

Assessment of Knowledge, Attitude, and Practice towards Sunscreen Preparations among Female University Students in Bangladesh: A Cross-Sectional Study

Madhabi Lata Shuma¹, Maruf Ahmed Hridoy², Shimul Halder^{3*}

¹Department of Pharmacy, Independent University, Dhaka, Bangladesh; ²Department of Pharmacy, University of Dhaka, Dhaka, Bangladesh; ³Department of Pharmaceutical Technology, University of Dhaka, Dhaka, Bangladesh

ABSTRACT

Background: UV exposure from the sun increases the risk of skin cancer in young individuals. Sunscreen reduces skin cancer risk and delays sun-induced aging.

Purpose: To assess Bangladeshi female university student's knowledge, attitudes, and behaviors about sun exposure and protection from the sun.

Materials and methods: This descriptive cross-sectional study includes 302 Bangladeshi female university students. An online pretested questionnaire created with Google Forms was used in the study.

Results: Out of the sample, 283 individuals, representing 93.7% of the total, were identified as sunscreen users. The study utilized multiple logistic regressions to examine the association between sunscreen usage and other sociodemographic factors. According to our investigation, the main reasons for using sunscreen were to reduce the risk of sunburn, prevent skin darkening, address uneven skin pigmentation, and prevent the creation of wrinkles. 78% of participants used sunscreen with an SPF higher than 15. The main reasons for not using sunscreen were lack of concern, time-consuming application, high expense, inefficacy, adverse reactions, and unpleasant texture. The study found that price, brand recognition, SPF rating, media coverage, packaging, endorsements, reduced thickness, water resistance, aroma, and additional sun protection methods affected sunscreen use. Common side effects include acne, skin sensitivity, inflammation, skin color loss, and folliculitis with pus-like discharge. Multiple sunscreen application errors must be found. Sunscreen knowledge may assist our community.

Conclusion: Overall, female university students had good knowledge, attitudes, and practice. However, ongoing awareness can encourage sunscreen use in the future.

Keywords: Sunscreen; Female adolescents; Knowledge; Attitude; Practice; Sun exposure

INTRODUCTION

Significant biological transformations in the physical appearance of the body characterize female adolescence [1]. The skin of adolescents experiences substantial physiological changes due to hormone production. These modifications impact the generation of sebaceous content, sebum, sweat, secondary sex hair growth, and body odor. Most adolescents are preoccupied

with the look of their skin, leading them to establish individualized strategies and routines for skin care [2]. Aside from aesthetic concerns, maintaining proper skin hygiene is important. Adolescents should be educated on the fundamental aspects of proper skincare. However, there is currently no universally agreed-upon set of guidelines for the daily skincare practice of healthy adolescents. Female adolescents are frequently exposed to sunlight throughout their daily routines. While sunshine does

Correspondence to: Shimul Halder, Department of Pharmaceutical Technology, University of Dhaka, Dhaka, Bangladesh, E-mail: shimulpht@du.ac.bd

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have health benefits for the body, excessive and unprotected exposure to sunlight can be linked to the onset of skin cancer [3].

The consequences of sun exposure are double, as it serves as the primary means of obtaining vitamin D while posing a significant danger of developing skin cancer [3]. There are two distinct forms of skin cancer. Malignant melanoma is a rare kind of skin cancer, but Non-Melanoma Skin Cancer (NMSC) is more common [4]. Squamous and basal cell carcinomas are the two most common kinds of NMSC [5]. In 2020, Bangladesh recorded 853 skin cancer fatalities, which accounted for 0.12% of total deaths, according to the latest data from the World Health Organization (WHO) [6]. Bangladesh is positioned at the 153rd rank globally based on the age-adjusted death rate, which stands at 0.68 per 100,000 individuals [7]. The primary factor responsible for developing skin cancer is Ultraviolet Radiation (UVR) emitted by the sun. Caucasian individuals possess a greater susceptibility to the development of skin cancer as a result of their heightened sensitivity to UVR exposure [8]. Although those with dark skin have a lower incidence of skin cancer, their prognosis is worse since the malignancies tend to be diagnosed at a later stage. UVR can cause substantial harm to the eyes, leading to the development of cataracts. UVB and UVA are the two therapeutically significant forms of UV. UVB (290-320 nm) is the primary wavelength responsible for sunburn, which directly damages cellular DNA by creating dimers of the 6-4 cyclobutane pyrimidine [9,10]. UVA, with a wavelength range of 320-400 nm, has lower energy than UVB. However, it can penetrate skin tissue more deeply. UVA interacts with both naturally occurring and externally introduced photosensitizers, producing Reactive Oxygen Species (ROS). UVR exerts its effects by directly impairing the DNA structure, resulting in genetic changes that affect the genes responsible for DNA repair, oxidative stress, and inflammation. Applying sunscreen can decrease the likelihood of acquiring melanoma and NMSC [11].

Numerous techniques are available to shield the skin from the detrimental impacts of UV radiation. Applying sunscreen is one of the effective strategies. Studies have revealed that sunscreen preparation substantially inhibits melanoma and non-melanoma skin cancer development [8]. Sunscreens enhance the skin's ability to withstand UV radiation by reflecting, absorbing, and dispersing these rays. An SPF 15 sunscreen effectively filters off around 93.3% of Ultraviolet Rays (UVR) from entering the outermost layer of the skin, known as the epidermis [12]. The Food and Drug Administration has authorized the utilization of sunscreens to prevent sunburn, photoinduced pigmentation, aging, and cancer. Only individuals who are chemically sensitive or younger than six months old should refrain from applying sunscreen. The fundamental guidelines for optimal sun protection encompass seeking shade, minimizing sunburns, abstaining from tanning beds, and utilizing wide-brimmed hats, protective clothing, and sunglasses [13].

Numerous global studies have been undertaken on sunscreen knowledge and usage, focusing on Australia and the USA. To our knowledge, no such study has been conducted in Bangladesh to assess the awareness and utilization of sunscreen among adolescents. Several variables, including the lotion's

expense and stickiness, hinder sunscreen's optimal utilization. A multitude of individuals employ other techniques of sun protection. There are sunscreen formulations such as gels, sprays, and lip balms that are less oily and sticky. However, many people who attend school, college, university, or work are unaware of this. There is a lack of precise information regarding the knowledge and practices of skin care among teenagers in Bangladesh. Additionally, there is no current data on where Bangladeshi female adolescents obtain skincare information. Therefore, this study aimed to assess the level of understanding, attitude, and consistent habits regarding sunscreen preparations among adolescents in Bangladesh.

MATERIALS AND METHODS

Study design and sample size

An online survey was conducted among female adolescents at the university level in Bangladesh utilizing convenient sampling procedures. A meticulously crafted questionnaire was created via Google Forms and disseminated to participants through various social media platforms such as Facebook, WhatsApp, and others. The sample size was determined using a formula for a single population proportion, assuming a 95% confidence interval and a 5% margin of error. It was believed that there is a 50% probability of having inadequate knowledge, attitude, and practices regarding sunscreen preparations in Bangladesh. Based on the assumptions above, a minimum sample size of 300 was necessary. We hypothesized that the response rate for this online survey would be 30%. Thus, we initially sent invitations to 1,000 prospective respondents.

Nevertheless, we received feedback from 320 individuals, but we disregarded 18 comments because they contained insufficient or unfinished details. Ultimately, we incorporated a total of 302 responses for the conclusive study. We demonstrated a comprehensive algorithm illustrating the sample selection, enrollment, and filtration process, as depicted in Figure 1.

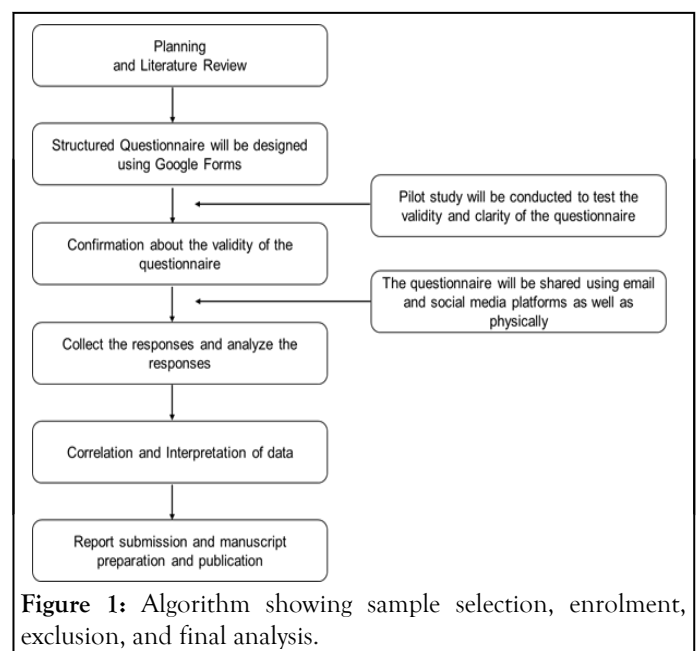


Figure 1: Algorithm showing sample selection, enrolment, exclusion, and final analysis.

Questionnaire design and measure

To fulfill our study objective, we developed the questionnaire in English using Google Forms. A pilot research was undertaken with a sample size of 20 participants to assess the questionnaire's validity and the clarity of its language. The Cronbach's alpha coefficient for the questionnaire in the pilot study was 0.78, indicating a satisfactory level of internal consistency. The questionnaire comprised two sections of inquiries. The initial segment gathered the sociodemographic information of the participants. The second phase included multiple questions that evaluated the understanding of sunscreen formulations.

Participants eligibility criteria

This study exclusively comprised respondents who were easily accessible for data collection and willing to participate. The selected participants were not persuaded to participate.

Sampling and sample size

A stratified random sampling technique was employed to pick participants from different academic levels, including both undergraduate and graduate students. The sample size was determined using the single proportion formula without applying the correction for continuity. It was computed as $n = Z^2 \times p(1-p)/d^2$ [14]. The total sample size (n) was determined based on the following assumptions: The proportion (P) was assumed

to be 0.5 (a commonly used random value representing the percentage of people choosing a specific option), the Z statistic for a 95% confidence level was set at 1.96, and the desired degree of precision (d) in the proportion was set at 0.05.

Statistical analysis

GraphPad Prism 8.0 (GraphPad Software, La Jolla, CA) was used to make the plots. All the data were looked at using SPSS software (version 23.0), and descriptive statistics were used for the statistical analysis. The Chi-square test was used to look at the link between the different demographic factors and the distribution patterns when it was needed. A p-value less than 0.05 is thought to be significant.

RESULTS

There were 320 participants in all. It was found that 302 participants responded to the survey questionnaire positively, with a response rate of 94.4%. Compared to single female participants, married female participants were 1.8 times more likely to use sunscreen (OR 1.80, p value=0.413) (Table 1). There is no connection between using sunscreen and having skin disorders. According to data, the middle, higher, and lower classes use sunscreen at significantly different rates. Participants from the upper middle class and middle class were much more likely to apply sunscreen than those from the lower middle class by a factor of about 28.2 and 18.2, respectively.

Variable	Characteristics	Univariate analysis		Multivariate analysis		
		Never used sunscreen (n, %)	Sunscreen users (n, %)	OR	95% CI	p value
Participants		19 (6.3%)	283 (93.7%)	NA	NA	NA
Area of residence	Hostels/Halls	9 (13.6%)	57 (86.4%)	1		
	Mess	3 (6.1%)	46 (93.9%)	2.4	0.51-11.32	0.27
	With family members	7 (3.7%)	180 (96.3%)	5.3	1.34-21.07	0.02
Socio economic status	Upper lower	2 (66.7%)	1 (33.3%)	1		
	Lower middle	3 (60.0%)	2 (40.0%)	1.2	0.05-29.56	0.93
	Middle	11 (4.7%)	221 (95.3%)	18.2	1.42-234.13	0.03
	Upper middle	1 (2.8%)	35 (97.2%)	28.2	1.15-694.41	0.04
Marital status	Single	14 (6.4%)	204 (93.6%)	1		
	Married	4 (5.0%)	76 (95.0%)	1.8	0.44-7.41	0.41
Having other skin disease	No	13 (5.1%)	240 (94.9%)	1		
	Yes	6 (12.2%)	43 (87.8%)	0.884	0.21-3.73	0.88

Table 1: Sociodemographic characteristics of the participants.

Table 2, compiles information on sunscreen use. In the summer, almost half of the participants use sunscreen. Approximately 44.9% of participants enjoy wearing sunscreen all year round. Approximately 69.3% of individuals only apply sunscreen on their faces. The usage of sunscreen on the hands and face is practiced by roughly 24.4% of participants. Only 6.4% of participants use sunscreen everywhere they are exposed.

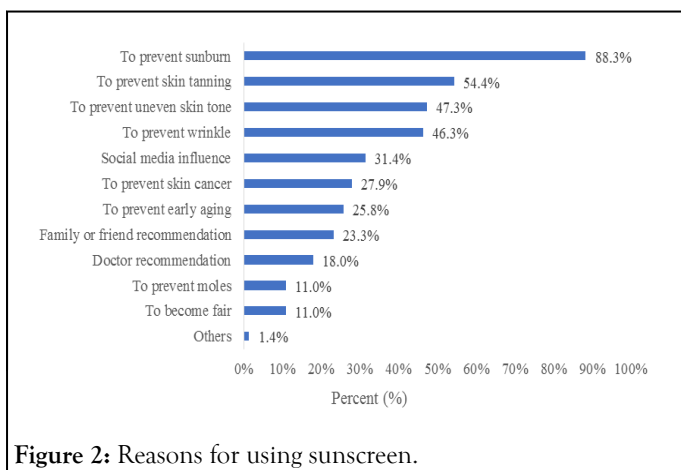
Approximately 45.9% of participants use sunscreen 10 to 20 minutes before going outside. About 63.5% of participants didn't reapply for sunscreen. 47.7% of participants said they use sunscreen daily. 61.1% of participants use a broad-spectrum sunscreen, which shields against ultraviolet A and ultraviolet B rays. Most students (58%) only consume one unit monthly (Table 2).

Variables		n	%
Season	Summer	153	54.10%
	Rainy	7	2.50%
	Autumn	10	3.50%
	Late autumn	9	3.20%
	Winter	34	12.00%
	Spring	19	6.70%
	Throughout the year	127	44.90%
Body site	Face only	196	69.30%
	Face and hands	69	24.40%
	All exposed skin areas	18	6.40%
Time of application	<10 minutes before going out	111	39.20%
	10-20 minutes before going out	130	45.90%
	>20 minutes before going out	42	14.80%
Sunscreen reapplication	Do not reapply	179	63.50%
	After taking a shower	43	15.20%
	After swimming	5	1.80%
	After excessive sweating	35	12.40%
	Every 2-3 hours	20	7.10%
Frequency of using sunscreen	Every day	135	47.70%
	Not every day but at least 2-3 times a week	111	39.20%
	Every week but <2-3 times	22	7.80%
	Less frequent than once a week	15	5.30%
Sun Protection Factor (SPF)	<10	2	0.70%
	10-30	26	9.20%
	31-50	132	46.60%

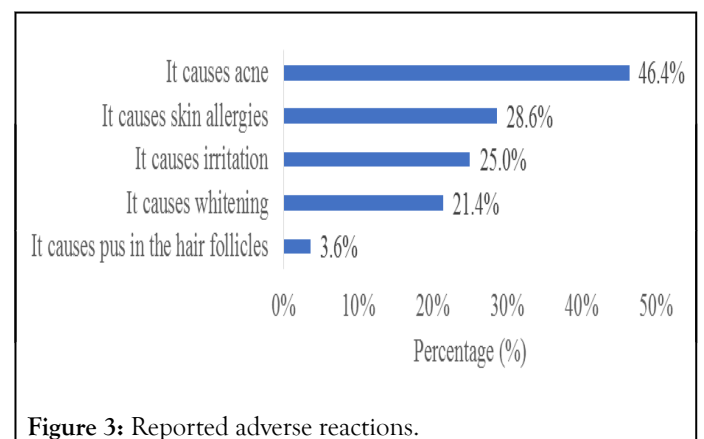
	>50	89	31.40%
	Do not know	34	12.00%
Broad-spectrum sunscreen	Yes	173	61.10%
	No	5	1.80%
	Do not know	105	37.10%
Number of bottles/tubes per month	Less than one	113	39.90%
	One	164	58.00%
	Two	4	1.40%
	Three	2	0.70%
Dosage form of sunscreen	Lotion	83	29.40%
	Ointment	5	1.80%
	Spray	22	7.80%
	Cream	247	87.60%
	Liquid	46	16.30%
	Gel/jelly	20	7.10%
	Do not know	5	1.80%
Side effect	No	255	90.10%
	Yes	28	9.90%

Table 2: Details of various characteristics related to sunscreen usage among participants.

Students use sunscreen mainly to prevent sunburn (88.3%), skin tanning (54.4%), uneven skin tone (47.3%), and wrinkles (46.3%) (Figure 2). Other causes for applying sunscreen include social media influence (31.4%), to prevent skin cancer (27.9%), to delay the onset of aging (25.8%), family or friend recommendations (23.3%), doctor recommendations (18%), to avoid moles (11%) and to become fairer (1.4%) (Figure 2).



About 28 (9.9%) individuals reported experiencing adverse effects (Figure 3). Acne is the main side effect (46.4%). In our study, factors that affected the use of sunscreen included price (62.2%), brand reputation (61.1%), SPF value (49.5%), media presence (48.4%), packaging (41.3%), recommendation (40.3%), less stickiness (39.6%), water resistance (13.1%), odor (1.8%), and others (2.8%), such as the use of other sun protection techniques (Figure 4).



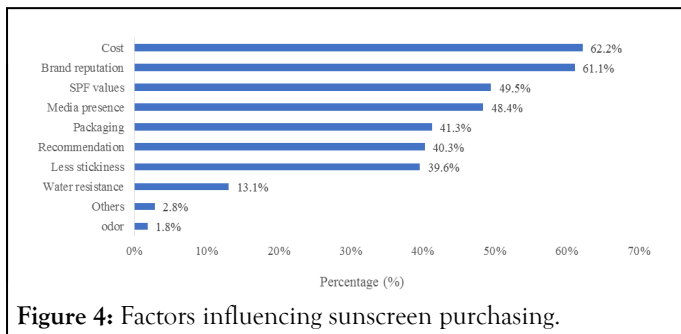


Figure 4: Factors influencing sunscreen purchasing.

The top six reasons given for not using sunscreen were never really thought about it (57.9%), time-consuming (36.8%), expensive (31.6%), lack of effectiveness (21.1%), adverse effects (15.8%), and sticky properties (5.3%). 15.8% of people utilize additional sun protection measures (Figure 5).

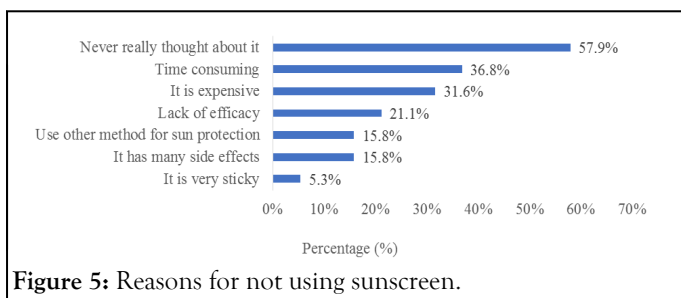


Figure 5: Reasons for not using sunscreen.

87.3% of participants said sunscreen provides some level of UV protection. A large proportion of respondents (80.2%) said sunscreen offers some protection against sunburn. 74.2% of participants believed sunscreen provides some level of UV protection. 55.8% of participants said that sunscreen offers some defense against skin darkening. An estimated 35.3% of participants claimed that sunscreen provides some degree of protection against skin cancer. Following 28.3% of the participants, sunscreen offers some protection against premature aging. 25.8% of the participants said that sunscreen helps prevent wrinkles in some way. 14.8% of respondents claimed that sunscreen lightens skin (Figure 6).

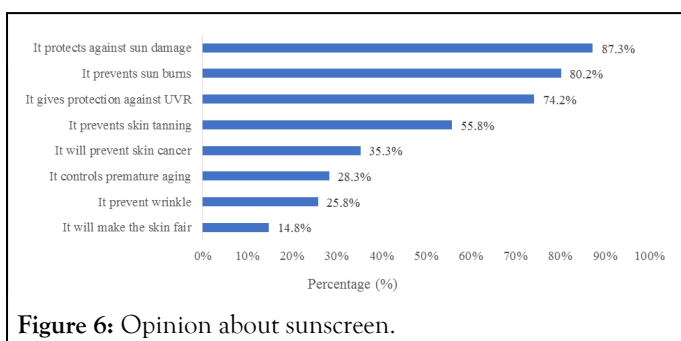


Figure 6: Opinion about sunscreen.

Information about public perceptions of the dangers of sun exposure is compiled in Figure 7. According to 82.1% of participants, skin darkening from the sunscreen might occur. According to 58.6% of participants, overexposure to the sun may cause melasma. 47% of the participants said that sun exposure could lead to wrinkles. The belief that too much sun exposure can cause cancer was expressed by 45.7% of participants. According to 44.7 % of survey participants, sun exposure can cause allergies. 6% of respondents are ignorant of the dangers of exposure to sunscreen.

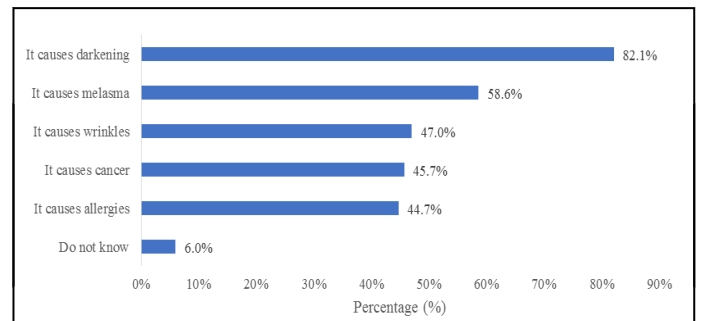


Figure 7: Knowledge on potential harms regarding sun exposure.

DISCUSSION

In addition to skin cancer, exposure to UVR from the sun can result in some other diseases, such as skin cell damage, suntan and sunburn, freckles, wrinkles, and skin moles [15]. These conditions can be avoided or reduced by increasing awareness, knowledge, and positive attitudes. Applying sunscreen is a crucial component of sun protection. We evaluated the use of sunscreen among an adequate number of female university students in Bangladesh. Almost 93.7% of the students use sunscreen. There have been several studies about sunscreen knowledge and use conducted all around the world. However, in Bangladesh, no study has been done regarding the knowledge and usage of sunscreen. About 35% of students in a Saudi university reported wearing sunscreen [16]. In a study of students at primary and secondary schools in Switzerland, 69% of students stated using sunscreen [17]. According to Brazilian research, 63% of people use sunscreen [18].

In contrast to research done in other nations, including Brazil, Switzerland, Saudi Arabia, and our study found that sunscreen use is far more common among Bangladeshi female students. Students may use sunscreen more frequently since they are younger and more knowledgeable. The greater use of sunscreen among our university students can be linked to the fact that individuals from other nations might use different sun protection techniques, such as wearing hats, staying in the shade, wearing sunglasses with long sleeves, wearing clothes that are significant to Saudi culture (such as the shemagh and niqab) [19]. Climate change and a lack of other sun protection methods may also be responsible for the greater incidence of sunscreen use among our university students [20]. Another reason to apply sunscreen is due to doctor recommendations.

Reasons associated with sunscreen use in our study were to prevent sunburn, skin tanning, uneven skin tone, wrinkles, social media influence, to prevent skin cancer, to delay the onset of aging, family or friend recommendations, doctor recommendations, to avoid moles and to become fairer. We found a link between socioeconomic level and sunscreen use. According to our research, people from higher social classes use sunscreen more frequently. Sunscreen use is typically correlated with education, the number of people living in the same home, and income relative to expenses. In our study, factors that influenced sunscreen usage included price, brand reputation, SPF value, media presence, packaging, recommendation, less stickiness, water resistance, odor, and other things like using other sun protection methods. The most important factors that

influence sunscreen use are cost and brand reputation. Consumers are also interested in the SPF rating of sunscreen. Participants prefer using sunscreen that is less sticky.

In the summer, almost half of the participants wear sunscreen. And about 44.9% enjoy applying sunscreen all year round. However, most apply sunscreen only on sunny days and mainly in summer. Studies have revealed that sunscreen should be used even on cloudy days since UV radiation levels are still high in the rainy and winter seasons [11]. UVA and UVB are the two types of UV rays from the sun that reach the earth. Both of these can injure skin if exposed over an extended period. A good sunscreen should provide broad-spectrum UVA and UVB protection. 37.1% of participants were unsure whether they were using broad-spectrum sunscreen in our study. 61.1% of participants use a broad-spectrum sunscreen, which shields against ultraviolet A and ultraviolet B rays [21]. In our study, most students (46.6%) use an SPF of 30 to 50. The current recommendation is to use sunscreen with an SPF of at least 30 [22].

Sunscreens were applied mainly to the face of our study population. Approximately 69.3% of individuals only apply sunscreen on their faces. Most participants applied sunscreen on their faces primarily to avoid premature aging and skin darkening. Only 6.4% of participants used sunscreen on every exposed body part to stop darkening. 39.2% of participants apply sunscreen fewer than 10 minutes before going outside. 14.8% of participants apply sunscreen 20 minutes or more before going outside. For most participants, 45.9% apply sunscreen 10 to 20 minutes before going outside. The current advice is to use it for 15 to 30 minutes before going outside in the sun [22]. About one to two tablespoons of sunscreen is considered adequate to cover the face and neck [23].

Participants didn't reapply sunscreen in roughly 63.5% of cases. After showering, 15.2% of participants use sunscreen. 1.8% of participants reapply for sunscreen following a swim. After severe sweat, 12.4% of participants use sunscreen. Every two to three hours, 7.1% of participants reapplied sunscreen. In our study, the majority of students rarely reapply sunscreen. Since they are students, they don't have enough time to reapply. It is necessary to reapply sunscreen every two hours after swimming or if you sweat a lot [23]. 47.7% of participants apply sunscreen daily. 39.2% of the participants reported using sunscreen at least twice or three times per week. In our study, the majority of students apply sunscreen every day. Most students (58%) only consume one bottle monthly, and 39.9% of participants consume less than one bottle. Cream was the most widely used type of sunscreen (87.65%), among the several used types. There were also sunscreen formulas in the following forms: Lotion, ointment, liquid, gel/jell, spray, and stick. They favor using cream since 69.3% of people only use sunscreen on their faces. About 9.9% of participants said that they had adverse symptoms. The most common adverse effect is acne (46.4%). In addition, skin allergies, irritation and whitening, and pus in the hair follicles are other typical side effects.

Sunscreen avoidance has been reported for various reasons, including never giving it much thought, time-consuming, costly, unfavorable consequences, and sticky qualities. 15.8% of people

use extra sun protection precautions. Additional sun protection measures must be used. UV-blocking textiles can significantly lower the hazards of sunlight, especially for apparel designed and marketed as UV-protective clothing [24].

82.1% of the participants thought skin darkening from sun exposure was possible. 58.6% of participants said sun exposure might cause melasma. According to 47% of the participants, exposure to the sun can lead to wrinkles. According to 45.7% of participants, getting too much sun can cause cancer. 44.7% of the participants believed that exposure to the sun could cause allergies. 6% of people are ignorant of the dangers of sun exposure. Many people today are still unaware of the risks of prolonged sun exposure. To change one's approach, knowledge alone is insufficient, thus, perhaps further learning is required. Behaviorally oriented-intervention techniques are preferred to modify attitudes and behaviors. Childhood is the best time when preventative behaviors are most adaptable for life. Schools are the ideal setting because they already have the necessary infrastructure to assist kids in developing healthy behaviors. Sun protection perceptions and concepts can be incorporated into already-existing subjects and study programs, such as science, home economics, health, and physical education [25].

In our study 87.3% of participants said sunscreen provides some UV protection. Per 80.2% of survey respondents, sunscreen offers some protection against sunburn. 74.2% said sunscreen provides some level of UV protection. By reflecting, absorbing, or scattering UV radiation, sunscreens lessen its penetration into the skin [11]. Married female participants were 1.8 times more likely to apply sunscreen than single female participants. Participants who lived in houses with family used sunscreen more frequently.

There were certain restrictions. Only the educated Bangladeshi population participated in the study. Due to the study's metropolitan setting, no comparisons between the urban and rural populations could be drawn. The absence of real-world evaluations of sunscreen use is another drawback. This might cause study participants to have some recollection bias. Another restriction is that we only conducted content validation and pilot testing for the questionnaire we utilized in our study.

Despite this, more than 93% of respondents said they regularly apply sunscreen. A little more than 13% of the participants had a personal or family history of skin cancer. These demographics lead us to conclude that our subjects should be more motivated and knowledgeable. The survey results show that there is still considerable work to be done to inform the public about sunscreen nomenclature and correct application, even among this highly motivated population.

CONCLUSION

We discovered that 93.7% of the participants in the study use sunscreen. Reasons associated with sunscreen use in our study were to prevent sunburn, skin tanning, uneven skin tone, wrinkles, social media influence, to prevent skin cancer, to delay the onset of aging, family or friend recommendations, and doctor recommendations, to avoid moles and to become fairer. In our study, Price, brand reputation, SPF value, media

presence, packaging, recommendation, less stickiness, water resistance, odor, and other characteristics were among those that affected how often participants used sunscreen. Sunscreen with a Sun Protection Factor (SPF) >30 was used in 78% of students. We have found several cases of incorrect sunscreen use. This finding emphasizes the need for further study and future health education campaigns to raise public awareness of sunlight's damaging effects on the skin and promote the significance of sunscreen use. Our community needs to become more aware of the benefits of using sunscreen.

STUDY LIMITATIONS

There are certain constraints in this study. Initially, this survey was conducted exclusively among teenagers in a few educational institutions in Bangladesh. Consequently, our findings may not apply to adolescents residing in different regions of the country. Furthermore, the data utilized in this study were acquired through self-report a questionnaire which implies that the data we gathered may not accurately represent actual skincare knowledge and practice. These constraints indicate potential areas for future investigation. Additional research should be planned and executed to incorporate variables not considered in the current study. These variables include:

- A more extensive sample size from a more significant number of institutions
- The inclusion of adolescents from both urban and rural regions
- The enrollment of students from both private and public schools
- The recruitment of teenagers from both high and low-income backgrounds

ETHICAL CONSIDERATIONS

Since this study is anonymous and involved no danger to participants, review board approval was not necessary. On the other hand, each participant in the survey gave their informed consent.

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CONFLICT OF INTEREST

The authors affirm that they have no personal or professional conflicts of interest pertaining to this work.

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