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ORIGINAL ARTICLE

Facial dermatosis papulosa nigra, a risk for the development of pterygium and myopia: a descriptive cross-sectional study in Ghana

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Abstract

Background. Dermatosis papulosa nigra (DPN) affects sun-exposed areas such as the face, neck, and trunk. The prevalence of pterygium and myopia in DPN patients in Ghana has not been studied. In this study, we examined the risk and protective factors for pterygium and myopia in DPN patients.

Materials and Methods. The study involved 100 participants with facial DPN. A standard ophthalmic exam was performed using a portable slit lamp and a 3.5X magnified loop. Participants completed a closed- ended questionnaire. Logistic regression was used to summarize the level of association between DPN, myopia, and pterygium, as well as demographic factors (gender, age, occupation, family history of lesion and skin complexion).

Results. 70% and 84% of participants had pterygium and myopia. Age, gender, complexion, and sun exposure were associated with pterygium and myopia ($p < 0.05$). Higher grade of pterygium and myopia were prevalent in the aged population. Both univariate and multivariable models highlighted that increasing age and sun exposure (outdoor) were risk factors for developing higher grade of pterygium and myopia in the DPN participants, while light skin color and male gender were respectively identified as protective factors.

Conclusions. Our study is the first to examine pterygium and myopia in facial DPN patients. Most Ghanaians with facial DPN are at risk for developing pterygium and myopia.

Keywords: Dermatosis papulosa nigra, pterygium, myopia.

INTRODUCTION

Facial Dermatosis papulosa nigra (DPN) is a condition characterized by hyperpigmentation and the appearance of some protuberances on the skin (1). They are mostly found on areas of the body that are commonly exposed to the sunlight, namely the face, neck and areas of the trunk (2). DPN are generally asymptomatic, benign and manifest as several small, about 1-5 mm diameter, firm, brown to black papules. The incidence, size and number of these lesions have been reported to increase with age and more common among females (3).

It was first identified among dark-skinned individuals of West-African descent and among other ethnic backgrounds such as Caucasians and Asians (4, 5). Few studies on DPN have been conducted in Africa, at health centres, with respondents attending these health centres due to cosmetic and dermatological reasons (6, 7).

Pterygium on the other hand, is a fibrovascular benign growth that develops on the mucous membrane that covers the sclera (8). Pterygium is idiopathic, however, too much exposure to ultraviolet (UV) rays has been observed to be the major risk factor of the disease. It also tends to occur more often in individuals who live in warm climates and spend a lot of time outdoors in windy environments. Common symptoms of pterygium include redness, blurred vision, eye irritation and itchiness (9, 10).

DPN and pterygium are both characterized by the enlargement and outgrowth of tissues. In Ghana, the local people classify facial DPN and pterygium as one entity, "kooko", an outgrowth at different anatomical locations. Though DPN is benign and asymptomatic, lesions can become inflamed and irritable (11).

Globally, myopia (short-sightedness) is one of the common eye disorders, affecting about 1.5 billion individuals (12). Though less common in Africa (10-20%), its incidence within target population often varies with country, gender, age, environment, ethnicity, occupation and other socio-demographic parameters (13). Myopia has been reported as protective factor for individuals with pterygium (14), however, its relationship in DPN subjects has not been carried out. Similarly, association between pterygium and facial DPN has not been reported.

To the best of our knowledge, this preliminary research, is the first study that seeks to examine individuals with facial DPN for signs of pterygium and myopia in Ghana.

MATERIALS AND METHODS

This was a preliminary descriptive cross-sectional study conducted among subjects at three different sites namely the University of Cape Coast (UCC) Hospital, Cape Coast, Tema General Hospital in Tema and Narh – Bita Hospital also in Tema, Ghana, between September 2015 to April 2016. We chose these three hospitals sites due to their location, in the coastal areas, as coastal areas have been reported to have high sun exposures than inland areas due to high ambient ultraviolet radiation in the former (15).

The UCC Hospital is located on the campus of the University of Cape Coast. Cape Coast is the regional capital, located in the coastal area with a population of more than 169, 894 inhabitants, mostly made up of low-income earning people. The hospital provides services to both the University and the adjoining communities in the Cape Coast Metropolis. Similarly, Tema General Hospital (public hospital) and Narh – Bita Hospital (private hospital) are all located in Tema Metropolis which is a coastal district located about 30 kilometres at the East of Accra which is the capital city of Ghana. Tema has a population of about 500,000 inhabitants reported to have a high incidence of DPN.

The study population comprised of individuals (both males and females) with suspected cases of DPN residing in Cape Coast and Accra metropolis for a minimum of one year by the time of data collection

Supplementary information The online version of this article (Figures/Tables) contains supplementary material, which is available to authorized users.

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and had undergone ophthalmic examination. The participants included in the study were Ghanaians aged ≥18 years. Other benign skin lesions that bear close resemblance to DPN such as seborrheic keratosis and facial syringomas on dark skinned individuals, were excluded from the study by the help of a professional dermatologist.

A structured questionnaire comprising mainly close-ended questionnaire was used to collect primary data. This type of questionnaires allowed respondents to select their answers from several options and also allowed for some individualized responses (by choosing other and specifying). The questionnaires captured respondents' demographic characteristics (gender, age, occupation and complexion), UV-related information (e.g. sun exposure levels) and information on eye disease (e.g. myopia and pterygium) which comprised of self and family history. Basic ophthalmic examinations using portable slit lamb, 3.5X magnified loop, under standard light conditions were done for all participants by a Senior Optometrist for the detection of pterygium. Clinical refraction was done for the assessment of myopia (-0.75DS to -3.50DS). In the administration of the questionnaires, the respondents were reassured of confidentiality about the responses they provided. The questionnaires were administered to the respondents by the researcher and a nurse in instances where the researcher was not present himself. The nurses have been taken through the questionnaires by the researcher before they were appointed to administer it. The questionnaires were read by the researcher and any cumbersome and vague sections of the questionnaires were explained to the respondents. The choice of administering the questionnaire was influenced by the participants level of education. The administration of the questionnaire lasted for an average of one (1) hour.

A simple random sampling was used to select the sample of 100 subjects for the study using the Yamane simplified formula for calculating sample size.

$$n = \frac{N}{1 + N(e)2}$$

The n in the formula represents the final sample size for this study while N represents the population and *e* represents the precision level.

Using this formula, a margin of error of 5% and a 95% confidence interval was accounted for to achieve the sample size for the study.

$$N=150$$
$$1 + N\,(e)^2 = 1+150(.05)^2$$
$$n = \frac{150}{1 + 150\,(.05)^2}$$
$$n= 110$$

Anecdotal report regarding suspicions DPN cases from the three selected hospitals revealed that an estimated number of persons around the figure of 150 had visited the three facilities for various reasons with suspicious symptoms of DPN within the six months preceding the start of this study. Therefore, it was concluded that 150 will be used as the total population within which a representative sample will be selected to investigate the incidence of pterygium and myopia among patients with facial DPN.

Using the simple random sampling, respondents were selected through a random process by asking them to pick folded papers that had 'Yes' and 'No' written in it. Daily, several respondents who picked folded papers with 'Yes' written in it were included and questionnaire administered to them. Data were collected within a period of 7 months employing 2 research assistants. The final analyses of the collected data did not take into account responses from ten (10) respondents who did not complete the study or dropped out at an early stage. Thus, the final sample size 100, was obtained as the sample size for respondent used in this current research.

The raw data gathered was first organized, analyzed, summarized in Microsoft Excel data and then analyzed using R statistical software (R Core Team, 2019) (16). Both descriptive statistics (percentage, frequency, mean and standard deviation) and inferential statistics (multivariate analysis and univariate analysis) were used.

Approval was granted by the Department of Biomedical Sciences, of the University of Cape Coast,

Ghana. Study respondents received adequate information regarding the study aim and scope and their consent was sought to participate. On-site ethical approval was also given by the three Hospitals. The identity of the study respondents was kept confidential throughout the study and to maintain anonymity, the identity of participants was not disclosed at any point in this study. Questionnaire was pre-tested at a location similar to the study location and results were analysed. Experts were consulted to clarify and modify any ambiguities with the questionnaires before it was finally administered.

RESULTS

Incidence of pterygium and myopia among participants with DPN

Table 1 presents the demographic characteristics associated with incidence of pterygium, grade of pterygium and myopia incidence among participants with DPN. From the table, average age was 45.06 $\pm$ 12.92. DPN were predominantly on the face of subjects than other parts of the body. The distribution of DPN on the face of subjects were more dispersed (70%) than localized (30%). Also,74% of the subject had developed pterygium, most commonly grade 2 (24%) and grade 3 (24%).

The prevalence of pterygium was significant across the age brackets (20-35 = 53.3%, 36-50 = 81.3%, 51-75 = 84.2%, p = 0.008); complexion (Dark skin = 84.1%, Light skin = 51.6%, p = 0.001) and sun exposure associated with occupation (Outdoor = 90.0%, Indoor = 53.3%, p < 0.001). However, there was no association between the development of pterygium among subjects with DPN and family history (p = 0.566); gender (p = 0.155).

The incidence of myopia was significant across the age groups (p = 0.003). There was a significant association between the development of pterygium and myopia among the respondents ($\chi^2(1) = 5.702$, p = 0.017). Among the subjects with DPN, the prevalence of developing both pterygium and myopia was significant (p < 0.001) across the age groups; gender (p = 0.009); complexion (p = 0.001); and sun exposure associated with occupation (p < 0.001). Hypermyopia on the other hand was not statistically significant (p>0.05) compared to the sociodermographic parameters used (Table 1).

Univariate Analysis

The risk of developing pterygium was found to be associated with advance age. For example, in comparing the risk associated with the age brackets, subjects aged between 36–50 (OR 3.79; 95% CI 1.26 to 12.63, p = 0.022) were at lower risk compared to subjects aged between 51-75 (OR 4.67; 95% CI 1.58 to 15.39, p = 0.007) and both age groups had higher risk compared to the baseline age group 20–35. Dark skinned individuals with DPN (as the baseline group) were found to higher risk of developing pterygium compared to light skinned individuals (OR 0.20; 95% CI 0.08 to 0.52, p = 0.001). Subjects with DPN with much exposure to sun have a higher risk (OR 8.75; 95% CI 3.14 to 28.81, p < 0.001) of developing pterygium compared to those who spend much time indoors. On the other hand, in assessing how the measured factors of subjects with DPN related to the development of myopia, no significant risk factor was found (p > 0.05) (see Table 2).

Multivariate Analysis

Table 2 presents the risks associated with the measured factors among subjects with DPN inrelation to the development of pterygium and/or myopia. The level of risk associated with each measured factor and the development of the conditions of interest (pterygium and/or myopia) was assessed controlling for the other measured factors. From the model, age, gender and sun exposure controlling for the other measured factors were identified as risk factors for developing pterygium among subjects with DPN. Subjects aged 51 – 75 (AOR 7.42; 95% CI 1.57 to 49.19, p = 0.016) were at higher risk of developing pterygium compared to those aged 36 – 50 (AOR 6.82; 95% CI 1.28 to 43.19, p = 0.036). Male gender (AOR 0.11; 95% CI 0.02 to 0.46, p = 0.006) was a protective factor among subjects with DPN in developing pterygium. Also, much exposure to sun (AOR 4.97; 95% CI 1.25 to 23.44) heightened the risk of developing pterygium. In relation to the development of myopia condition among subjects with DPN, male gender (AOR 0.22; 95% CI 0.01 to 0.88, p = 0.039) and exposure to sun (AOR 0.17; 95% CI 0.03 to 0.85,

p = 0.042) were protective factors. However, ageing increased the risk of developing myopia condition. For example, subjects with DPN aged 51–75 (AOR 5.48; 95% CI 1.96 to 22.24, p < 0.001).

Pterygium was in 74% individuals of the study participants. Age group, complexion and sun exposure were significantly associated with the incidence of pterygium in the facial DPN subjects. Previous studies have shown that age group (9, 17), skin colour (14) and sun exposure (9, 18) are associated with pterygium. This observation could partly be explained by the fact that cumulative UV exposure have been consistently linked with DPN (6) and pterygium (9, 19), and both lesions tend to occur in adults with incidence increasing with age.

Observed results in the current study also reveals that, incidence of myopia was significant (p=0.003) across the age groups, and there was a significant association between the development of pterygium and myopia in the DPN respondents. The latter statement is in contrast with other study report that used respondents having pterygium (14). In those studies, myopia was a protective factor rather than a risk factor. The inconsistency of the results may be as a result of our target group. Thus, other large prospective study should be carried out to confirm our findings.

Advanced age group 51-75 years, had higher risk compared with the other age groups (36-50 year > year 20-35), giving an age dependent risk factor. Studies on pterygium only attest to this result (19, 20). Thus, DPN subjects with more advanced age has higher risk of developing pterygium.

Furthermore, light skinned was a protective factor, as opposed to dark skinned DPN subjects. This finding in some part, contrary to findings from Barbados (21, 22). Though the researchers used pterygium subjects as their target population, their results showed that dark skin was a protective factor. DPN however is more associated with dark skinned colour, with results consistently showing that lightly pigmented individuals are at lower risk (1, 2). Thus, our results may be due to the biasness of our target population. Hence, a larger prospective sample size using DPN subjects at other geographical areas is warranted to confirm our findings.

Sun exposure associated with occupation or outdoor occupation has been widely acclaimed as a potential risk factor for the development of pterygium compared with indoor occupation (9, 14, 17, 19, 20). Observed results from our study also confirm the higher risk of developing pterygium with chronic exposure to sun outdoors compared to indoor occupation.

Thus, with a high incidence of pterygium positive cases (74%) in our target DPN subjects, and with DPN being associated with chronic sun exposure itself, it is suggestive that chronic UV exposure is a potential aetiological agent for the development of the two lesions.

Association between gender and pterygium is highly debatable. Multivariate analysis showed that, male gender was a protective factor, with female gender having 89% risk of developing pterygium among the DPN subjects. This result is consistent with earlier reports (23, 24), though their studies were not conducted among DPN subjects. However, studies have showed that men are more prone to the condition (14, 25), while other studies had no significant association between gender and pterygium (21, 26). The disparity between these findings could be due to the occupational preferences of the men and women in this current study. In Ghana, women are more likely to work as petty traders outdoors compared to men. In other parts of the world this could be the opposite. Also, another factor to consider was the fact that all subjects are DPN positive, which could shift the risk towards the female gender, as prevalence of DPN is higher in females (3).

In relation to the development of myopia condition among subjects with DPN, male gender and exposure to sun were protective factors. Spending time outdoors early in life irrespective of the activity being engaged in, has been reported to decrease the risk of myopia in children (27). Similarly, a more recent study reporting on the risk factors of pterygium, highlighted myopia as a protective factor (14). Thus, though myopia has a positive association with pterygium in the current study, it stands independently as a protective factor in the DPN subjects.

Ageing however, increased the risk of developing myopia. In the DPN subjects, the more advanced age group 51-75, showed a 5.48 higher risk of developing

myopia than the other age groups. A previous study demonstrated that the physiologic thinning of the retinal nerve fiber layer in healthy eyes is more apparent with the aged (28). Thus, in the current study, the observed results may have a more normal physiological bearing, rather than its association with DPN.

CONCLUSIONS

Most individuals with facial DPN are at risk of developing pterygium and myopia in Ghana. Overall, the associations of pterygium and myopia with age, gender, complexion and sun exposure, suggest a pos-sible multifactorial aetiopathogenic link that has the potential to modulate the development of the afore-mentioned eye conditions in the DPN respondents.

Notwithstanding, certain limitations identified in our work includes the high incidence of pterygium and myopia realized in the DPN participants. This could probably be due to individuals visiting the health sector due to eye complications, since most Ghanaians do not normally go for eye check-up unless complications have developed. Thus, target group from the general population with facial DPN, could give a true representation of the burden of the lesion. Furthermore, the findings on the incidence cannot be generalized in Ghana, since people from different ethnic backgrounds may not be included in this study.

INFORMATION

Consent for publication. Not applicable.

Availability of data and materials. A complete document of this study and its results can be found at the Department of Biomedical Sciences, University of Cape Coast, Cape Coast, Ghana.

Competing interests. The authors declare that they have no competing interests.

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Table 1: Demographic characteristics associated with incidence of pterygium, grade of pterygium, myopia and hypermyopia.

Variable		Pterygium		Grade of pterygium				Myopia		Hypermyopia		Pterygium & Myopia	
	N (100)	*n (%)*	*p-value*	Grade 1 *n (%)*	Grade 2 *n (%)*	Grade 3 *n (%)*	Grade 4 *n (%)*	*n (%)*	*p-value*	*n (%)*	*p-value*	*n (%)*	*p-value*
Age			**0.008****						**0.003****		**0.113**		**<0.001****
20-35	30	16 (53.3)		11 (68.8)	5 (31.3)	0	0	22 (73.3)		1 (3.3)		12 (40)	
36-50	32	26 (81.3)		5 (19.2)	18 (69.2)	1 (3.8)	1 (3.8)	24 (75.0)		4 (12.5)		22 (68.8)	
51-75	38	32 (84.2)		0	1 (2.6)	23 (60.5)	8 (21.1)	38 (100)		0		32 (84.2)	
Gender			0.155						0.479		0.403		**0.009****
Female	58	46 (79.3)		14 (30.4)	15 (32.6)	13 (32.6)	3 (6.5)	50 (86.2)		2 (3.4)		40 (69.0)	
Male	42	28 (66.7)		2 (7.1)	9 (32.1)	11 (39.3)	6 (21.4)	34 (81.0)		3 (7.1)		26 (61.9)	
Complexion			**0.001****						0.571		0.655		**0.001****
Dark	69	58 (84.1)		10 (17.2)	21 (36.2)	18 (31.0)	8 (13.8)	57 (82.6)		3 (4.3)		50 (72.5)	
Light	31	16 (51.6)		6 (37.5)	3 (18.8)	6 (37.5)	1 (6.3)	27 (87.1)		2 (6.5)		16 (51.6)	
Distribution on face			0.995						0.775				0.244
Dispersed	70	52 (74.3)		8 (15.4)	17 (32.7)	20 (38.5)	7 (13.5)	60 (85.7)		2 (2.9)		46 (65.7)	
Localized	30	22 (73.3)		8 (36.4)	7 (31.8)	4 (18.2)	2 (9.1)	24 (80.0)		3 (10.0)		20 (66.7)	
Distribution on other parts			0.310						0.742		0.754		0.366
Fore limbs	4	4 (100)		2 (50.0)	0	1 (25.0)	1 (25.0)	4 (100)		0		4 (100)	
Hind limbs	2	2 (100)		0	2 (100)	0	0	2 (100)		0		2 (100)	
Torso	22	18 (81.8)		2 (11.1)	7 (38.9)	4 (22.2)	5 (27.8)	18 (81.8)		2 (9.1)		16 (72.7)	
None	72	50 (69.4)		13 (26.0)	15 (30.0)	19 (38.0)	3 (6.0)	60 (83.3)		3 (4.2)		44 (61.1)	
Family history			0.566						0.930		0.183		0.193
No	51	39 (76.5)		10 (25.6)	14 (35.9)	11 (28.2)	4 (10.3)	43 (84.3)		4 (7.8)		35 (68.6)	
Yes	49	35 (71.4)		6 (17.1)	10 (28.6)	13 (37.1)	5 (14.3)	41 (83.7)		1 (2.0)		31 (63.3)	
Sun exposure			**<0.001****						0.511		0.489		**<0.001****
Outdoor	55	50 (90.9)		4 (8.0)	20 (40.0)	17 (34.0)	9 (18.0)	45 (81.2)		3 (5.5)		43 (78.2)	
Indoor	45	24 (53.3)		12 (50.0)	4 (16.7)	7 (29.2)	0	39 (86.7)		2 (4.4)		23 (51.1)	

Table 2: Univariate and multivariate analyses for risk factors of pterygium and myopia.

	Pterygium				***Myopia***			
	Univariate analysis		*Multivariate analysis*		*Univariate analysis*		*Multivariate analysis*	
Variables	OR (95% CI)	p-value	AOR (95% CI	p-value	OR (95% CI)	p-value	AOR (95% CI)	p-value
Age								
20-35	1.00		1.00		1.00		1.00	
36-50	3.79 (1.26, 12.63)	**0.022***	6.82 (1.28, 49.16)	**0.036***	1.09 (0.35, 3.45)	0.881	3.05 (0.73, 14.40)	0.136
51-75	4.67 (1.58, 15.39)	**0.007****	7.42 (1.57, 43.19)	**0.016***	1.14 (0.13, 3.68)	0.991	5.48 (1.96, 22.24)	**<0.001****
Gender								
Female	1.00		1.00		1.00		1.00	
Male	0.52 (0.21, 1.29)	0.158	0.11 (0.02, 0.46)	**0.006***	0.68 (0.23, 2.02)	0.481	0.22 (0.01, 0.88)	**0.039***
Complexion								
Dark	1.00		1.00		1.00		1.00	
Light	0.20 (0.08, 0.52)	**0.001****	0.28 (0.07, 1.08)	0.075	1.42 (0.45, 5.45)	0.573	0.76 (0.12, 4.49)	0.761
Distribution on face								
Dispersed	1.00		1.00		1.00		1.00	
Localized	0.95 (0.37, 2.61)	0.921	1.75 (0.46, 7.35)	0.427	0.67 (0.22, 2.15)	0.477	1.33 (0.36, 5.57)	0.677
Family history								
No	1.00		1.00		1.00		1.00	
Yes	0.77 (0.31, 1.89)	0.566	0.41 (0.11, 1.11)	0.149	0.95 (0.32, 2.82)	0.930	0.91 (0.26, 3.27)	0.881
Sun exposure (Occupation)								
Indoor	1.00	**< 0.001****	1.00		1.00		1.00	
Outdoor	8.75 (3.14, 28.81)		4.97 (1.25, 23.44)	**0.028**	0.69 (0.22, 2.04)	0.512	0.17 (0.03, 0.85)	**0.042***

OR: Odds ratio; CI: confidence interval; AOR: Adjusted odds ratio; *$p < 0.05$; **$p < 0.01$