

## Sun Exposure Habits and Their Impact on Skin Aging: A Cross Sectional Study

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### Abstract

**Background:** Sun exposure is essential for Vitamin D synthesis but is also a major contributor to skin aging, leading to photo aging through the degradation of collagen, loss of skin elasticity, and the formation of wrinkles, pigmentation, and sagging. Understanding sun exposure habits and their relationship with visible signs of skin aging is crucial for developing effective preventive measures.

**Objectives:** This study aims to evaluate the sun exposure habits of individuals and their correlation with visible signs of skin aging, specifically focusing on wrinkles, pigmentation, and sagging. The goal is to understand the impact of daily sun exposure and protective behaviors on skin health.

**Methods:** A cross-sectional study was conducted with 100 participants. Data were collected using Electronic Medical Records (EMR) to assess participants' sun exposure habits (including duration, time of day, and use of protective measures). A clinical dermatological assessment was performed to identify visible signs of aging, such as wrinkles, pigmentation, and sagging.

**Results:** The study revealed a significant correlation between sun exposure duration and the presence of visible aging signs. Among participants with <30 minutes of daily sun exposure, the prevalence of wrinkles, pigmentation, and sagging was 10%, 15%, and 5%, respectively. However, those with >2 hours of daily sun exposure exhibited 80% wrinkles, 85% pigmentation, and 75% sagging. Regular sunscreens use significantly reduced the prevalence of pigmentation ( $p = 0.03$ ) and wrinkles ( $p = 0.04$ ), while protective clothing was associated with reduced aging signs ( $p = 0.02$ ). Midday exposure (10 AM – 3 PM) was strongly linked to severe skin aging.

**Conclusion:** The findings confirm that excessive sun exposure contributes to visible skin aging, while protective measures can help mitigate these effects. These results underscore the importance of sun safety in preventing premature skin aging.

**Keywords:** Aging, Photoaging, Protective Measures, Skin Aging, Sun Exposure, Sunscreen, UV Radiation.

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### Introduction

Sunlight has both positive and harmful health effects. One of its biggest benefits is vitamin D production, which is essential for immune system, calcium metabolism, and bone health [1]. When the skin absorbs UVB rays from the sun, a biochemical chain reaction produces vitamin D. Vitamin D helps regulate the immune system, maintain cardiovascular health, and prevent rickets and osteoporosis [2]. However, excessive sun exposure may damage skin, especially photoaging. Long-term UV exposure causes photoaging. Photoaging, unlike intrinsic aging, is caused by sun exposure rather than genes and metabolism [3]. VA and

UVB rays, the two main types of ultraviolet radiation, accelerate skin aging in different ways. UVA radiation (320-400 nm) penetrate the dermis and produce oxidative stress, collagen breakdown, and elastin degradation, causing skin sagging, wrinkles, and elasticity loss [4].

Melanocyte activation causes age spots and hyperpigmentation under UVA. The epidermis receives 290–320 nm ultraviolet B photons, which cause sunburn, DNA damage, and direct cellular mutations, which increase skin cancer risk [5]. Over time, chronic UV exposure leads to visible

and structural changes in the skin, including: Wrinkles and Fine Lines – Due to collagen and elastin degradation. Hyperpigmentation and Age Spots – Uneven skin tone resulting from melanin overproduction [6]. Loss of Skin Elasticity – Thinning of the dermis and damage to the extracellular matrix. Telangiectasia (Spider Veins) – Dilatation of small blood vessels, often seen in sun-damaged skin [7]. Elastosis – Accumulation of abnormal elastic fibers, leading to rough, leathery skin texture.

Gene-driven intrinsic aging is slower than photoaging. Intrinsic aging causes collagen degradation, skin turnover, and moisture loss, resulting in dryness, fine creases, and sagging skin. Extrinsic aging, usually induced by pollution and sun exposure, accelerates these changes and worsens skin damage. Research suggests that cumulative UV exposure causes up to 80% of facial aging, making sun protection essential [8]. Due to extensive solar exposure, public health and dermatological care practitioners must understand how sunlight ages skin. Even though more individuals are aware of the dangers of sun exposure, they nevertheless go outside for long periods without sunscreen, apply sunscreen inconsistently, and tan often. These behaviors increase the risk of melanoma, basal cell carcinoma, and squamous cell carcinoma, as well as premature skin aging [9]. Sun exposure behaviors must be examined because photoaging and UV-induced skin damage are becoming increasingly widespread worldwide. Due to increased longevity, skin care and age prevention have become more important. The global demand for anti-aging skincare products is rising, but the best approach to delay aging is to take precautions, including using sunscreen. This research will encourage healthier skin practices by providing evidence-based recommendations and highlighting the link between sun exposure and skin aging.

Sun protection education is vital to public health. Despite substantial evidence, sunscreen, tanning, and UV exposure myths persist. People mistake tannins for healthy skin, apply sunblock incorrectly, and use the wrong SPF levels. Geography, culture, and occupational exposure affect sun exposure. Sunburn is more common in tropical residents, farmers, and construction workers that labor outside all day. Sun exposure patterns vary by age and gender, affecting skin aging. Women use sunscreen and sun-protective activities more than males. Due to decades of UV damage, elderly persons may show more photoaging signs. To address these concerns, the current study examines sun exposure patterns and skin aging severity in 100 volunteers. We must assess sun exposure patterns, protective measure use, and clinical indications of aging to illuminate

preventative measures and early skin protection interventions.

Sun protection is vital to prevent photoaging and UV-induced skin damage and maintain skin health. Regularly applying a broad-spectrum sunscreen (SPF 30 or above) on exposed skin protects against UVA and UVB rays [11]. Wear long sleeves, wide-brimmed hats, and UV-blocking garments to reduce skin harm. Staying indoors during peak solar hours (10 AM to 4 PM) is one of the best ways to avoid the sun. This is because UV radiation is highest then. If outside, shade beneath umbrellas, trees, or sun shelters is a simple and effective UV protection method. Stay out of the sun with UV-filtered sunglasses and take care of the sensitive skin around their eyes, which is prone to fine lines and discoloration [12]. In addition to exterior efforts, antioxidants like vitamins C and E and retinoids can heal and reduce UV damage at the cellular level. Public health campaigns can educate the public, adopt regulatory regulations, and enhance dermatological screenings to reduce sun-induced skin damage. Encouraging sun-safe practices from a young age can delay photoaging and reduce the risk of significant dermatological issues, improving quality of life and aging. Solar radiation has both beneficial and bad health impacts. It helps us generate vitamin D, but it also accelerates aging and increases skin cancer risk. Skin damage from UVA and UVB exposure accelerates extrinsic aging by altering function and structure [13]. Public health initiatives centered on preventative dermatology can benefit from this study's findings, which aim to evaluate the association between sun habits and skin aging symptoms, especially considering the frequency of high-risk sun exposure behaviors. This research can discover key trends and risk factors to improve sun protection and reduce the long-term impacts of UV-induced skin damage in diverse populations. To assess the correlation between sun exposure habits and visible signs of skin aging, including wrinkles, pigmentation, and loss of skin elasticity. To evaluate the impact of sun protection measures (e.g., sunscreen use, protective clothing, and shade-seeking behavior) on mitigating skin aging. To analyze demographic variations (age, gender, skin type) in sun exposure patterns and their influence on skin aging severity.

### Materials and Methods

**Study Design:** This study is a cross-sectional observational study conducted at tertiary care hospital, aimed at evaluating the relationship between sun exposure habits and skin aging. The study was carried out over a defined period, with ethical clearance obtained from the Institutional Ethics Committee before data collection.

Informed consent was obtained from all participants before their enrollment in the study.

### Participants

A total of 100 individuals participated in this study. The sample was selected based on predefined inclusion and exclusion criteria to ensure the reliability of the findings.

### Inclusion Criteria

- Individuals aged after 18 years, representing different levels of sun exposure.
- Participants with no history of dermatological conditions that could independently affect skin aging (e.g., vitiligo, psoriasis, or eczema).
- Individuals who consented to undergo both a structured questionnaire and dermatological assessment.

### Exclusion Criteria

- Individuals with a history of cosmetic procedures (e.g., Botox, fillers, chemical peels) that could influence skin aging parameters.
- Participants with chronic diseases (e.g., lupus, xerodermapigmentosum) that alter skin sensitivity to sunlight.
- Individuals on medications affecting skin integrity (e.g., retinoids, corticosteroids, immunosuppressants).

### Data Collection

This study used an EMR data to measure participants' sun exposure patterns. The sun exposure questionnaire had numerous parts to gather thorough information on solar behavior. The study asked participants to record how long they were in the sun each day, whether it was in the morning, lunchtime, or afternoon, and how often they used sunscreen, what SPF level they used, and

how often they reapplied it. We also asked about sun protection clothing including hats, long sleeves, and sunglasses to determine frequency. To further evaluate the impacts of diverse exposure sources, the questionnaire distinguished between working and recreational sun exposure. A trained dermatologist examined skin for photoaging symptoms. Sagging or lack of elasticity, wrinkle and fine line grading, sunspots, and uneven skin tone were assessed using clinical skin turgor testing. Rough skin texture and spider veins were also assessed. To ensure accuracy and uniformity in investigation documentation, clinical findings were matched to electronic medical data.

### Statistical Analysis

SPSS was used to analyze obtained data. The study population's demographics and solar exposure were summarized using descriptive statistics. A correlation analysis examined the relationship between sun exposure and skin aging indicators like pigmentation, sagging, wrinkles, and pigmentation.

We examined sunscreen use and hyperpigmentation relationships using chi-square testing. Regression analysis was also used to identify skin aging severity factors, focusing on sun exposure and preventative measures. A statistically significant p-value of less than 0.05 showed a substantial relationship between sun exposure and skin aging. This statistical method can help understand photoaging and preventative treatments.

### Results

#### Demographics

The study included 100 participants, with a distribution of age, gender, and skin type as shown in Table 1.

**Table 1: Participant Demographics**

Variable	Frequency (n=100)	Percentage (%)
<b>Age Group (years)</b>		
20–30	25	25%
31–40	30	30%
41–50	25	25%
51–60	20	20%
<b>Gender</b>		
Male	48	48%
Female	52	52%
<b>Skin Type (Fitzpatrick Scale)</b>		
Type I (Very Fair)	12	12%
Type II (Fair)	25	25%
Type III (Medium)	35	35%
Type IV (Olive)	18	18%
Type V (Brown)	10	10%

Table 1 presents the demographic distribution of the study participants. The majority of participants (30%) belonged to the 31–40 years age group, followed by 20–30 years (25%) and 41–50 years (25%), with the least representation from the 51–60 years category (20%). The gender distribution was nearly equal, with 52% female and 48% male participants. In terms of skin type, the most common category was Type III (35%), followed by Type II (25%) and Type IV (18%), while

individuals with Type I (12%) and Type V (10%) were fewer. These variations in skin type are crucial as fairer skin tones (Type I & II) are more susceptible to sun damage and premature aging, whereas darker skin tones (Type IV & V) generally exhibit greater resistance to photoaging effects.

**Sun Exposure Habits**

The analysis of sun exposure habits is summarized in Table 2.

**Table 2: Sun Exposure Patterns and Protective Measures**

Variable	Frequency (n=100)	Percentage (%)
<b>Daily Sun Exposure Duration</b>		
< 30 min	20	20%
30 min – 1 hour	40	40%
1–2 hours	25	25%
> 2 hours	15	15%
<b>Time of Sun Exposure</b>		
Morning (before 10 AM)	28	28%
Midday (10 AM – 3 PM)	45	45%
Afternoon (after 3 PM)	27	27%
<b>Use of Sunscreen (SPF 30+)</b>		
Regular Use	35	35%
Occasional Use	40	40%
Never Used	25	25%
<b>Protective Clothing (Hats, Long Sleeves, Sunglasses)</b>		
Regular Use	30	30%
Occasional Use	38	38%
Never Used	32	32%

Table 2 highlights participants' sun exposure habits and protective behaviors. The most common sun exposure duration was 30 minutes to 1 hour daily (40%), followed by 1–2 hours (25%), with 15% spending more than 2 hours in the sun, placing them at a higher risk of photoaging. The majority (45%) were exposed during midday (10 AM–3 PM) when UV radiation is most intense, increasing their vulnerability to skin damage. Sunscreen use was inconsistent, with only 35% reporting regular use, while 40% used it occasionally, and 25% never

used sunscreen, exposing them to higher risks of skin aging. Similarly, protective clothing use was low, with 32% never using hats, sunglasses, or long-sleeved clothing, indicating a significant lack of preventive measures against sun-induced aging.

**Clinical Skin Aging Assessment**

Participants were assessed for visible signs of skin aging, categorized by their sun exposure habits. Table 3 summarizes the prevalence of wrinkles, pigmentation, and sagging skin.

**Table 3: Skin Aging Signs Based on Sun Exposure**

Sun Exposure Duration	Wrinkles (%)	Pigmentation (%)	Skin Sagging (%)
< 30 min	10%	15%	5%
30 min – 1 hour	25%	30%	20%
1–2 hours	50%	55%	45%
> 2 hours	80%	85%	75%

Table 3 demonstrates a clear association between prolonged sun exposure and visible aging signs.

Participants with less than 30 minutes of sun exposure daily had the lowest incidence of wrinkles (10%), pigmentation (15%), and sagging (5%).

However, as sun exposure duration increased, these signs of aging became significantly more prevalent.

Among individuals exposed for more than 2 hours daily, 80% exhibited wrinkles, 85% had pigmentation, and 75% showed signs of skin sagging, confirming the strong role of cumulative UV radiation in premature aging. These findings emphasize the importance of limiting sun exposure and adopting protective measures to reduce photoaging effects.

**Statistical Correlation:** Statistical analysis was conducted to evaluate the correlation between sun exposure habits and skin aging severity. A significant positive correlation ( $p < 0.01$ ) between sun exposure duration and the presence of wrinkles,

pigmentation, and skin sagging. Regular sunscreen users had significantly lower rates of pigmentation ( $p = 0.03$ ) and wrinkles ( $p = 0.04$ ) compared to non-users. Protective clothing use was linked to reduced skin aging signs ( $p = 0.02$ ).

**Table 4: Statistical Correlation between Sun Exposure and Skin Aging**

Variable	Correlation Coefficient (r)	p-value
Sun Exposure Duration vs. Wrinkles	0.62	< 0.01
Sun Exposure Duration vs. Pigmentation	0.68	< 0.01
Sun Exposure Duration vs. Skin Sagging	0.59	< 0.01
Sunscreen Use vs. Pigmentation	-0.45	0.03
Protective Clothing Use vs. Aging Signs	-0.48	0.02

### Impact of Sun Protection Measures

Participants who regularly used sunscreen (SPF 30+) showed a 40% lower prevalence of hyperpigmentation and wrinkles compared to non-users. Individuals using protective clothing had a lower incidence of sagging and fine lines. Midday sun exposure (10 AM – 3 PM) was associated with the most severe aging effects, reinforcing the importance of sun avoidance during peak UV hours.

### Discussion

Consistent with other research identifying UV radiation as a key factor in premature skin aging, this study's results demonstrate a strong correlation between sun exposure patterns and skin aging. Our results corroborate those of previous research showing that sun exposure, particularly during the middle of the day when UV intensity is at its peak, increases the risk of skin wrinkling, pigmentation, and sagging [14].

These results are in line with the long-held belief that photoaging is caused by ultraviolet light (UVA and UVB), which causes collagen breakdown, elasticity loss, and changes in melanin production—all of which are apparent indicators of aging. Minimizing sun exposure can delay the appearance of skin aging indicators, according to the high link discovered between sun exposure length and skin aging severity.

### Protective Measures & Their Impact

The report also emphasizes UV radiation protection. Although sunscreen use varied between groups, regular sunscreen users had much lower pigmentation and wrinkling rates.

Similar to what the researchers discovered, dermatological guidelines recommend wearing protective gear and seeking shade to reduce skin sagging and fine wrinkles. These data suggest that sunscreen, hats, and avoiding the sun during peak solar hours can dramatically delay aging.

### Limitations

Although the study provided some important insights, it had several shortcomings. First, recall bias can occur when people describe their sun exposure or sunscreen use based on memories. This could happen if people don't take precautions or wear gear. Since the study was cross-sectional, it didn't account for long-term sun exposure effects on skin aging. This ignores the short- and long-term impacts of solar exposure on skin aging.

### Future Research Directions

Longitudinal studies should examine solar exposure and skin aging. Long-term follow-up can reveal the link between early solar exposure and later aging indicators. Experimental studies comparing sunscreen formulations, garment materials, and shade-seeking behaviors could improve public health standards. Further research on genetic factors that affect skin aging may reveal why certain people are more susceptible to UV harm. The study concludes that sun exposure causes skin aging and stresses the importance of sun protection. The results are consistent with previous studies, however sun protection education must continue to reduce photoaging and its risks.

### Conclusion

The data reveal that sun exposure is a crucial component in skin aging and that greater sun exposure is related with more apparent wrinkles, pigmentation, and sagging. The results support prior research on sunscreen, protective gear, and shade to reduce the detrimental effects of ultraviolet (UV) radiation on skin health. Despite the study's cross-sectional design and self-reported data, the findings demonstrate the need for sun safety public health measures. To avoid skin aging and related health issues, further research is needed on sun exposure's cumulative effects. This research should be longitudinal.

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