Sun Protection Practices in Persons with Albinism and the Normal Pigmented Population and the Risk of Cutaneous Malignancies in Anambra State, Nigeria

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ABSTRACT

Background: Skin cancers are relatively uncommon in black Africans despite a higher Ultraviolet (UV) intensity. Consequently, little attention is paid to sun protection with few policies adopted to protect at-risk individuals. Persons with albinism (PWA) in Sub-Saharan Africa (SSA) are at risk of developing cutaneous malignancies due to the combined effect of diminished or absent melanin on their skin and the prevalent high UV index. They are therefore obligated to practice photoprotection. There is a paucity of data on sun protection practices and their relationship with cutaneous malignancies in Africans.

Objectives: To determine the sun protection practices of PWA and normal pigmented controls and their relationship with cutaneous malignancies.

Methods: Interviewer-administered questionnaires were used to obtain information on sun exposure from 59 PWA and 58 age and sex-matched controls with normal pigmentation. Diagnosis of skin lesions was clinical and/or histological.

Results: The PWA spent less time in the sun, [median 12 (0 – 64) hours/week] than the controls, [median 32 (0.2 – 70) hours/week], ($p<0.001$). Most PWA spent more time outdoors during times of maximum UV intensity and did not adhere strictly to sun protection guidelines. There was no statistically significant relationship between most sun protection practices and cutaneous malignancies.

Conclusion: Black Africans in Nigeria do not practice adequate sun protection. The absence of cutaneous malignancies in the controls reiterates the protective role of melanin. The poor compliance of PWA to sun protection in most domains explains the higher prevalence of malignant photodermatoses among them.

Keywords: Sun protection. Albinism. Skin cancers

Pratiques de Protection Solaire chez les Personnes Atteintes d'Albinisme et la Population Pigmentée Normale et le Risque de Tumeurs Malignes Cutanées dans l'État d'Anambra, au Nigeria

ABSTRAIT

Contexte: Les cancers de la peau sont relativement rares chez les Africains noirs malgré une intensité ultraviolette (UV) plus élevée. Par conséquent, peu d'attention est accordée à la protection solaire et peu de politiques sont adoptées pour protéger les personnes à risque. Les personnes atteintes d'albinisme (PWA) en Afrique subsaharienne (ASS) risquent de développer des tumeurs malignes cutanées en raison de l'effet combiné d'une mélanine réduite ou absente sur leur peau et de l'indice UV élevé qui prévaut. Ils sont donc obligés de pratiquer la photoprotection. Il y a peu de données sur les pratiques de protection solaire et leur relation avec les tumeurs malignes cutanées chez les Africains.

Objectifs: Déterminer les pratiques de protection solaire des PVA et des contrôles pigmentés normaux et leur relation avec les malignités cutanées.

Méthodes: Des questionnaires administrés par des enquêteurs ont été utilisés pour obtenir des informations sur l'exposition au soleil de 59 PVA et de 58 témoins appariés selon l'âge et le sexe avec une pigmentation normale. Le diagnostic des lésions cutanées était clinique et/ou histologique.

Résultats: Les PVA ont passé moins de temps au soleil, [médiane 12 (0 – 64) heures/semaine] que les témoins, [médiane 32 (0,2 – 70) heures/semaine], (p<0,001). La plupart des PVA passaient plus de temps à l'extérieur pendant les périodes d'intensité UV maximale et ne respectaient pas strictement les directives de protection solaire. Il n'y avait pas de relation statistiquement significative entre la plupart des pratiques de protection solaire et les tumeurs malignes cutanées.

Conclusions: Les Africains noirs au Nigeria ne pratiquent pas une protection solaire adéquate. L'absence de tumeurs malignes cutanées chez les témoins réitère le rôle protecteur de la mélanine. La mauvaise observance des PVA à la protection solaire dans la plupart des domaines explique la prévalence plus élevée des photodermatoses malignes parmi elles.

Mots clés: Protection solaire. Albinisme. Cancers de la peau.

Introduction

Tropical Africa is close to the equator (latitude between 13° North and 34° South) and has a relatively high ultraviolet (UV) index. The maximum daily temperature in Sub-Saharan Africa often exceeds 35°C during the summer months with extreme levels of ambient solar UVR.[1] Black skin was believed to be immune to the damaging effects of ultraviolet radiation (UVR).[2] This was attributed to the high UVR protection factor (UPF) in the black African skin when compared with lighter skin phenotypes.[2] Consequently, the practice of sun protection among blacks especially in Sub-Saharan Africa has remained poor.[2-4] Current data, however, shows an increasing incidence of photo-dermatoses including skin cancers in Black Africans.[6] A pattern that may be explained by climate change without concomitant adaptational sun exposure behaviour.

Oculocutaneous albinism (OCA) is a genetic condition characterized by a reduction or absence of melanin, a skin pigment with inherent photoprotective properties. Africans with OCA living in Africa are at a much higher risk of UV-induced skin damage and skin cancers than their normal pigmented counterparts. As a result of an intrinsic increased sensitivity to sunlight and susceptibility to the harmful effects of ultraviolet radiation (UVR), they are required to practice strict photoprotection. Photoprotection practices range from simple actions like the use of protective clothing to the liberal use of sunscreens.[7]

A relatively large number of PWAs live in South East Nigeria with a reported prevalence of 1 in 1100.[8-10] In this region, there is a high prevalence of premalignant and malignant photo-dermatoses among individuals with OCA.[11] A combination of a high UV index and poor sun protection practices due to ignorance, lack of access to and high cost of sun protection gadgets is probably contributory.[11] In addition to poor awareness of the adverse effects of sun exposure, several reports show that sun protection messages are hardly adhered to or practised in reality.[12] Consequently, most PWAs present with advanced skin cancers with considerable morbidity and mortality.[8] In contrast, there are fewer reports of skin cancers in normal pigmented black Africans in the absence of co-morbidities or other genetically induced UV damage repair conditions despite living in similar environmental conditions.

There are limited studies describing sun protection practices in Africa and particularly in African PWAs. Some of the reports were carried out in children with OCA; in the school environment alone or occupational settings and therefore may not have captured incidental sun exposure.[2, 13-16] Another report explored sun protection practices in PWAs with respect to vitamin D status.[17] A practical sun protection data for resource-limited settings should capture incidental sun exposure and rely on detailed and precise documentation of specific sun protection practices of the individuals. It would also be more beneficial if their relationship with the occurrence of photo-dermatoses can be explored. This will enable adaptation of the shortfalls of the sun exposure

behaviour of the individuals to culturally sensitive, cost-effective and skin cancer preventive strategies with better prospects of improved compliance.

There are currently no sun protection programmes for individuals with oculocutaneous albinism in Nigeria despite the prevalence of this condition and the associated occurrence of skin cancers.[11] This study was conducted to explore the individual sun protection and avoidance strategies, their determinants and their relationship with premalignant and malignant dermatoses in PWA and to ascertain the differences in sun protection behaviour between PWA and the general population. It is believed that the data obtained from this study will guide the design of an effective and inclusive sun protection programme for individuals in Sub-Saharan Africa.

Methods

This was a cross-sectional study carried out in South Eastern Nigeria. Persons with Albinism (PWA) were recruited randomly from the list of members of The Albino Foundation (TAF) Anambra State, chapter. Healthy age and sex-matched pigmented controls from the relatives of TAF living within the same locality were recruited as controls. Ethical approval was obtained from the institutional Ethical Review Board of Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State. All study participants gave informed consent before enrollment.

The recruited participants were interviewed by trained research assistants using validated sun exposure questionnaires from a previous study from Pakistan and adapted to our indigenous setting.[18,19] Individual sun exposure patterns were assessed using the duration of sun exposure including the time frame, sun protection habits, and skin tone. Skin examination and dermoscopy were carried out to assess for the presence of any dermatoses. In doubtful cases or suspected premalignant or malignant dermatoses, patients were counselled for a skin biopsy and those who gave consent had skin biopsies performed. Tissue biopsy samples were transferred to the histopathology laboratory for histologic diagnosis.

Data analysis: All data was extracted from the questionnaires and input into SPSS analytical software package version 22 after data cleaning. Baseline socio-demographic characteristics, clinical findings and sunlight-associated variables of albinos and controls were reported as proportions for categorical variables and mean (SD) for continuous variables after the test of normality was carried out using the Shapiro-Wilk test.

All domains that affect sun exposure at an individual level-minutes of sun exposure, different domains of sun protection practice were taken into consideration. Additional items were added to some domains, while some items were modified as they didn't apply to the cultural practice in our society. Responses were used to derive a constant, k and to calculate an adjusted sun exposure time of the participants. The constant, k, was developed based on different weights (ranging from 0 – 1) for sun protection practices in all domains listed in the questionnaire including clothing weave, the barrier against direct sun exposure, skin tone etc. (Table 1). This was extrapolated by seeking the SPF of those items thereby calculating how much sunlight will be blocked by each parameter (Table 1).

The total minutes spent in the sun was adjusted for sun protection practices by multiplying the minutes with the average score of sun protection practice and the value gotten for each hour was multiplied by the hour's fractional equivalent of peak hour UVB to achieve standardized total minutes spent in the sun.

The skin tone of the normal pigmented participants was determined by comparing the skin tone on the inner aspect of their forearms with a colour-matched chart bearing Von Luschan's chromatic scale.[20] This was later matched with a table incorporating the Fitzpatrick's equivalent of the Von Luschan's scale while that of the PWAs were considered as Fitzpatrick 1.[21] The weights were derived from a previously validated study and adapted to our environment using some additional data.[18,19] (Table 1). An expert in textiles was consulted to match the native cloth weaves with their equivalent standard cloth based on a previous study (Table 1 footnote).[19] Occupational exposure was also considered in the final scoring algorithm.[22] Selected PWA with histopathologic diagnosis of their skin lesions were

also sub-analyzed with Fisher's exact and Wilcoxon rank sum used to determine the difference in selected variables between participants with malignant skin lesions and those without cutaneous malignancies. Statistical significance was defined as when the p-value < 0.05.

Results

Background Description

A total of 90 PWA and 61 controls with normal skin pigmentation were recruited into the study. Out of these, 59 PWA and 58 controls had complete data for analysis. The mean age of the participants was 29.1 (7.0) years for PWAs and 29.8 (9.3) years for the controls. There were 22 male PWA and 37 female PWA; and 31 male and 27 female control participants. Most of the participants (PWA and controls) were involved in low UV exposure occupations (66.1% PWA, 69% controls) such as indoor service and sales jobs, clerical support workers, managers, and predominantly indoor professional jobs.

Sun protection-seeking behaviour

The total adjusted sun exposure time was 12 (0 – 64) hours/week for the PWA, while that for the controls was 32 (0.2 – 70) hours/week, (p<0.001) (Table 2). However, most of the PWA (49.1%) were mostly outdoors at the time of maximal UV radiation (between 11a.m to 4p.m) (Table 2). The PWA had better sun protection-seeking behaviour in some domains when compared with the controls (p<0.001) see Table 3). However, most of the PWA were surprisingly not adherent to the recommended standards and were more completely exposed to the sun than the controls (p<0.001) see Table 3.

Out of the 58 controls, only one participant used sunscreen. Among the PWA, 9(15.2%) reported using sunscreens, 36(61%) did not use sunscreens while 14(23.7%) were uncertain about sunscreen use. Only 10(62.5%) PWA who used sunscreens applied it on all sun-exposed areas with the frequency of application ranging from once/day to once every three days. Among the PWA, the reasons cited for not using sunscreens included inaccessibility/unavailability of sunscreens, costs, ignorance, and cutaneous reactions to sunscreens while most of the controls felt that they did not need sunscreen.

Although the PWA who do not use sunscreens spent fewer hours outdoors (27.5hrs/week) when compared to those using sunscreen (41.1hrs/ week [p: 0.282]), the sunscreen group practised better overall sun protection than the non-sunscreen group.

Photo-dermatoses

There were no premalignant and malignant dermatoses found in the control population. The premalignant lesions were actinic keratosis while the cutaneous malignancies diagnosed in the PWA were basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). None of the sun exposure domains had a statistically significant relationship with the occurrence of cutaneous malignancies in PWA (Table 4 and Fig.1). The PWA with cutaneous malignancies had a higher adjusted sun exposure time (14.9[8.4-30.5]) when compared with those without cutaneous malignancies (9.0[3.4-19.5]), however, this was not statistically significant (p=0.316). (Table 4) There was no statistically significant association between sunscreen usage and the occurrence of histologically confirmed cutaneous malignancies (Pearson chi2 =1.400, p-value=0.497). (Fig.2)

Discussion

There was an overall poor adherence to sun protection and sun avoidance standards among the PWA and normal pigmented controls (Tables 2 and 3). This is consistent with earlier studies that show poor sun protection and sun avoidance practice in Africans.[2,3,5,12-17] This may be explained by the erroneous belief that black skin is totally protected from the effects of UVR. Additionally, some of the sun protection gadgets are expensive and also uncomfortable under the hot tropical African skin and are considered culturally and socially superfluous.

Predictably, this study observed that the PWA spent less overall time in the sun when compared to the controls (Table 2). This is likely due to the increasing awareness of the deleterious effects of UVR on the skin of PWA and also the occurrence of acute cutaneous reactions to acute sun exposure. Sunburns are uncommon in normally-pigmented individuals except in those who use depigmenting agents or photosensitizing agents.

Few studies have documented the calculated adjusted sun exposure time of participants. However, Chu et al found that majority of the PWA spent an estimated <1 hour in the sun daily, a finding which contradicts our findings but agrees with reports from Tanzania and Congo DR. [5,23-25] This could be attributed to the albinism care program established in Botswana which provides speciality care to PWA prior to the study by Chu et al. There are limited sun protection education programs in Nigeria dedicated to teaching the PWA and normally-pigmented blacks about safe sun exposure habits. Additionally, some of the albinos are aware of the dangers of sun exposure but are unable to comply due to a high rate of unemployment and limited indoor predominant occupation available for most of the PWA.[8] The poor sun avoidance practice among the controls agrees with earlier studies on the poor adherence of black Africans to sun avoidance guidelines. [2,3,5,12-17]

Certain practices like sun avoidance at the time of maximal UV exposure; colour and fabric (weave) of clothing preference (among the albinos) (Table 3) showed poor compliance among both groups. The reasons cited for the poor adherence to some of the sun protection practices mirror that from previous studies where fashion, lack of knowledge, ignorance, affordability and accessibility of the sun protection gadgets were cited as causes.[17,23] This finding is consistent with the findings by several studies across Africa.[2,3,17,23,26] This corresponds with the conclusion by Labat et al suggesting that sun protection messages are rarely retained and practiced.[12]Additionally, we observed that the PWA in this study were erroneously told that the "early morning sun" (between 9 a.m. and 12 noon) was harmful to their skin while the UVR during the rest of the day was safe. The majority of PWA were also unaware of the influence of cloth weave on UV protection, were misinformed of the colour of clothing which affords better UV protection and as such believed that darker-coloured clothing made them feel hotter and therefore affords less UV protection and were also uncomfortable and unfashionable. The broad-brimmed hats were considered old-fashioned while the umbrellas were considered inconvenient and outlandish except when used in the rain.

There was poor sunscreen usage among the PWAs and controls. This corroborates the findings in other studies.[2,14,26-28] This is in contrast to the findings by Chu et al in Botswana.[24] This is probably because of the universal health programme and special albinism care programme practised in some parts of Africa which incorporates free sunscreen, sun protection gadgets distribution and counselling on sun avoidance habits which are not available in Nigeria.[29-31] Reasons for poor and improper sunscreen usage in our study included lack of funds to procure sunscreens and unavailability of suitable and cosmetically acceptable brands: similar reasons to that found in previous studies.[2,14,22-26]. An earlier report had shown that most PWA and black Africans do not use sunscreens as frequently as recommended which agrees with the findings in this study.[2,3,17,23,26-28]

Although we did not explore the quantity of sunscreen applied, one previous report showed that sunscreen users customarily apply half or less than the FDA-stipulated amount of product required to generate the stated level of protection (2 mg/cm^2 and hence achieve far less protection.[32]

None of the participants who used sunscreens applied their sunscreens according to the standard recommendation of reapplication after every two hours whenever they are outdoors.[33]

The finding of a significantly higher adjusted sun exposure time among the albinos who use sunscreens agrees with several studies where sunscreen use has been proposed to lead to a longer time spent in the sun as the impression of having sun protection cream on makes the individuals pay less heed to sun avoidance as a supplementary strategy for photoprotection.[34]

Although, there have been several studies on the protective effects of sunscreens on skin cancer prevention, the extent of the impact of sunscreen use on the occurrence of premalignant and malignant photodermatoses in albinos is largely unknown.[35] This study found that despite having a higher adjusted sun exposure time, the PWA who used sunscreens had fewer skin cancers (Fig. 2) than the controls although this was not statistically significant.

In contrast, there was an increase in the occurrence of premalignant and malignant photodermatoses

among PWAs who do not use sunscreens and those who were not sure if their skin care products contained sunscreens. This difference, however, was not statistically significant. This suggests that sunscreen use offers some protection even when the recommended frequency of application is not strictly adhered to.

Although recall bias is a limitation in this study, its strength rests in the capturing of incidental sun exposures while travelling and during the weekends, the consideration of other factors like skin tone and cloth weave and the relationship between other sun exposure variables and skin cancers.

Conclusion

Black Africans and PWA in Nigeria do not practice adequate sun protection. The absence of premalignant and malignant dermatoses in the normal pigmented controls validates the protective role of melanin against the occurrence of skin cancers. Although the PWA had better sun protection practices when compared with the controls, they did not adhere strictly to sun protection and sun avoidance recommendations in most domains and are at risk of cutaneous malignancies.

Recommendation

There is a need to educate the albinos on proper sun protection and sun avoidance regimen. Education on sun avoidance and sun protection should be intensified in their group meetings and in the hospital. Health education on the regular and proper use of sunscreens as well as the technique of application. Affordable and accessible sun protection gadgets which are environmentally and culturally sensitive should be emphasized to ensure sun protection in both PWA and normally-pigmented black Africans.

Larger prospective studies are required to determine the degree of protection afforded by the different sun protective practices in the prevention of UVR-induced photodermatoses.

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TABLES AND FIGURES

Table 1: Scoring Guide For Adjusted Sun Exposure Measurement Calculation

SUN PROTECTION PRACTICE			
A. SUNSCREENS			
4. Do you use Sunscreens?	No, I don't use any products on my skin [ ] score 1	I don't know but use creams and lotions [ ] score 0.9	Yes SPF 15 and above [ ] score 0.08
If yes to (4) above, how often do you apply sunscreens in a day? …….	Once a day	Once in two days	Three times a week
At what time intervals do you usually reapply your sunscreen? ……	Does not (0)	Once a day	> Twice a day
If you use sunscreens, to which portions of the body do you typically apply the sunscreen			

Region	Frequency	Percentage
Face and head		
Neck		
Upper arms		
Lower arms		
Chest		
Back		
Upper legs		
Lower legs		
Hands and feet		

B. SUN PROTECTIVE CLOTHING, GADGETS AND OTHERS				
Whenever you are mostly outdoors, how do you handle sun exposure?	I do not seek shade [ ] Score: 1	I seek shade under a building [ ] Score:0.4	I use Umbrellas. Score [ ] :0.10	I seek shade under a tree [ ]Score: 0.1
What is your typical outdoor clothing on most days of the week				
Clothing	Frequency		Percentage	
Typical white T-shirt or its equivalent in weave.[SPF4] Score: 0.25				
Typical dark T -shirt or its equivalent in weave.[SPF 18] Score: 0.10				
White Jeans/Denim or its equivalent. [SPF 12]Score: 0.10				
Dark Jeans/Denim or its equivalent.[SPF 166] Score: 0.01				
Lightly woven clothes with gaps in its/Native.[SPF 2] Score: 0.5				
When you are mostly outdoors, how can you describe your degree of sun exposure?	I am completely exposed (no hats, no shirts) [ ] Score :1	Partially exposed(short-brimmed hats, short-sleeved or sleeveless clothes) [ ] Score :0.5	I am not exposed/ I am totally covered (broad–brimmed hats, long–sleeved clothes, below-knee clothes) [ ] Score : 0	
What is your commonest mode of transportation?	I ride a bike or walk [ ] Score 1	I use a vehicle but with the window/glass mostly down [ ] Score 0.5	I use a vehicle but with the window/glass mostly up [ ] Score 0.1	
C. SUN EXPOSURE MEASUREMENT: Exposure Duration in the Sun.				
When are you mostly outdoors?				
Average number of hours spent outdoors on weekdays .....…… .....….	Before 11 a.m.	11 a.m. – 4 p.m.	After 4 p.m.	
Average hours spent outdoors on Saturdays…….	Before 11 a.m.	11 a.m. – 4 p.m.	After 4 p.m.	
Average hours spent outdoors on Sundays……	Before 11 a.m.	11 a.m. – 4 p.m.	After 4 p.m.	
		.		

Table 2: Comparison Of Time And Duration Of Maximal Sun Exposure Between Albinos And Controls

	PWA	CONTROLS	P-VALUE
Sun Time Hours/wk(Med, Range)	12(0-64)	32(0.2-70)	<0.001
Adjusted Sun time Hours/week(Med, Range)*	11(0 64)	32(0.2 70)	<0.001
Time Outdoor (N,%)			
Before 11a.m	25(42.4)	38(65.5)	0.023
11a.m—4p.m	29(49.1)	16(27.6)	
After 4p.m	5(8.5)	4(6.9)	

*Adjusted sun exposure time was calculated by multiplying the cumulative sun exposure times in a week by a factor determined by different weights assigned to the different domains reflecting the degree of exposure like cloth weave, use of hats, umbrellas, shades etc. (see table I)

Table 3: Comparison Of The Individual Sun Protection Practices Between Pwa And Controls

SUN PROTECTION HABITS (N,%)	PWA	CONTROLS	P–VALUE
No shade	14(23.7)	48(82.7)	<0.001
Shade under building	20(33.9)	6(10.3)	
Umbrella	18(30.5)	3(5.3)	
Others	7(11.8)	1(1.7)	
CLOTHING (N,%)			
White T–shirt/Equivalent in weave	25(42.4)	17(29.3)	0.368
Dark T–shirt/Equivalent in weave	20(33.8)	23(39.6)	
White Jeans/Equivalent in weave	3(5.1)	5(8.6)	
Dark Jeans/Equivalent in weave	3(5.1)	7(12.1)	
Light weaved clothing	8(13.5)	6(10.3)	
DEGREE OF SUN EXPOSURE (N,%)			
Completely covered	4(6.8)	4(6.9)	<0.001
Partially covered	33(55.9)	51(87.9)	
Totally exposed	22(37.3)	3(5.2)	
MODE OF TRANSPORTATION			
WALKING	44(74.6)	43(74.1)	<0.678
GLASS WOUND DOWN	10(16.9)	11(19.0)	
GLASS WOUND UP	5(8.9)	4(6.9)	

Table 4: Relationship Between Selected Variables And Occurrence Of Skin Malignancies

VARIABLE	No skin cancers	Skin cancers present	P-VALUE
OCCUPATIONAL UVR EXPOSURE			
High Exposure Job	–	6 (31.6)	0.291
Moderate Exposure Job	1 (11.1)	2 (10.5)	
Low Exposure Job	8 (88.9)	11 (57.9)	
Sun Sensitivity	4 (80.0)	15 (100.0)	0.250
Adjusted Sun Exposure Time Hours/Wk (Median/Range)	9.0 (3.4-19.5)	14.9 (8.4-30.5)	0.316

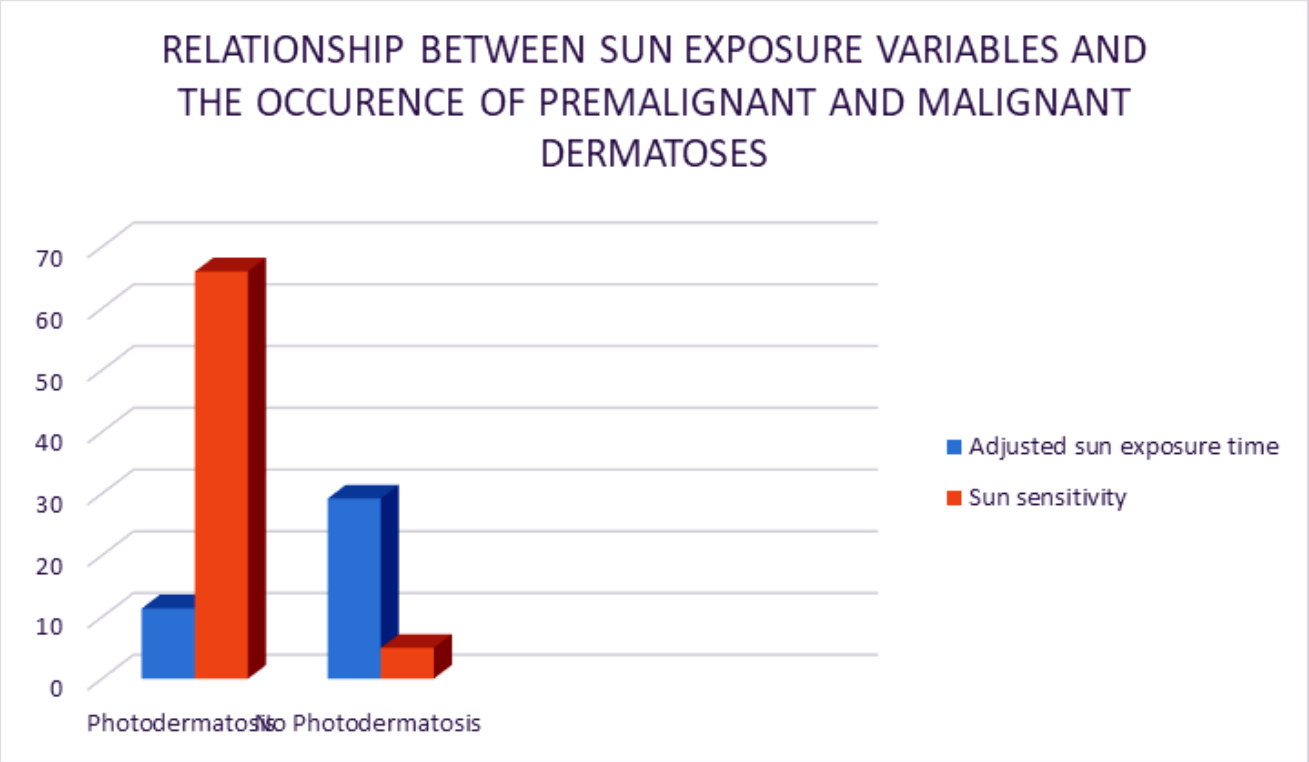

Figure 1: Relationship between sun exposure time and sun sensitivity with the occurrence of premalignant (actinic keratosis) and malignant skin lesions.

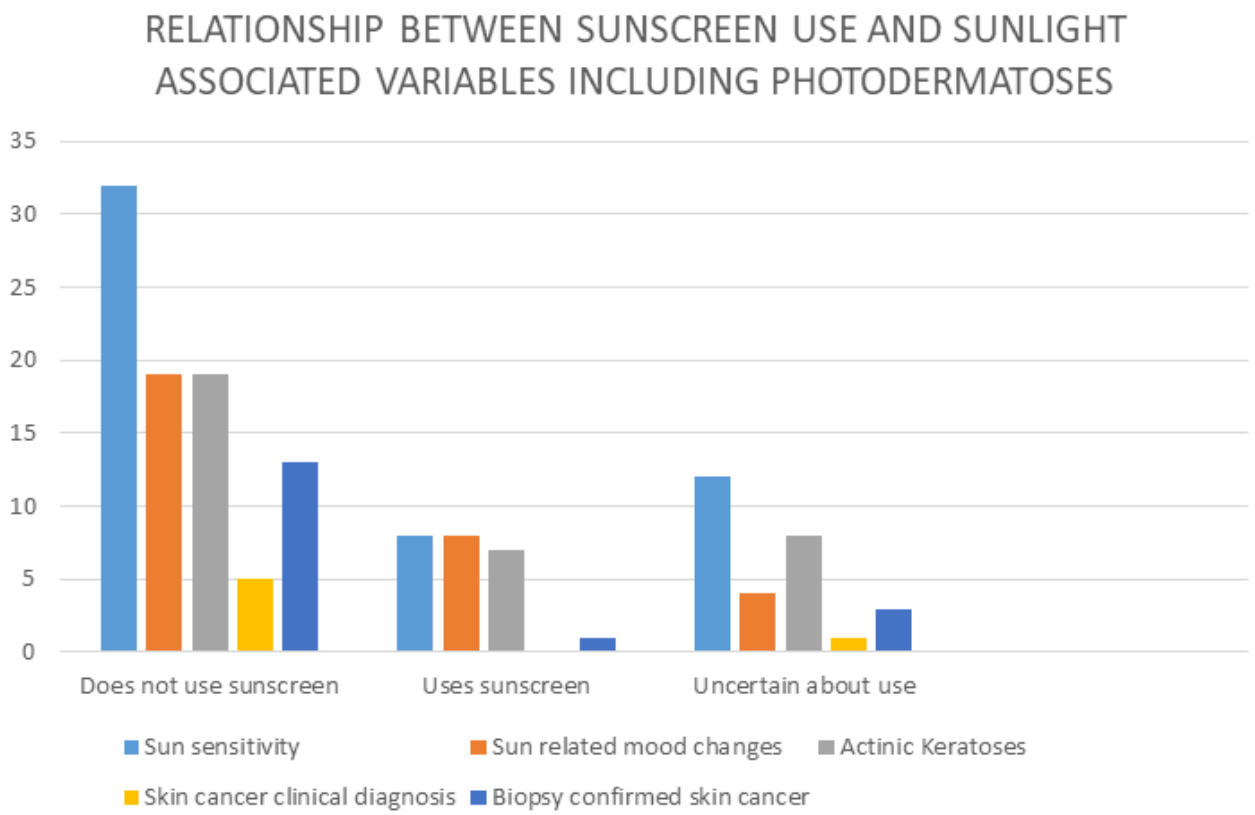

Figure 2: Relationship between the use of sunscreens with sun exposure time and premalignant and malignant skin lesions.