Original Article

Infra-orbital Hyper-pigmentation (Dark Circles): A Study of its Prevalence, Etiology and its Association with Other Dermatological Symptoms among Young Adults

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Abstract

Background: In this modern era, having healthy skin is important because it is the first layer of defense against environmental hazards and can give important clues to overall health. Healthy skin care is essential to treat and prevent many dermatological conditions and keep skin looking younger. Dark circles have become one of the most significant concerns for society. Dark circles under the eyes contribute to a tired, aged, and sad appearance mark the importance of understanding of dark circles for their management.

Objective: This study aims to determine the prevalence of IOHP in our society, to identify potential factors related to its etiology, and to co-relate IOHP with other dermatological symptoms, especially among young adults.

Method: The study had a cross-sectional design; it was analyzed among the age groups of 17–25 years through a questionnaire using a convenient non-probability sampling technique. The estimated sample size was calculated through open epi software.

Results: Total of 373 participants were included for statistical analysis. In participants 75.9% were females and 24.1% were males, mean age was found to be 20.97 SD 1.63 years, and mean weight 56.5 SD 11.4 kg. The prevalence of a high rate of IOHP was 79.1% among young adults and was associated with high psychological stress p=0.05, usage of face wash p=0.01, sunscreen p=0.01, and cosmetics p=0.03. Moreover, different dermatological skin symptoms, such as oily skin p=0.02 and acne/pimples p=0.05, were also found to be significantly associated.

Conclusion: The study identified many factors that were significantly associated with IOHP among young adults, such as the use of face wash and sunscreen cosmetics, high psychological stress, oily skin, and pimples or acne, highlighting the importance of a multidisciplinary approach to treating dermatological conditions.

Keywords: Infrared orbital hyper pigmentation, dark circles, young adults.

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Introduction

Skin care is important for maintaining healthy skin and preventing skin conditions.[1] Proper and healthy skin care can also help to protect against various environmental damage, like from the sun, wind, and environmental pollution.[2] Skin care can also help improve the appearance of skin, giving it a more youthful and vibrant look. Skin problems are common in all age groups, but some skin conditions are more common in certain age groups.[1] A study found the highest number of new dermatological cases in South Asia. Numerous factors, such as a low socioeconomic background, significantly contribute to the burden of skin diseases. Consequentially, Pakistani healthcare, given its limited resources, is more vulnerable to the burden of dermatological diseases.[3] One of the common skincare complaints in modern society is

infra-orbital hyper-pigmentation (IOHP), commonly known as dark circles.[1] Dark circles are characterized by the presence of bilateral homogeneous pigmentation.[4]

Dark circles are a common concern, especially in women between the ages of 16 and 25, up to 47.50%.[5] The reasons behind dark circles vary from individual to individual due to various exogenous and endogenous factors, which also makes their treatment very subjective.[1] The physiological factors identified with the development of IOHP or dark circles are hyperpigmentation, tendency to dilate in orbital vessels, thicker or numerous capillaries, and thinning of periorbital skin. These three factors provide a strong indication for the development of infra-orbital dark circles.[5,6]

The thinning of the skin around the eyes allows the underlying blood vessels to become more visible. This can be exacerbated by inflammation and fluid accumulation in the area or an increase in melanin production (which is a physiological skin pigment).[2] Additionally, we know that the dark circles are a common sign of aging because, as we age, our skin loses collagen and elastin fibers, making the area around our eyes thinner and more fragile.[7]

Chromophores present in our skin that regulate skin pigmentation mainly include melanin levels and oxygen hemoglobin ratios.[5] The study revealed that there was high melanin deposition with a low hemoglobin oxygen ratio in the dark circle area.[1] Dark circles are classified into three types: high pigmented, vascular, and intended dark circles.[2] Dark circles have been recognized as one of major cosmetic concerns.[8,9]

This study aims to determine the prevalence of IOHP in our society, to identify potential factors related to its etiology, and to co-relate IOHP with other dermatological symptoms, especially among young adults. If we determine the factor underlying this impact, we can manage it via awareness and prevention, as opposed to employing skin care products that may result in side effects.

Methods

This cross-sectional study was performed on university students. The open epi software was used to determine the estimated sample size of the study. Participants in the age group of 17 to 25 years who gave the informed consent were included in the study, whereas those participants with any diagnosed with any metabolic, psychiatric, or dermatological active disease or taking medication for any disease, as well as individuals with incomplete questionnaires or who refused to participate, were excluded from the study. The data collection was done between December 5, 2022, and March 1, 2023. Study participation was completely voluntary; participants were allowed to withdraw their participation at any stage of the study. The study got IRB and ERC approval from Liaquat National Hospital and Medical College's review board.

We distributed a questionnaire with a total of 52 questions in the English language. Our questionnaire had three sub-sections: demographic information, perceived psychological stress, and dermatological questions. Perceived stress scale questionnaire (PSSQ).[10] A validated 10-item questionnaire was used to measure the degree to which situations in one's life were appraised as stressful over the last month on a 5-point Likert scale in various conditions: 0= never, 1= almost never, 2= sometimes, 3= fairly often, and 4= very often. The cutoffs used for the PSSC were according to the percentile: individuals scoring less than the 75th percentile had mild psychological stress, and those with more than the 75th percentile were classified among participants with high psychological stress.

Self-reported skin complaints questionnaire (SSCQ): A validated self-reported skin questionnaire[11] with 10 items is used to assess dermatological morbidity on a 4-point Likert scale. 1=no, 2=yes, a little, 3=yes, quite a lot, and 4=yes, very much, which also had questions regarding infra-orbital hyperpigmentation (dark circles). We modified the SSCQ by adding two more conditions, oily skin and hair greying, due to common social concerns.[5] The SSCQ was used to evaluate the

dark circles on the Likert scale, and those who scored 4 on that were categorised as individuals with a high rate of dark circles, and those who reported between 1-3 were classified as individuals with no dark circles, which were considered a control group.

The data was analysed in SPSS version 22. All statistical data is presented in tabular form through the mean and standard deviation. A P-value less than 0.05 is considered statistically significant (P = ≤ 0.05). In order to determine the association between the rate of IOHP and other associated factors and dermatological symptoms, a chi-square test was applied. The odds ratio (OR) was also calculated between the rate of IOHP and other dermatological symptoms.

Results

We finalized 373 participants meeting our inclusion criteria for statistical analysis. Out of which (75.9%) 283 were females and (24.1%) 90 were males, The mean age of participants was 20.97 SD 1.63 years and mean weight of the participants was 56.5 SD 11.4 Kg, and most were found to have a normal range of BMI. The prevalence of IOHP among young adults was 79.1% (n=295).

We studied many lifestyle factors related to the rate of IOHP and found that use of face wash (p = 0.001), sunscreen (p = 0.001), cosmetics (p = 0.003), and a high level of psychological stress (p = 0.005) were significantly associated with the level of IOHP (dark circle). Whereas daily sun exposure, hours of sleep, use of eye cream, smoking, fluid intake, and facial treatment were not associated with the level of IOHP.

We related the level of IOHP with different dermatological skin symptoms evaluated with the help of the SSCQ (self-reported skin complaint questionnaire). Those skin symptoms that were prevalent among the participants were oily skin (68.4%), and pimples or acne (66%). We found a significant association between pimples or acne (p = 0.005) and oily skin (p = 0.02).

Table 1: *Daily lifestyle factors in relation to the level of IOHP (dark circles). Represented in percentage, and P-value.*

Daily Lifestyle Factors		Percentage of Participants %	Rate of Dark Circles		p-value
			High %	Low %	
Daily Sun exposure	**Less than 20 minutes**	52	41.8	10.2	0.678
	More than 20 minutes	48	37.3	10.7	
daily hours of sleep	**Less than 7 hours**	50.4	41	9.4	0.304
	More than 7 hours	49.6	38.1	11.5	
Use of Face wash	**Yes**	75.1	62.5	12.6	0.001*
	No	24.9	16.6	8.3	
Use of Sun screen	**Yes**	57.1	37.5	5.4	0.001*
	No	42.9	41.6	15.5	
Use of Eye cream	**Yes**	5.6	5.1	0.5	0.107
	No	94.4	74	20.4	
Use of cosmetics	**Yes**	25.7	23.1	2.7	0.003*
	No	74.3	56	18.2	
Smoking habit	**Yes**	7	4.8	26	0.059
	No	93	74.3	18.8	
Daily intake of Fluid	**Less than 8 glasses**	81.5	14	4.5	0.192
	More than 8 glasses	18.5	65.1	16.4	
Facial treatment	**Yes**	21.8	62.4	15.9	0.546
	No	78.2	15.8	5.9	
High stress	**Yes**	15.3	14.2	1.1	0.005*
	No	84.7	64.9	19.8	

** P-value ≤0.05 statistically significant*

Table 2: *Dermatological symptoms in relation to the level of IOHP (dark circles). Represented in percentage and P-value.*

Dermatological conditions		Percentage of participants %	Level of Dark circles		p-value
			High%	Low%	
Itchy Skin	Yes	34.6	29.3	5.4	0.062
	No	65.4	49.9	15.5	
Dry/sore rash	Yes	26.3	22.3	4	0.112
	No	73.75	54.8	16.9	
Scaly skin	Yes	20.4	17.4	2.4	0.122
	No	79.6	61.7	18	
Itchy rash on hands	Yes	19	17.2	1.9	0.11
	No	81	61.9	19	
Pimples/acne	Yes	66	55	11	0.005*
	No	34	24.1	9.9	
Other rashes on face	Yes	16.6	14.5	2.1	0.089
	No	83.4	64.6	18.8	
Warts	Yes	8	7	1.1	0.287
	No	92	72.1	19.8	
Troublesome sweating	Yes	39.9	31.9	8	0.763
	No	60.1	47.2	12.9	
Hair fall	Yes	78	64.1	13.9	0.06
	No	22	15	7	
Oily skin	Yes	68.4	57.1	11.3	0.02*
	No	31.6	22	9.7	
Hair graying	Yes	35.4	30.6	4.8	0.11
	No	64.6	48.5	16.1	

** P-value ≤0.05 statistically significant*

Discussion

All dermatological conditions combined were found to be the fourth leading cause of burden of nonfatal disease at the global level. Low-socio-economic countries were also likely to have a higher burden of skin diseases.[12] Infra-orbital hyper-pigmentation (IOHP), commonly known as dark circles a multi-factorial dermatological condition that affect an individual's self-esteem and appearance. Dermatological symptoms are usually multi-factorial making its management very subjective.[13] Recent studies conducted upon the pigmentation around the orbit mostly don't address the basic lifestyle factors.[14] Hence, we conducted a study to investigate this important dermatological condition in our population among young adults.

Our study primarily addressing one of our common society concerns,[5] determining prevalence of infraorbital hyperpigmentation (dark circles) among young adults, along with highlighting factors that cause dark circles in this population. Moreover, to co-relate IOHP with other dermatological symptoms, which may help to treat and relate other dermatological symptoms, this cross-sectional study has collected data from university students between the ages of 17 and 25 after the approval of the LNH Review Committee. Dermatological symptoms, including the level of IOHP, were assessed using a modified version of the SSCQ.

This study included 383 participants, having 3:1 female to male ratio, the mean age of participants was 20.97 SD 1.63 years, and the mean weight was 56.5 SD 11.4 kg. It was revealed that the use of face wash, sunscreen, cosmetics, and a high level of psychological stress were significantly associated with the level of IOHP. Most of

the young adults reported to have dark circles during high stress periods, 14.2% of the participants with high PS had dark circles. A significant association was found between high levels of IOHP and certain dermatological skin symptoms like oily skin (68.4%) and pimples or acne (66%). With respect to the use of such dermatological products and dermatological conditions longitudinal studies are required to understand causal effect relationship.

Previously reported studies showed prevalence of 30.76% between the age group of 16-25 having more female ratio than male, whereas, a clinical study conducted in Pakistan found 53% of the prevalence of dark circles however we found a prevalence of 79.1% in same age group. Studies have also highlighted the relationship between psychological stress, sleep deprivation, fatigue, and alcohol and tobacco use with dark circles.[14,15] Similarly, we found a significant association between psychological stress and IOHP. An association was found between dark circles, eye strain, refractive errors, and eye rubbing, however, we did not studied such factors.[14] Similarly, some studies have found deoxygenated blood and an increase in the thickness, dilation, and number of capillaries in the skin around the eye contributing to dark circles (16,17).Our study did not evaluate the measure of quality of life of patients, although studies have found poor quality of life among people with dark circles, especially among women.[18] Previous studies have shown a strong association between sleep quality and sleep duration; however, in our study we didn't find any statistically significant association between sleep duration and rate of infraorbital hyperpigmentation.[14,16]

Such studies highlight the importance of a multidisciplinary approach to treating IOHP, including both dermatological and psychological perspectives. Addressing the underlying causes of IOHP, can help to improve their prognosis, quality of life and emotional well-being.[19,20]

Cross-sectional studies, which provide a current picture of a population at a specific time period, come with inherent limitations. One of the major constraints is their inability to establish causal effect relation. Secondly, having a self-report questionnaire also increases the risk of participant bias, which can be controlled by having a clinical evaluation of the dermatological symptoms in upcoming studies. Recommendations for the studies include cautious interpretation of associations, employing other sampling techniques to increase representativeness, and implementing standardized measurement tools to minimize biases.

Our study addresses one of the common dermatological concerns of modern society targeting the young adult age group that is often overlooked in the dermatological research. Our study highlights the basic lifestyle factors that might be the potential factors causing IOHP. We also associated the other dermatological symptoms present in our participants with the rate of IOHP, which was a novel association. The potential etiology we studied was mostly modifiable factors linked to basic lifestyle factors. Our study identifies the influence of use of dermatological products and different dermatological treatments on the rate of IOHP.

Conclusion

The study identified many factors which were significantly associated with the prevalence of Infra orbital hyper pigmentation among young adults such as use of face wash sunscreen cosmetics and high psychological stress including some dermatological factors like oily skin and pimples/acne. This marks the importance of interdisciplinary approach in treating such conditions.

Ethical Approval: The study was approved by the Ethical Review Committee of Liaquat National Hospital and Medical College's Ethical Review Board vide reference number # 0912-2023-LNH-ERC.

Conflict of Interest: There was no conflict of interest to be declared by any author.

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Author's Contribution

MHI: Conception & design, analysis & interpretation of data, acquisition of data, drafting of article.

RSK: Acquisition of data, analysis & interpretation of data, drafting of article.

MB: Acquisition of data, analysis & interpretation of data.

SZ: Analysis & interpretation of data, drafting of article, Critical revision for important intellectual content, final approval.

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