

## Patterns, Effects and Outcomes of High Altitude on Skin Diseases in Gilgit Baltistan, Pakistan

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### ABSTRACT

**Objectives:** To determine the effects and outcomes of high altitude on dermatological diseases in patients from Gilgit Baltistan, Pakistan, presenting to a secondary care hospital in Gilgit.

**Study Design:** Descriptive cross-sectional study.

**Place and Duration of Study:** Department of Dermatology, Combined Military Hospital (CMH), Gilgit Baltistan, Pakistan, from Mar 2015 to Mar 2017.

**Methodology:** A total of 4612 patients attending the dermatology OPD from March 2015 to February 2017 were included. Non-residents of Gilgit Baltistan were excluded. Patients were examined by a consultant dermatologist. Diagnoses were primarily clinical, supported where required by skin biopsies, histopathology, laboratory tests, and skin scrapings. Data was analyzed using Statistical Package for the Social Sciences (SPSS) version 11.00 and comparisons were made with other studies.

**Results:** Of 4612 patients, 2738 (59.40%) were female and 1874 (40.60%) were male (Female: Male ratio of 1.5:1). Eczemas were most common (22.80%), followed by pigmentary disorders (18.60%). Noninfectious diseases (71.00%) predominated over infectious diseases (29.00%). Seasonal variation was evident, with more patients attending in summer (60.40%) than in winter (39.60%).

**Conclusion:** High-altitude climate significantly influences dermatological disease patterns. Findings can help guide health advisories, preventive strategies, and resource allocation. Photo protection and effective moisturization are important preventive measures.

**Keywords:** Eczema, Gilgit Baltistan, High altitude, Pigmentation disorders, Skin disease

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### INTRODUCTION

To date, no published data exist on the frequency or distribution of skin diseases in high-altitude regions of Gilgit-Baltistan, Pakistan, with elevations ranging from 1,500 to 2,500 meters, even though studies have been conducted on the same subject in other parts of the country but not in this region with an estimated population of 1.8 million<sup>1</sup>. This population is sparsely distributed with limited availability of medical facilities especially in higher altitude areas, with less oxygen saturation and higher exposure to ultraviolet (UV) light, lower humidity levels, extreme temperatures in winter (17°C to -30°C) and high wind velocity which makes the living conditions in these areas difficult<sup>2</sup>. Skin diseases are influenced by many geographical attributes along with economic status<sup>3</sup> and occupation such as, mountaineers, soldiers, trekking teams, miners, pilgrims, and porters<sup>4</sup>. The aim of the study was to know the effects of high altitude on the patterns of skin disorders prevalent in

Gilgit Baltistan keeping in mind its geographical location and weather conditions.

### METHODOLOGY

This descriptive cross-sectional study was conducted at Department of Dermatology, Combined Military Hospital (CMH), Gilgit Baltistan, Pakistan after obtaining ethics clearance for the study from the Institutional Ethics Review Board (ERC/IERB No. 04/01/2015). Informed consent was obtained from all patients or their guardians prior to inclusion in the study, in accordance with institutional standards. The study was carried out over a two-year period, from March 2015 to March 2017. Sample size was estimated using the formula ( $n = Z^2p(1-p)/d^2$ ) at 95% confidence level, with a conservative occurrence of  $p = 0.50$  and a margin of error of  $d = 0.02$ , the required sample size calculated was 2401 while the achieved sample size was 4612, exceeding this requirement, thereby, ensuring more precise estimates. Non-probability purposive sampling was employed and all eligible patients, who presented during the study period to Dermatology outpatient clinic, and belonged to Gilgit-Baltistan, were included in the study.

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**Inclusion Criteria:** Patients belonging to either gender, of all ages, both new and follow-up, and belonging to Gilgit-Baltistan, were included.

**Exclusion Criteria:** Non-residents of Gilgit-Baltistan and patients with incomplete records were excluded.

The primary mode of diagnosis was clinical; however, histopathology and laboratory investigations were undertaken whenever required to confirm the diagnosis. Data was analyzed by using Statistical Package for Social Sciences (SPSS) 22.00. Qualitative data was represented by using percentage and frequency.

### RESULTS

Of total 4612 patients, 1874(40.63%) were male and 2738(59.37%) were female, with female to male ratio being 1.5:1. The frequency of skin diseases differed in males and female where most common diseases among male patients were eczemas 533(28.8%), and viral warts 277(14.97%) while most common diseases among female patients were pigmentation disorders 607(22.58%) and eczemas 580(21.18 %), as shown in Table I.

**Table-I: Gender wise distribution of diseases (n=4612)**

Diseases	Male n (%)	Female n (%)
Eczema/Dermatitis	473(25.72%)	580(21.54%)
Pigmentation disorders	252(13.70%)	607(22.54%)
Viral Infections	363(19.74%)	318(11.81%)
Acne and Related	91(4.95%)	478(17.75%)
Papulosquamous Dermatitis	186(10.11%)	192(7.13%)
Fungal Infections	186(10.11%)	170(6.31%)
Bacterial Infections	147(7.99%)	152(5.64%)
Urticaria and Angioedema	81(4.40%)	95(3.53%)
Hair Disorders	60(3.26%)	101(3.75%)

Overall, the commonest diseases were eczemas 1053(22.83%) and pigmentation disorders 859(18.62%). Noninfectious diseases predominated 3276(71.00%) while infectious diseases were lesser (n=1336, 28.96%). Amongst the infections, viral infections were the most common 681(50.97%) followed by fungal infections 356(26.65%). More patients attended dermatology clinic in summers 2786,(60.40 %) as compared to winters 1826(39.60 %) with details on disease frequency shown in Table II.

### DISCUSSION

In our study, female patients outnumbered male patients with a ratio of 1.5:1, which was also noted in many recently published studies<sup>5-10</sup> however, in one study, the ratio of male to female was 1.4:1, due to the peculiar cultural and social norms of that region<sup>9</sup>. In our study, noninfectious diseases were more common

than infectious diseases, consistent with findings of other studies where infective diseases was much higher (44.73%) than our study (28.96%)<sup>3,10</sup>. A study from northern areas of India also shows that non infective causes were the most common reason of skin diseases<sup>11</sup>. Climate and geography also affect the epidemiology of skin diseases<sup>12</sup> because with changing seasons, there is a change in temperature, humidity and ultraviolet rays which can have a detrimental effect on the epidermal barrier while warm and humid environmental conditions are conducive to the development of fungal infections<sup>13-15</sup>. In our study, more patients attended dermatology clinics in summers (60.40%) than in winters (39.60%) which is consistent with other studies in Pakistan<sup>3, 4</sup> but contrary to an international study<sup>9</sup>. In addition, studies from the Himalayas have documented a wide range of high-altitude dermatoses including xerosis, pernio, and UV-induced disorders<sup>16</sup>. Experimental data also suggest that hypoxia at high altitude alters cutaneous vascular responses, potentially exacerbating dermatological problems<sup>17</sup>. Furthermore, in high-altitude forested regions such as Peru, environmental conditions increase the risk of infectious dermatoses such as cutaneous leishmaniasis, underscoring the unique epidemiological challenges faced in mountain populations<sup>18</sup>.

**Table II: Seasonal Variation in Skin Diseases (n=4612)**

Diseases	Total n (%)	Winter n (%)	Summer n (%)
Eczema/Dermatitis	1053 (22.83%)	487 (46.25%)	566 (53.75%)
Pigmentation Disorders	859 (18.63%)	363 (42.26%)	496 (57.74%)
Viral Infections	681 (14.77%)	257 (37.74%)	424 (62.26%)
Acne and Related	569 (12.34%)	149 (26.19%)	420 (73.81%)
Papulosquamous Dermatitis	378 (8.20%)	184 (48.68%)	194 (51.32%)
Fungal Infections	356 (7.72%)	107 (30.06%)	249 (69.94%)
Bacterial Infections	299 (6.48%)	109 (36.45%)	190 (63.55%)
Urticaria and Angioedema	176 (3.82%)	36 (20.45%)	140 (79.55%)
Hair Disorders	161 (3.49%)	104 (64.60%)	57 (35.40%)
Others	80 (1.73%)	30 (37.50%)	50 (62.50%)

### LIMITATIONS OF STUDY

This study has several limitations. Being a descriptive cross-sectional design, it provides only a snapshot of dermatological disease patterns and cannot establish causality or temporal relationships between high-altitude exposure and skin conditions. The diagnoses were mainly clinical, with limited histopathological and laboratory confirmation, which may introduce diagnostic misclassification for some disorders. Additionally, the findings are confined to a single secondary-care center in Gilgit, so they may not fully represent all of Gilgit-Baltistan or other high-altitude populations, and seasonal factors (such as higher summer attendance) may have influenced the observed distribution of diseases.

### CONCLUSION

High-altitude environmental conditions in Gilgit Baltistan significantly shape the pattern of dermatological diseases, with eczemas and pigmentary disorders being the most common presentations and noninfectious diseases predominating over infectious ones. The marked seasonal variation, with higher patient attendance in summer, points to the impact of intense ultraviolet radiation and climatic extremes on skin health.

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### Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AHM & MA: Data acquisition, data analysis, critical review, approval of the final version to be published.

NSZ: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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