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THE EFFECTIVENESS OF A DIHYDROTESTOSTERONE BLOOD TEST IN THE DIAGNOSIS OF ANDROGENETIC ALOPECIA.

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Abstract. The study group had miniaturized hair follicles, increased hair shedding, a shining yellow spot around the hair shaft, and an oily scalp, whereas the control group had normal hair growth patterns. Dihydrotestosterone (DHT) is important in the pathogenesis of androgenetic alopecia, but DHT levels in patients' serum did not rise during the study. This study should be replicated in different regions and countries to determine the precise role of genetics and other factors in the development of androgenetic alopecia.

Keywords: androgenetic alopecia, dihydrotestosterone, diagnostic

Introduction

Androgenetic alopecia is a type of hair loss that affects both men and women. Men present with hair thinning in the temporal areas (producing a characteristic M shape) that advances to the crown (vertex) area as the alopecia progresses. Women usually have more diffuse thinning in the crown area and are less commonly presented with a male-type pattern. The diagnosis is clinical and based on recognizing the pattern of hair loss. In addition to the pattern of hair loss, healthcare professionals may also consider other factors such as the patient's age, family history, and any accompanying symptoms to confirm the diagnosis of androgenetic alopecia. Furthermore, physicians may use additional tools like dermoscopy or trichoscopy to further evaluate the scalp and hair follicles for a more accurate assessment [1, 2].

The issue that we are dealing with in this research is whether the amount of DHT in the blood of people with androgenetic alopecia increases. Also, can checking the amount of DHT in the blood be used as a basis for the diagnosis of androgenetic alopecia? Understanding the relationship between DHT levels and androgenetic alopecia is crucial for developing effective treatment strategies. Additionally, if a correlation is found between DHT levels in the blood and androgenetic alopecia, it could provide a non-invasive diagnostic tool for early detection and intervention.

This correlation could potentially lead to the development of targeted therapies that specifically address DHT levels, ultimately improving outcomes for individuals with androgenetic alopecia. Furthermore, monitoring DHT levels in the blood may also help in assessing the effectiveness of treatment interventions and adjusting them accordingly [3,4].

In this study, I attempted to replicate a comparable study conducted in 2014 at the Medical University of Lodz, Poland, with a few changes. The difference in our experiment is in the groups that were chosen. We conducted research for the men in two groups. The previous study conducted at the Medical University of Lodz focused on both men and women in their research groups. However, in our experiment, we specifically chose to conduct research solely on men. This difference allows us to explore potential gender-specific effects and draw more targeted conclusions regarding the male population [5].

The study aimed to assess whether serum DHT levels differ significantly between patients with androgenetic alopecia and individuals in the control group. Additionally, it aimed to determine

if there is a correlation between serum DHT levels and the severity of hair loss in patients with androgenetic alopecia [6].

What is DHT?

Dihydrotestosterone is a testosterone tissue metabolite. It is generated as a result of the 5α-reductase enzyme, which occurs in two isoforms. Type 1 5α-R is mostly found in the sebaceous glands and the epidermis, although it is also found in sweat glands, hair follicles, endothelial cells, and Schwann cells in nerve myelin sheaths, whereas type 2 5α-R is mostly found in hair follicles (inner layer, infundibulum, and sebaceous glands) Isoenzyme 5α-R type 2 is primarily responsible for the conversion of circulating testosterone to DHT [7].

Fetal development and DHT

The differentiation of male or female sexual anatomy occurs during fetal development because of a particular and distinctive hormonal environment. In males, DHT works in conjunction with other hormones, such as testosterone, to prevent the development of the female anatomy and promote the growth of the male anatomy.

The development of a fetus' male external genitalia, which include the penis and scrotum, depends on DHT. Furthermore, DHT aids in prostate development [8].

Hair Cycle and Androgenetic Alopecia

The anagen to telogen ratio is reduced in androgenetic alopecia because the length of anagen shortens with each cycle while telogen stays the same or grows longer. Patients with balding frequently describe times when their hair sheds excessively, which is most obvious when brushing or washing. This results from a relative rise in the number of follicles in telogen.

Because the rate of hair growth is essentially constant, hair length is determined by the length of the anagen phase. The length of each hair shaft is thus decreased with each successively foreshortened hair cycle. An empty follicular pore results when the anagen period is too short for the growing hair to grow long enough to reach the skin's surface. A higher percentage of empty hair follicles are present, which contributes to balding, as the kenogen phase, also known as the lag phase or the delayed replacement of telogen hair, seems to last longer in male androgenetic alopecia. Furthermore, male androgenetic alopecia prolongs the latent phase of the kenogen cycle, which results in fewer hairs and speeds up the balding process [9]. Traditional Male androgenetic alopecia models predict that follicular miniaturization takes place gradually, but this theory has recently been called into question. Individual hair shaft cross-sectional areas remain constant throughout fully developed anagen, indicating that the size of the hair follicle and its dermal papilla does not change. Furthermore, a decrease in anagen duration results in shorter hair length, whereas an increase in telogen duration delays regeneration and results in hairs that are so thin and short that they do not reach the scalp's surface [10].

The genetic factor of Androgenetic Alopecia

Male androgenetic alopecia is probably an autosomal dominant disorder characterized by variable gene penetrance and multigenic effects [11].

Methods

The study included 35 participants. The study group included 25 patients with male pattern hair loss who volunteered between January 2022 and December 2022 and were being treated by Dr. Soheil Beitollahalakbar in the Yerevan hair clinic.

A history, clinical examination, and trichoscopy were used to make the initial diagnosis of androgenic alopecia. The study group included 25 men ranging in age from 21 to 50; their androgenetic alopecia's stages ranged from V to VII.

The control group included 10 healthy male volunteers who did not have hair loss. The patients in the control group ranged in age from 20 to 51 years. The control group underwent the same history, clinical examination, and trichoscopy procedures as the study group to ensure accurate comparisons.

A complete history was taken in all patients, consisting of personal data, the patient's age at the onset of hair loss, the duration and pattern of hair loss, the cause of hair loss based on patient description, such as past medical history, stress, lifestyle, improper hair care, medications, and family history of alopecia, as well as any details concerning the applied treatment, for example, minoxidil and its effectiveness.

During the clinical investigation, the patients' scalp, hair, and skin were inspected objectively as well as using trichoscopy to look for evidence of seborrhea and other scalp problems or diseases. The Hamilton-Norwood scale was used to assess the degree of alopecia in males with male androgenetic alopecia. The patients were also asked about any symptoms they experienced, such as itching or hair loss patterns. Additionally, their overall health and any underlying medical conditions were taken into consideration during the assessment.

The serum concentrations of dihydrotestosterone were measured in both groups. (Control group and patients' group).

Results

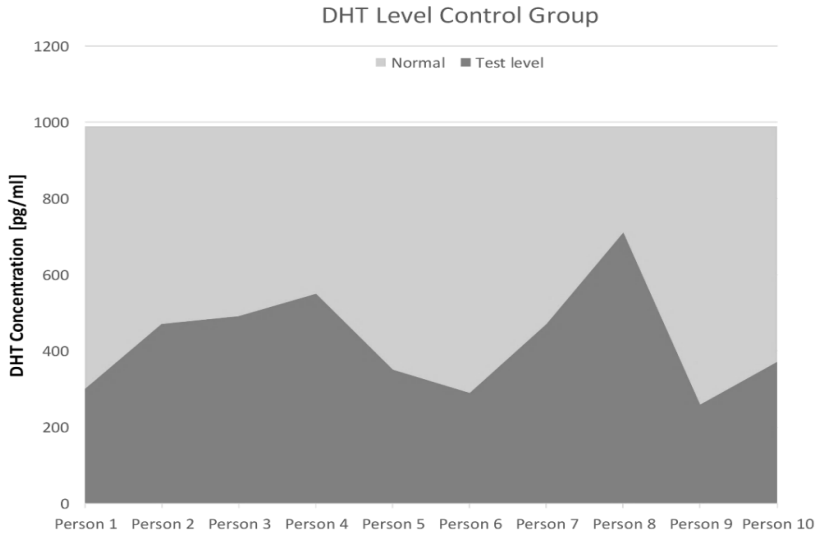
In the clinical examination of the groups, the study group all agreed about the history of androgenic hair loss in their family, but less so in the control group. This disparity suggests a potential genetic predisposition to androgenic hair loss in the study group. However, further investigation is needed to determine the exact role of genetics in this condition and to establish any other contributing factors.

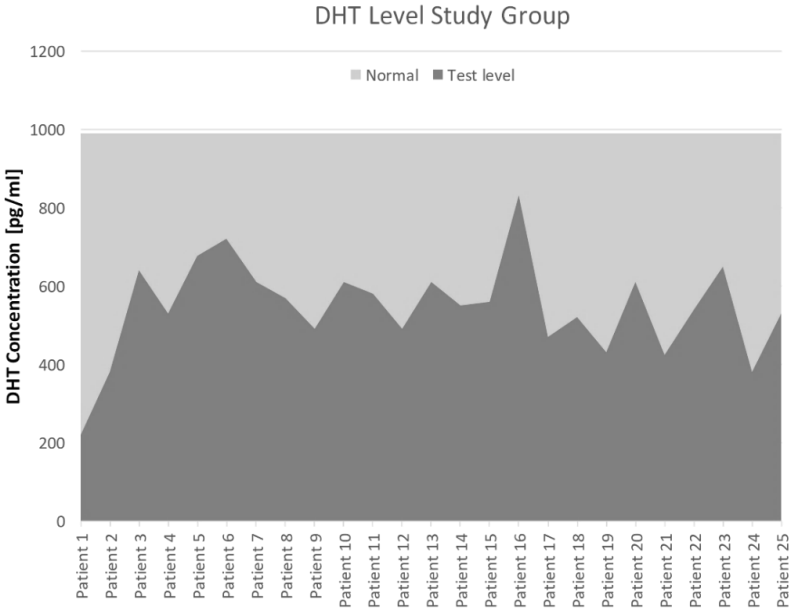
There was no inverse or direct correlation between smoking, alcohol consumption, and androgenetic alopecia in either group due to the stark differences in these behaviors. Additionally, the study found that age did not significantly impact the occurrence of androgenic hair loss in either group. However, it should be noted that most cases of the onset of hair loss are reported between the ages of 18 and 19, and the active process can be detected up to the age of 36. However, among the volunteers, some exceptions were found. The rate of development of the process varied greatly; for instance, in a 34-year-old patient with androgenetic alopecia grade five, while in another with androgenetic alopecia grade seven, the patient was only 24. This suggests that factors other than age may play a more prominent role in the development of this condition. Further research is necessary to identify these potential factors and understand their influence on androgenetic alopecia.

Only 30% of the patients in the study showed improvement after applying topical minoxidil. Almost all of the patients stopped their treatments gradually. A few patients had their medicine stopped due to side effects. The majority of patients discontinued due to drug ineffectiveness and aversion to this topical therapy approach. These findings suggest that while topical minoxidil may have some efficacy in treating androgenetic alopecia, it is not a universally effective solution for all patients. This highlights the need for alternative treatment options that address the underlying

factors contributing to this condition and are better tolerated by patients. Further research should focus on developing personalized therapies that target specific factors involved in the development of androgenetic alopecia, potentially leading to more successful outcomes and improved patient adherence.

The results of the trichoscopy examination revealed significant differences between the study group and the control group. The study group showed characteristic signs of androgenic alopecia, such as miniaturized hair follicles, increased hair shedding, a shining yellow spot around the hair shaft, and an oily scalp, while the control group exhibited normal hair growth patterns. These findings suggest that the study group may be experiencing symptoms specific to androgenic alopecia, which could be contributing to their hair loss. Additionally, the presence of an oily scalp in the study group further supports the diagnosis of androgenic alopecia, as excessive sebum production is commonly associated with this condition.





According to this past research, "5-alpha reductase enzyme activity, which converts testosterone to dihydrotestosterone (DHT), increases in balding scalp", "Blocking conversion of testosterone to DHT delays progression of AGA,", "Number of DHT receptors on the hair follicles increases in balding scalp" and "DHT increases in balding scalp". The serum levels of dihydrotestosterone and our predicted outcomes suggested that many study participants would have levels of the hormone that were significantly higher than those in the control group were. However, both groups' serum levels of DHT showed a very large range of variation. It should also be noted that all the results were within the standard range. The standard serum DHT concentrations are based on diagnostic Laboratory

Female: premenopausal = 24–368 pg/ml postmenopausal = 10–181 pg/ml

Male: 250-990 pg/ml

These reference ranges are used to assess and monitor the levels of DHT in individuals. It is important to note that these values may vary slightly depending on the specific laboratory and testing methods used.

Conclusion

DHT has a particular molecular form that allows it to bind to its own receptors located on the nucleus of the cell. The binding of DHT to the nucleus sends a message to the cells: the signal to produce sebum. Sebum is an oily substance that plays a crucial role in keeping the skin and hair moisturized. This signal triggers the cells to increase sebum production, leading to oilier skin and hair. Although dihydrotestosterone (DHT) plays an important role in the pathogenesis of androgenetic alopecia, we discovered that the concentration of DHT in our patients' serum did not increase during our investigation; however, this research was limited to one area (Armenia), and it should be repeated in different regions and countries. It is unclear and possibly useless to measure serum DHT levels in order to diagnose androgenetic alopecia, and it is likely that genetic factors play a role in the DHT's ability to bind to susceptible follicles.

Topical minoxidil is not effective for all patients with androgenetic alopecia, and nearly all of the patients discontinued their treatments gradually.

Alcohol consumption, smoking, and androgenetic alopecia were not associated in an inverse or direct manner with each other in this study. I found no significant correlation between alcohol consumption or smoking habits and the occurrence of androgenetic alopecia. These findings suggest that other factors may be responsible for the development of this condition.

It is also important to note that all-degree of androgenetic alopecia was accompanied by a shining yellow spot around the hair shaft, an oily scalp. This shining yellow spot around the hair shaft and oily scalp are common characteristics observed in individuals with all degrees of androgenetic alopecia. These symptoms are believed to be caused by an excess production of sebum; a natural oil produced by the scalp.

Acknowledgment

Finally, I would like to express our sincere gratitude to all of the study participants who so kindly gave of their time, experiences, and insights. I am very appreciative of their participation because it was crucial to the project's success that they were willing to participate in the study.

Overall, without the assistance and contributions of so many people, this research project would not have been possible. I want to express our sincere gratitude to everyone who made this project possible and our hope that the field will benefit from the insights I have to offer.

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Բեյթոլահալաքբար Ս. - ԴԻՀԻԴՐՈՏԵՍՏՈՍՏԵՐՈՆԻ ԱՐՅԱՆ ԹԵՍՏԻ ԿԻՐԱՌՄԱՆ ԱՐԴՅՈՒՆԱՎԵՏՈՒԹՅՈՒՆԸ ԱՆԴՐՈԳԵՆԵՏԻԿ ԱԼՈՊԵԿԻԱՅԻ ԱԽՏՈՐՈՇՄԱՆ ՄԵՋ. Հետազոտման ենթակա խումբն ուներ մանր մազային ֆոլիկուլներ, մազաթափության բարձր մակարդակ, փայլուն դեղին կետ մազի արմատի շուրջ և յուղոտ գլխամաշկ, մինչդեռ ստուգիչ խումբն ուներ մազերի աճի նորմալ ձևեր: Դիհիդրոտեստոստերոնը (DHT) կարևոր է անդրոգենետիկ ալոպեցիայի պաթոգենեզում, սակայն հիվանդների շիճուկում DHT-ի մակարդակը հետազոտության ընթացքում չի բարձրացել: Այս ուսումնասիրությունը պետք է կրկնվի տարբեր տարածաշրջաններում և երկրներում՝ որոշելու ժառանգական և այլ գործոնների ճշգրիտ դերը անդրոգենետիկ ալոպեցիայի զարգացման մեջ:

Հիմնաբառեր՝ անդրոգենիկ ալոպեցիա, դիհիդրոտեստոստերոն, ախտորոշում

Бейтоллахалакбар С. - ЭФФЕКТИВНОСТЬ АНАЛИЗА КРОВИ НА ДИГИДРОТЕСТОСТЕРОН В ДИАГНОСТИКЕ АНДРОГЕНЕТИЧЕСКОЙ АЛОПЕЦИИ. У исследуемой группы были миниатюрные волосяные фолликулы, повышенное выпадение волос, блестящее желтое пятно вокруг стержня волос и жирная кожа головы, тогда как у контрольной группы волосы росли нормально. Дигидротестостерон (ДГТ) играет важную роль в патогенезе андрогенной алопеции, но уровни ДГТ в сыворотке пациентов не повышались во время исследования. Это исследование необходимо повторить в разных регионах и странах, чтобы определить точную роль генетики и других факторов в развитии андрогенетической алопеции.

Ключевые слова. андрогенетическая алопеция, дигидротестостерон, патогенез