

Hair Loss in Medical Students: A Global Approach

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Abstract—Across the globe, medical students recognize hair loss as a growing cause of concern; however, data exploring this issue is very limited. This study aims to explore the prevalence of hair loss amongst medical students as well as its common causes, treatments and management techniques. The influence of Covid-19 on hair loss was also examined. Using social media as a platform, an online survey was conducted which consisted of 20 questions. Responses from 1382 medical students were recorded, after receiving informed consent. It was interesting to note that more local medical students are experiencing hair loss ($p=0.0001$) as compared to students studying abroad ($p=0$). The results indicated that hair loss in males was a consequence of increasing age, whereas in females, stress was recognized as the major factor. A large number of participants experienced hair loss for more than a year. It is noteworthy that despite dealing with hair loss for a prolonged period, most medical students do not seek treatments for their hair loss. Majority of participants stated that their hair loss had a negative impact on their lives in terms of their overall self-esteem and frame of mind. It can be concluded that stress and various health conditions were the primary cause of hair loss in foreign medical students ($p<0.0001$) and local medical students ($p=0.0001$). This comprehensive experimental study reveals that a significant proportion of medical students around the world experience hair loss and effective methods should be placed in the future to prevent its growing incidence.

Keywords—hair loss; medical students; global; stress; telogen effluvium.

I. INTRODUCTION

Throughout the history of humanity, for centuries, hair has played an important role in symbolizing virility, intellect, and sexuality. Hair is also associated with social status and is important for one's cultural identity as is evident from the ancient Egyptians, imperial China, Native American culture, and many more. [1, 2] In the 21st century, hair plays just as important a role. Therefore, it is understandable the psychological impact hair loss can have. We aim to investigate the phenomena of hair loss in medical students, undeniably one of the groups of society subjected to considerable stress.

Stress releases cytokines, including tumor necrosis factor (TNF α) and interferon-gamma (IFN γ), which regulate both innate and adaptive immune responses. These cytokines shift the cellular adaptive immune response to type 1 T helper (TH1). Prolonged exposure to stress has been shown to drive epithelial and mesenchymal cells in the skin into apoptosis or senescence. It also causes the premature termination of hair growth resulting in stress-induced alopecia; telogen effluvium. [3] Highly stressed medical

students are also known to experience a myriad of other effects such as oily, waxy patches on the scalp, dry or itchy rashes, acne, trichotillomania, and hyperhidrosis. [4]

Beyond stress, several other factors may contribute to alopecia in medical students such as environmental factors including humidity, wind, air pollution, and strong sunlight resulting in dryness, rough surface texture, increased stiffness and brittleness, and decreased color and luster. [5,6,7] The study by Misery et al in 2008 defines “Sensitive Scalp Syndrome” caused as a result of air pollution. [8]

Hair care practices are critical in maintaining healthy hair. Daily shampooing removes the cuticle, the protective layer of sebum covering the hair shaft, causing it to dry out and become more prone to damage by friction. [5] Other physical causes include excessive use of heat and friction from hair accessories and towel drying. Chemical causes of hair damage are frequent bleaching, perming, and hair dyeing, and incorrect or excessive use of hair care products. [5, 7]

Moreover, due to hectic lifestyles, and living away from home, leading to poor diets, medical students may also suffer from micronutrient deficiencies. Micronutrients are vital for healthy hair follicle development and immune cell function. [9] Iron deficiency is a well-known cause of hair loss, with vegans and vegetarians at an increased risk. [5] Along with low iron levels, low intake of vitamin C and vitamin D are observed in telogen effluvium and androgenetic alopecia, two common types of hair loss. [9]

It is also important to consider androgenetic alopecia as the cause of hair loss in medical students as the majority of men begin to lose hair in their twenties, overlapping with the age group of most medical students. [10] People genetically predisposed to androgenetic alopecia have a higher production of dihydrotestosterone, and higher levels of 5 alpha-reductase and androgen receptors in their scalp. [11] Typically, men lose hair from the vertex and frontotemporal regions of their scalp while women experience more diffuse hair loss at the center of their scalp. [10, 11]

In light of the COVID-19 pandemic, it is also noteworthy that female patients have reported new-onset diffuse hair loss, telogen effluvium, secondary to SARS-CoV-2 infection. Though self-limiting, it is important to acknowledge this emotionally and physically distressing condition. [12]

II. METHODS

An observational study was conducted in the form of an online survey to gather information on how stress plays a major role in hair loss seen in medical students. The survey was conducted and shared over social media platforms. Some of the questions asked in the survey among many were about their demographic information, age, gender, hair type; if they experienced hair loss, and for how long, type of alopecia, and other scalp conditions; underlying health problems, precautionary measures and treatments, family history, hair styling methods. We also asked them to rate their stress levels, and got insight about their overall feelings of themselves towards hair loss. After obtaining this data and analysing it, we compared our p-values with our previously published paper and other similar articles from literature available on online databases.

III. RESULTS

A total of 1382 participants consented to fill the survey. Among them 56.2% (n=776) were local medical students and 43.8% (n=606) were foreign medical students. The majority of the participants belonged to South Asian ethnicity, followed by Arabs and Europeans. Most of the participants were from medical schools in India and Georgia, with significant participation from Pakistan, Malaysia, Sri Lanka, and the USA. The mean age among the participants was 21. The female participants comprised 64.6% (n=893) while the males comprised 35.4% (n=489).

Among the local medical students, 69.3% (n=537) were females. The majority of them described themselves as having wavy hair, followed by straight hair. 90.1% (n=484) of them experienced hair loss and 9.9% (n=53) did not experience any hair loss. Amongst those with hair loss, 68.6% (n=332) experienced hair loss for more than a year. Most participants reported their hair loss to be a consequence of androgenic alopecia or telogen effluvium. The majority of the participants, 52.9% (n=256), experienced scalp conditions like dandruff. 43.2% (n=209) reported having none of the scalp conditions. A large proportion of the participants, 71.3% (n=345) did not consult a physician while only 28.9% (n=140) consulted a physician. Most participants stated that their hair loss had a negative impact on their student life and affected their self-confidence and performance.

30.7% (n=238) of the local medical students were male participants. The vast majority described themselves as having straight hair, followed by wavy hair. 19.7% (n=47) did not report any hair loss while 80.3% (n=191) reported hair loss. 73.8% (n=141) of those that had hair loss experienced it for more than a year. The most common types of hair loss were hereditary pattern baldness and androgenic alopecia. Similar to the trends among the female participants, 51.8% (n=99) experienced dandruff while 45.5% (n=87) had no scalp conditions. 63.3% (n=121) did not consult a physician and the remaining 36.6% (n=70) did consult a physician. A majority reported their hair loss to negatively impact their life.

The foreign medical students included 58.5% (n=354) female participants. Most of them described their hair type as wavy, followed by straight hair. 10.7% (n=38) did not experience hair loss while 89.3% (n=316) experienced hair loss. About 74.4% (n=235) of participants reported hair loss lasting more than a year. Telogen effluvium followed by androgenic alopecia was stated as the most common type of alopecia. Dandruff was reported as a scalp condition among 52.2% (n=165) participants while 46.2% (n=146) reported not having any scalp issues. 75% (n=237) of the participants did not consult a physician whereas 25% (n=79) consulted a physician. Most participants described their hair loss to have a negative impact on their lives.

Male population among foreign medical students comprised 41.5% (n=251). The hair type most commonly described was straight followed by wavy hair. Hair loss was experienced by 66.5% (n=167) of them while the remaining 33.5% (n=84) had no hair loss. Those that experienced hair loss for more than a year were 72.5% (n=121). Most participants reported their hair loss to be a consequence of hereditary pattern baldness or telogen effluvium. 48.5% (n=81) did not have any scalp conditions while those with dandruff accounted for 49.1% (n=82) of the total participants. Majority, 74.3% (n=124) did not consult a physician while 25.7% (n=43) consulted a physician. Most participants stated that their hair loss negatively impacted their lives.

Overall 73.1% (n=356) (fig-1) of male participants have reported hair loss.

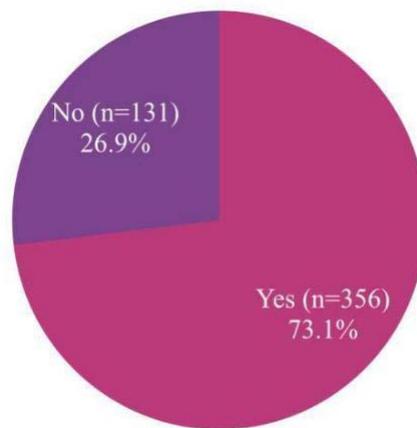


Fig 1 - Male participants experiencing hair loss

73.8% (n=265) of the male participants did not take any treatment (fig-2). 26.2% (n=94) male participants did take treatment in the following order of usage: minoxidil, medicated shampoos, cosmetic procedures like PRP, and supplements like biotin.

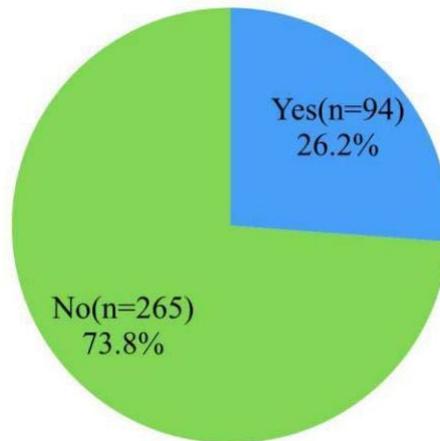


Fig 2 - Male Participants receiving treatment

For 54.5% (n=58) (fig-3) participants the treatments have been described as effective. For 45.5% (n=36) however, the treatments were ineffective. A majority of 53.8% (n=193) did not take any precautionary measures to control their hair loss while 46.2% (n=166) do take measures. An overwhelming majority of 90.3% (n=324) participants are concerned about future hair loss.

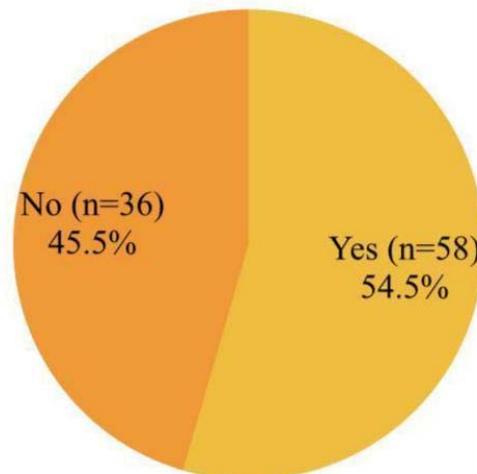


Fig 3 - Treatment effectiveness in male participants

The vast majority, comprising 81% (n=648) (fig-4) of the female participants are not taking any treatments to control their hair loss.

The 19% (n=152) participants that did take treatment relied on supplements like biotin, home remedies (Ayurveda, hair oils, etc.), medicated shampoos, and minoxidil. 65.1% (n=99) (fig-5) of the participants have stated that their treatment has been effective while 34.9% (n=53) have stated the opposite. Precautionary measures were taken by 50.4% (n=403) participants whereas 49.6% (n=397) participants did not take any. 91.6% (n=733) of women expressed concerns about more hair loss in the future.

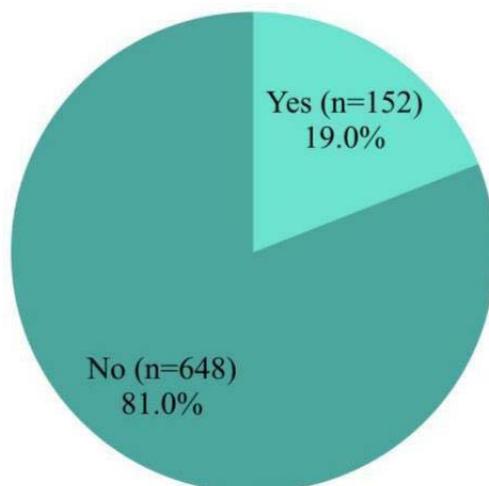


Fig 4 - Female participants receiving treatment

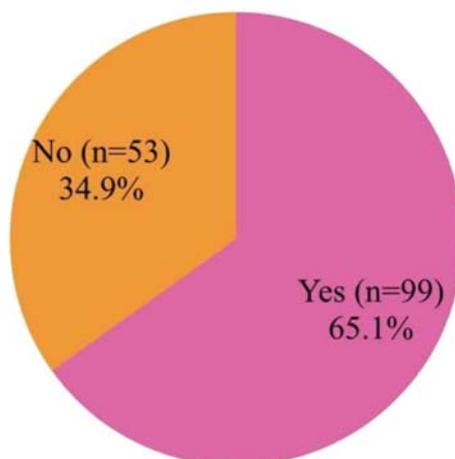


Fig 5 - Treatment effectiveness in female participants

Among males experiencing hair loss, 78.6% (n=302) have no micronutrient deficiencies. Of those suffering from micronutrient deficiencies, vitamin D deficiency is reported at the highest followed by vitamin B deficiency. The majority do not take any supplements and those who do, take multivitamins, vitamin D, vitamin C and/or protein powders. 97.4% (n=374) participants do not suffer from hypothyroidism and 98.7% (n=379) participants do not suffer from diabetes mellitus. 59.6% (n=229) participants report a positive family history while 40.4% (n=155) saw no relation to family history. The majority of the participants followed a non-vegetarian diet, closely followed by vegetarian and Mediterranean diets. Most participants stated that they do not use heat on their hair and amongst those that do, the majority did not use a heat protectant. 42.2% (n=162) of participants washed their hair every day followed by 21.4% (n=82) washed their hair on alternate days. 52.9% (n=203) of participants use sulphate free shampoo and 94.5% (n=363) have never bleached or dyed their hair.

Among males without hair loss, 86.3% (n=113) have no micronutrient deficiencies. Vitamin D followed by vitamin B12 were the most common micronutrient deficiencies observed among those that had deficiencies. The majority do not take any supplements and those that do, take multivitamins, vitamin C, protein powders, and/or omega 3. 97.7% (n=128) do not suffer from hypothyroidism and 99.2% (n=130) do not suffer from diabetes mellitus. 57.3% (n=75) say that they do not have a family history

of hair loss while 42.7% (n=56) do have a positive family history. The most common diets included non-vegetarian followed by vegetarian and Mediterranean. A majority of the participants do not use heat on their hair, and among those that do, the majority do not use a heat protectant. 48.8% (n=64) washed their hair every day followed by 20.6% (n=27) washed their hair on alternate days. 52.7% (n=69) of participants use sulphate free shampoo and 95.4% (n=125) have never bleached or dyed their hair.

A total of 89.5% (n=799) female participants reported to experience hair loss as medical students. (fig-6).

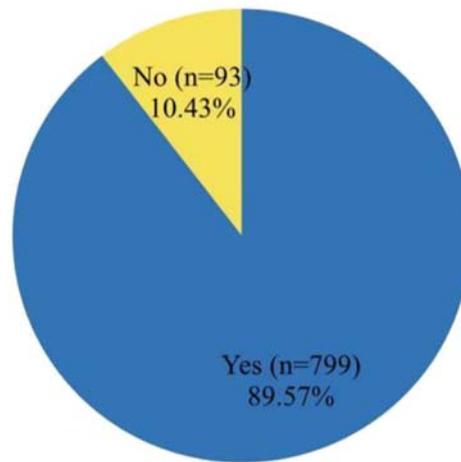


Fig 6 -Female participants experiencing hair loss

Women experiencing hair loss included 54.3% (n=434) that did not have any micronutrient deficiencies, 29.4% (n=235) participants with iron deficiency, and 23% (n=184) with vitamin D deficiency. The majority of the participants did not take any supplements followed by those that take multivitamins, vitamin D and vitamin C. 93.9% (n=751) do not suffer from hypothyroidism, 78.8% (n=630) do not suffer from PCOS and 99.8% (n=798) do not suffer from diabetes mellitus. 61.9% (n=495) did not observe a family history of hair loss while 38.1% (n=305) have a family history of hair loss. Most consumed diets included non-vegetarian followed by vegetarian and Mediterranean. Most participants stated that they do not use heat on their hair and amongst those that do, the majority did not use a heat protectant. 35.4% (n=283) of participants washed their hair twice a week followed by 22% (n=176) who washed their hair on alternate days. 53.4% (n=427) participants use sulphate free shampoo and 85.9% (n=687) have never bleached or dyed their hair.

Among females who did not experience hair loss, the majority of 59.1% (n=55) do not have any micronutrient deficiency. Vitamin D deficiency was seen among 26.9% (n=25) participants followed by iron deficiency among 21.5% (n=20) participants. The majority of the participants did not take any supplements followed by those that took multivitamins, vitamin D, vitamin C, and iron supplements. 95.7% (n=89) participants do not suffer from hypothyroidism, 91.4% (n=85) do not suffer from PCOS and 97.8% (n=91) do not suffer from diabetes mellitus. The majority of 67.7% (n=63) do not have a positive family history of hair loss while 32.3% (n=30) do. Most participants had non-vegetarian diets followed by vegetarian and Mediterranean diets. Most participants stated that they do use heat on their hair and the majority that do, do not use a heat protectant. 30.1% (n=28) of participants washed their hair twice a week followed by 23.7% (n=22) washed their hair on alternate days. The majority of 51.6% (n=48) participants use sulphate free shampoo and 74.2% (n=69) have never bleached or dyed their hair.

Males experiencing hair loss described their stress levels as high while males not experiencing hair loss described having moderate stress levels. Similarly, females experiencing hair loss described their stress levels as high and those without hair loss stated that they had moderate stress levels.

Among the male participants with hair loss 27.3% (n=105) were infected with Covid-19 and 72.7% (n=279) were not. As for the female participants with hair loss, 79.9% (n=639) have not been infected with Covid-19 while 20.1% (n=161) have been affected. Among the participants who were infected with Covid-19, 45% (n=127) did experience hair loss whereas 55% (n=155) did not.

IV. DISCUSSION

In this study, we discuss hair loss, its different types, some of the most common causes, and its effects. Hair loss, or scientifically known as alopecia, occurs when new hair does not grow back once shed. It is a chronic inflammatory/immune mediated disorder, which usually affects the hair follicles. [13] On average a healthy person can lose anywhere between 50 to 200 strands of hair a day. [14] Failure of new growth replacing the old one daily is what concerns us. Hair loss can be seen anywhere where hair follicles are present, be it the body, scalp or both. Hair loss of the latter, also known as baldness, is what worries almost all of us. Hair loss can be temporary or permanent. [13] It may be due to varied reasons and therefore can manifest differently depending on the cause. It can be a gradual change or can occur abruptly. It can affect just your scalp or your entire body. Most

common signs indicating hair loss are hair thinning, circular or patchy bald spots, sudden loosening of hair after a physical or emotional shock, scaling round patches with broken hair, and red, inflamed skin, seen in fungal infections, and receding hairline. Furthermore, scalp conditions such as dandruff and psoriasis accompany hair loss quite often, and full body hair loss is usually seen in patients undergoing chemotherapy or using certain medications. The reasons are numerous that lead to hair loss. They can be genetic/hereditary, hormonal changes and medical conditions, medications and supplements, deficiencies, poor nutrition, radiation therapy, hair styling products, age, and the primary focus of our study, stress. [15]

Our previous work discusses how stress has an impact on our hair growth patterns, but the study was limited to foreign medical students. [22] In this paper, we gathered results globally by asking medical students from different years around the world questions about their hair loss. We also give importance to gender wise result sorting because there has been evidence that hair fall affects the genders differently.

Both stress and age play significant roles in determining the hair loss in both genders. While stress affects the hair loss pattern in both genders, it is predominant in women, whereas age plays a greater role in men due to their relation with androgenic pattern baldness. By age 30, one in four is balding and by the age of 60, two in three men are balding or bald. [16]

During our study, we found out that globally all our participants had complaints of hair fall due to exceedingly high levels of stress during their study course. Almost all medical students share common complaints of having increased hair fall after starting their studies. One is emotional stress; the type of stress students may have due to exams, work or relationship problems. The other type is medical stress, which patients experience after having surgery or after being in a car accident. Hair loss caused due to stress is usually an environmental factor and is usually of two types: alopecia areata and telogen effluvium. In a normal, healthy person's scalp, about 85% of the hair follicles are actively growing hair (anagen hair) and about 15% are resting hair (telogen hair). A few hairs may also be in catagen. Anagen phase lasts for four years or so, and then rests for about four months. New anagen hair begins to grow under the resting telogen hair and pushes it out. Then, a shock to the system can cause as many as 70% of the anagen hairs to go back to the resting state or the telogen phase thus reversing the ratio. [17] In the past 10 years, more studies prove that stress can cause a range of diseases, hair loss being one of them. [18] Researchers say that there exists a positive correlation between stress and cortisol levels in hair. [19, 20] Stress be it physical, mental or psychological, especially seen in students stressing over their studies and career is enough to lead to hair loss which, reported by many in our survey, impacts their life negatively, weighing down on their confidence and self-esteem. A previously done study on the relation between exam stress and cytokines shows that students preparing and appearing for exams have higher levels of T helper cell 1 as compared to the students not having exams. Stress exposure kick starts neurogenic inflammation, which induces adaptive immunity cytokine-imbalance characterized by a shift to Type 1 T-helper cell cytokines. An increase in TH1 cytokine hampers hair growth and leads to apoptosis of epithelial cells. [3]

However, there is definitely still a possibility that it may not always be stress that is causing hair loss in students. Of course other factors such as medical health conditions, family history or change in diet or geography are responsible in their own way for hair fall as seen in some percentage of our participants who had micro and macro nutrient deficiencies, and other scalp problems such as dandruff that are usually predisposing factors to poor scalp health. However, none in our study reported any serious underlying health problems. Geography and change in environment, such as change in the food and water we consume too plays a decent role in this. However, as seen in our study, surprisingly more local medical students are experiencing hair loss ($p=0.0001$) as compared to international students or students studying abroad ($p<0.0001$). This means that change in the environment may not necessarily lead to hair loss. In comparison to our previous paper published on hair loss where we targeted foreign medical students studying in Tbilisi, Georgia [21], this study throws light on the possibility that irrespective of geography, students are under a

concerning amount of stress, especially when staying away from family or studying abroad that is causing hair loss undoubtedly. What is still unclear is whether a change in environment accelerates or decelerates this process.

TABLE 1- HAIR LOSS IN LOCAL MEDICAL STUDENTS

	Local Medical Students		
Sex	<i>Participants experiencing hair loss (n)</i>	<i>Participants not experiencing hair loss (n)</i>	
Male	191	47	p=0.001
Female	485	53	

TABLE 2 - HAIR LOSS IN INTERNATIONAL MEDICAL STUDENTS

	International Medical Students		
Sex	<i>Participants experiencing hair loss (n)</i>	<i>Participants not experiencing hair loss (n)</i>	
Male	167	84	p<0.0001
Female	316	38	

Hair loss is always a concerning issue for all genders especially females and losing hair poses a great perceived threat to their femininity. This leads females to seek medical and non-medical hair care to prevent hair from falling. [22] But according to our survey, very few students sought treatment or visited their dermatologists possibly due to the high cost, and students usually do not have time, patience and money to maintain a proper sleep schedule, diet and treatment and tend to switch to home remedies and cheaper treatments without consulting their dermatologists. In recent years due to the advancement in technology and gadgets used for styling the hair, the damage done is inevitable and too drastic.

A few participants who suffered from Covid-19 started experiencing hair fall after testing positive, the reason being the disease itself or the treatment is still unclear. Though, COVID-19 is infamous for causing respiratory distress and pulmonary damage, recent studies have shown its role in cutaneous manifestations and hair loss. A recent study showed that COVID-19 patients had concerns of increased hair loss following SARS-CoV-2 infection. The patients were all female, with no previous history of hair loss, belonged to diverse ethnicity, and had an average age of 60. All patients had lab work confirming COVID-19; some reported mild symptoms while others, severe disease requiring hospitalization. All the patients experienced excessive hair loss within weeks to months after being diagnosed, which included hair coming out in large clumps and thinning along the frontal hairline.

Doctors believe that the physical and emotional stress that accompanies a case of COVID-19 may lead to telogen effluvium which could have been due to any stressful events related to covid-19 ranging from high fever to emotional distress or major surgery. The condition is known to occur a few months, mostly 2-3 months after a stressful event such as emotional distress, major surgery, high fever or severe infective episodes triggering telogen effluvium. As mentioned earlier, cytokine-storm, here induced by the infection, can damage hair-producing matrix cells and lead to the development of telogen effluvium. [24] There were also a few drug induced TE cases where anticoagulant drugs like enoxaparin triggered telogen effluvium 3 weeks after administration and resolved 1 month after its suspension. [25,26] While the Centre for Disease Control and Prevention (CDC) does not include hair loss on its list of COVID-19 symptoms, doctors say there's compelling evidence that it can be a long-term effect from the illness.

V. LIMITATIONS

There was more participation from local students as compared to international students. Local students were medical students studying in their home country. Students belonging to this category were Georgians, Indians, Pakistanis, Malaysians, Sri Lankans, Arabs, and others. The foreign medical students comprised of students studying abroad in countries like the USA, Georgia, and other European countries. More participation from foreign medical students would have given us more information on the correlation between complex lifestyles of medical students and their hair loss.

Despite our count being 1382 participants, the sample size is small and is not sufficient to prove or conclude the hypothesis of stress levels in medical students having adverse effects on scalp health and hair loss. Therefore, individual scalp analysis should be done to confirm the incidence of hair loss.

The year/semester of the medical students was not asked which could have helped us in understanding if the final years were more stressful and directly proportional to hair damage and loss.

Stress too was a limitation as a parameter, since it is a subjective matter, so it's not a good indicator in and of itself.

The survey itself posed some limitations, as some participants complained about not being able to find their ethnicity or gender that they identified with in the list, nor were given the option of being able to add it under other.

VI. CONCLUSION

Thus far, it is evident that hair loss affects a significant number of medical students, both foreign and local, with the leading causes being telogen effluvium and hereditary pattern baldness. The vast majority have also said that their hair loss negatively

affects their mood, and an overwhelming proportion is concerned about further hair loss in the future. Therefore, it is concerning that the majority, 81% of female participants and 73.8% of male participants, are not seeking any treatment to control their hair loss given their background of medical knowledge.

This may be due to the lack of time and money, given their student status and busy schedules. Dermatologists and clinical aestheticians can provide treatments and medications to help prevent and reverse hair loss such as PRP, topical minoxidil, and finasteride, which can help to avoid surgical hair transplantation as a last resort. It is common knowledge that various multivitamin supplements are available over the counter (OTC), and some participants are taking Vitamin C, Vitamin D, biotin, and iron supplements to support their hair growth. However, it is important to identify the cause of one's hair loss and target treatment for that cause.

We encourage medical students with hair loss to investigate and understand the cause, the type of alopecia, and the available treatments for this condition, which can be physically, psychologically, and socially debilitating.

VII. FUNDING

We have spent a total of 11\$ on social media platforms like Instagram and Facebook to share the survey. This research received no external funding.

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