun protection advice as well as daily UV index alerts. Of the 305 participants a 147(48.2%) would support the nationwide initiative to encourage sun protection practices, like "Sunscreen Day" and 68(31.5%) participants reported that their support for this initiative will be conditional upon providing free sunscreen samples.

The Differences in the Study's Variables According to Socio-Demography Characteristics

The major hypothesis is that there are statistically significant differences in the study's variables according to (Gender, Age, Education Level, occupation, region). Statistically significant differences in the study's variables according to the Gender are conducted used the Mann-Whitney test to variance analysis. Table 5 shows that the level of significance for the dimension (Sun Protection Practices) according to Gender is less than 0.05 (sig.<0.05), which mean that there's significant difference in the study sample's answers to these dimensions. While the remaining dimensions are greater than 0.05 (sig.>0.05), which mean that there's no significant difference in the study sample's answers to these dimensions according to Gender.

Significant differences in the study's variables according to Age is investigated using Kruskal-Wallis test to variance analysis and age. The results in Table 6 show that the level of significance between the dimension (Knowledge of Sun Exposure and Skin Health) and age categories is less than 0.05 (sig.<0.05), which mean that there's significant difference in the study sample's answers to these dimensions

Table 5: The Results of the Variance Analysis of the Study's Variables According to the Gender

Variables	Gender	N	Mean Rank	Mann-Whitney	Sig.	Comments
Knowledge of Sun Exposure and Skin Health	Female	275	151.19	3628.5	0.276	Not significant Sig.>0.05
	Male	30	169.55			
Sun Protection Practices	Female	275	144.48	1781.0	0.000	There is significant Sig.<0.05
	Male	30	231.13			
Barriers and Misconceptions	Female	274	150.03	3434.0	0.137	Not significant Sig.>0.05
	Male	30	175.03			
Recommendations and Awareness	Female	275	153.17	4078.0	0.919	Not significant Sig.>0.05

Table 6: The Result of the Variance Analysis of the Study's Variables According to Age

Variables	Age	N	Mean Rank	Kruskal-Wallis	Sig.	Comments
Knowledge of Sun Exposure and Skin Health	18 - 24	104	176.88	17.3300	0.002	There is significant Sig.<0.05
	25 - 34	71	147.17			
	35 - 44	64	126.66			
	45 - 54	47	134.82			
	55 and above	19	177.79			
Sun Protection Practices	18 - 24	104	160.21	1.531	0.821	Not significant Sig.>0.05
	25 - 34	71	152.07			
	35 - 44	64	143.24			
	45 - 54	47	150.84			
	55 and above	19	155.24			
Barriers and Misconceptions	18 - 24	104	145.30	5.433	0.246	Not significant Sig.>0.05
	25 - 34	70	142.25			
	35 - 44	64	154.62			
	45 - 54	47	169.37			
	55 and above	19	180.79			
Recommendations and Awareness	18 - 24	104	143.21	8.640	0.071	Not significant Sig.>0.05

Table 7: The Result of the Variance Analysis of the Study's Variables According to Education

Variables	Education level	N	Mean Rank	Kruskal-Wallis	Sig.	Comments
Knowledge of Sun Exposure and Skin Health	No formal education	6	240.08	21.85	0.000	There is significant Sig.<0.05
	Primary school	3	105.83			
	Secondary school	76	184.32			
	University degree	195	142.43			
	Postgraduate degree	25	125.00			
Sun Protection Practices	No formal education	6	223.25	6.57	0.161	Not significant Sig.>0.05
	Primary school	3	127.83			
	Secondary school	76	160.93			
	University degree	195	151.16			
	Postgraduate degree	25	129.36			
Barriers and Misconceptions	No formal education	6	81.58	9.84	0.043	There is significant Sig.<0.05
	Primary school	3	131.83			
	Secondary school	76	159.68			
	University degree	195	156.97			
	Postgraduate degree	24	113.71			
Recommendations and Awareness	No formal education	6	161.00	7.007	0.136	Not significant Sig.>0.05
	Primary school	3	195.00			
	Secondary school	76	161.72			
	University degree	195	153.97			
	Postgraduate degree	25	111.96			

according to Age. While the remaining dimensions are greater than 0.05 (sig.>0.05), which mean that there's no significant difference in the study sample's answers to these dimensions according to Age.

Statistically, significant differences in the study's variables according to education level, the Kruskal-Wallis test to variance analysis is used. Table 7 shows that the level of significance for the dimensions (Knowledge of Sun Exposure and Skin Health and Barriers and Misconceptions) is less than 0.05 (sig.<0.05), which mean that there's significant difference in the study sample's answers to these dimensions according to education level. While the remaining dimensions are greater than 0.05 (sig.>0.05), which mean that there's no significant difference in the study sample's answers to these dimensions according to education level.

Statistically significant differences in the study's variables according to occupation, the Kruskal-Wallis test to variance analysis is used. Table 8 shows that the level of significance for the dimension (Knowledge of Sun Exposure) is less than 0.05 (sig.<0.05), which mean that there's significant difference in the study sample's answers

Table 8: The Result of the Variance Analysis of the Study's Variables According to Occupation

Variables	Occupation	N	Mean Rank	Kruskal-Wallis	Sig.	Comments
Knowledge of Sun Exposure and Skin Health	Student	103	171.48	9.880	0.043	There is significant Sig.<0.05
	Healthcare professional	12	121.38			
	Office worker	76	133.55			
	Outdoor worker	27	154.07			
	Unemployed	87	152.15			
Sun Protection Practices	Student	103	153.95	0.445	0.979	Not significant Sig.>0.05
	Healthcare professional	12	143.17			
	Office worker	76	157.27			
	Outdoor worker	27	149.98			
	Unemployed	87	150.44			
Barriers and Misconceptions	Student	103	141.11	4.740	0.346	Not significant Sig.>0.05
	Healthcare professional	12	136.63			
	Office worker	76	167.54			
	Outdoor worker	27	151.98			
	Unemployed	87	155.23			
Recommendations and Awareness	Student	103	138.93	8.875	0.064	Not significant Sig.>0.05
	Healthcare professional	12	125.63			
	Office worker	76	161.45			
	Outdoor worker	27	138.06			
	Unemployed	87	170.69			

Table 9: The Result of the Variance Analysis of the Study's Variables According to Region

Variables	Region	N	Mean Rank	Kruskal-Wallis	Sig.	Comments
Knowledge of Sun Exposure and Skin Health	Central	188	153.81	3.695	0.449	Not significant Sig.>0.05
	Eastern	16	129.53			
	Western	29	174.93			
	Southern	14	160.82			
	Northern	58	144.01			
Sun Protection Practices	Central	188	158.76	9.734	0.045	There is significant Sig.<0.05
	Eastern	16	162.41			
	Western	29	168.59			
	Southern	14	164.57			
	Northern	58	121.14			
Barriers and Misconceptions	Central	188	156.23	6.812	0.146	Not significant Sig.>0.05
	Eastern	16	108.69			
	Western	29	166.57			
	Southern	14	122.00			
	Northern	58	155.44			
Recommendations and Awareness	Central	188	158.38	12.629	0.013	There is significant Sig.<0.05
	Eastern	16	82.31			
	Western	29	150.48			
	Southern	14	180.57			
	Northern	58	149.66			

Table 10: Spearman's Correlation Coefficient Among the Study Variables

Correlation Spearman's	Knowledge of Sun Exposure and Skin Health	Barriers and Misconceptions	Recommendations and Awareness
Knowledge of Sun Exposure and Skin Health	1	-	-
Barriers and Misconceptions	0.374**	1	-
Correlation Coefficient sig. (2 tiled)	0.000	0000	-
Recommendations and Awareness	0.349**	0.413**	1
Correlation Coefficient sig. (2 tiled)	0.000	0.000	-

**Correlation is significant at the 0.01 level

to these dimensions according to occupation. While the remaining dimensions are greater than 0.05 (sig.>0.05), which mean that there's no significant difference in the study sample's answers to these dimensions according to occupation.

The Kruskal-Wallis test to variance analysis shows that the level of significance for the dimensions (Sun Protection Practices and Recommendations and Awareness) is less than 0.05 (sig.<0.05), which mean that there's significant difference in the study sample's answers to these dimensions according to region. While the remaining dimensions are greater than 0.05 (sig.>0.05), which mean that there's no significant difference in the study sample's answers to these dimensions according to region (Table 9).

Correlation Coefficient Among the Participant's Responses to Questions of the Three Studied Variables

The Table 10 showed the correlation spearman, among the knowledge of sun exposure and skin health, barriers and misconceptions and recommendations and awareness variables. Significant positive correlation was recorded between knowledge of sun exposure and skin health and

barriers and misconceptions variables ($r = 0.374$) at $p<0.01$. Also between knowledge of sun exposure and skin health, barriers and misconceptions and recommendations and awareness variables at $p<0.01$ ($r = 0.349$). Also, significant correlation at $p<0.01$ ($r = 0.413$) between barriers and misconceptions and recommendations and awareness variables.

DISCUSSION

Stressors such as solar ultraviolet radiation (UVR) can affect skin health [15,16] Among these risk factors, skin damage induced by solar UVR is an escalating problem in dermatology, along with an increased incidence of skin cancer, especially non-melanoma skin cancer [15].

Knowledge, wright concepts, attitudes and practices to sun exposure risks reveal important insights about public awareness and behaviors to skin health, include skincare various practices. Skin problems significantly effect on individuals' health [17], especially in older adults, as the skin structural changes [18]. The most essential functions of the skin are maintenance of water, electrolytes and protein retention [19], acting as a barrier from external environment to internal tissues [20,21], sweat and vitamin D excretion, absorbing the beneficial dose of UV, regulating temperature and autonomic/immunologic actions.

This study evaluated the knowledge, misconcepts, practices and awareness of participants from Saudi Arabia to sun exposure risk. The results of the participated sample show that these populations need to be done to provide more education individuals within these population groups that should aid to improve their knowledge, correct the misconcepts, behavior towards skincare and encourage them to follow wright practices that will offer them opportunities for healthier lives.

Five hundred questionnaires were sent electronically to 500 individuals, with the target of 384 responses. The results showed that 305(61%) individuals responded. Therefore, the study didn't achieved a response rate. This may be due to the lack of interest of a large part (49%) of the sample.

The Participants' sociodemographic characters indicated that the most respondents are female which 1.5 duplicate is more than that recorded in Jazan area [21]. This result may be indicated a bias or may be they are the most interested for skin healthcare. In addition, the majority of respondents were young adults (78.3%) with a high level of education (97.0%), primarily living in the central region of Saudi Arabia, which is an area with higher socioeconomic status and education. The present data indicated a bias to these categories, also indicated that these data is normal for these categories (paraphrased).

In terms of the knowledge, most of participants well know the adverse effect of exposure to sunlight on skin pigmentation issues, primary consequences of prolonged exposure to sunlight ranging from skin darkening or pigmentation, sunburn, premature aging and vitamin D deficiency. This knowledge promotes the most respondents to use sunscreen SPF 50 and different sun protection techniques outside. Social media and healthcare professionals represented the main knowledge for sun protection. High percentages of these sources may be due to the high percentage of those have skin disease. In addition, most of the participants have information to select and buy appropriate sunscreen. Most of the participants believe that it should be combined sunscreens with other protective measures and believe that sunscreen reduces but does not eliminate risks. In spite of participants good knowledge high percentage of them forgets to apply sunscreens. Results of this study are in consistent with the findings of study. The Good knowledge of the most participants about skin sun exposure risks influence on using skin protection and this indicating high awareness for the current issue. In addition it indicated a gap between knowledge and application (paraphrased).

Regarding to barriers and misconcepts, most of most the participants have wright concepts. Where most of them believed that lighter and darker skins need sun protection, UV rays penetrate windows and shade, so most of them prefer applying sunscreen regularly as they can still get enough Vitamin D. Also, most of respondents prefer using sun screen than tanning and think that tanning increases sun risks. Dermatologists recommendations and public awareness campaigns are important factors motivate most participants to apply sun screen protections (paraphrased).

Protective measures, such as limiting outdoor activities during peak UV hours, seeking shade, wearing suitable hats and clothing and sunglasses and using sunscreen, play a crucial role in preventing and saving the skin against disorders [22,23]. Practices related to sun exposure protection varied widely from region to region and country to others, with 57.7 of the total participants is always use sunscreen is higher than the findings from a previous study in Gazan (KSA) and Peru [21,24]. This variation could be attributed to differences in socioeconomic status and level of education among the participants. Concerning proper sunscreen application, 225(73.8%) recognized that the lighter as darker-skinned peoples need to apply sunscreen repeatedly every day for and the maximum time for exposure is 10-30 minutes. These results highlight a noticeable variation between knowledge behaviors. In spite of knowing the risks of sun exposure, many participants reported inconsistent sun protection practices. This suggests a potential gap between awareness and actual application of preventive measures.

The current study also indicates that sciodemographic characteristics such as gender, age, level of education, occupation and place of residence have a significant impact on knowledge level and the awareness of participants.

There is a positive correlation between knowledge of harmful of sun exposure on skin and misconcepts and behavior toward skin protection and awareness, also, positive correlation was between behavior toward skin protection and awareness. Public education from dermatologists and finally, most of participants agreed that to be a part of a nationwide initiative to encourage sun protection practice.

In contrast to study, the current results indicate that low gap between knowledge, skin protection and awareness. This conclusion is supported by that the most of participants need to raised there awareness through different strategies. In addition, the willingness of most participants to take part in a nationwide initiative to encourage sun protection practices.

The positive significant correlation showed low gap between knowledge, skin protection and awareness may be due to the bios to category of the study sample, where 90% of participants are females, youngest ages, belonging to university degree and students.

Therefore, the sample should include approximately equal counts of people from different segments of society to clearly demonstrate the gap between the knowledge about the harmful of sun exposure and the behaviors related the use of different sunscreen methods. This will also reveal the extent to which knowledge and use of sunscreen affect awareness.

CONCLUSIONS

The current study showed that most participants have good knowledge about the risks of sun exposure on the skin and understand the importance of using sunscreen and other protective measures. The results also showed a positive correlation between knowledge and correct perceptions about sun exposure risks and sun protection behaviors. However, there is a need for further awareness and education to enhance knowledge and correct perceptions about sun exposure risks and sun protection behaviors among different segments of society. Especially, since there is a low gap between knowledge and actual sun protection behaviors, which requires ongoing efforts to promote awareness and adherence to sun protection behaviors. Further studies are needed with a large sample distributed along the KSA without bias to gender, age, education level, occupation and region.

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