

ORIGINAL CONTRIBUTION

# The relation between androgenetic thin hair diagnosed by trichoscope and benign prostatic hyperplasia

Khaled Mohey Eldin Monib PhD | Mohamed Saber Hussein MD  |  
Wael Saber Kandeel MD

Faculty of Medicine, Benha University,  
Benha, Egypt

\*Correspondence

Mohamed Saber Hussein, Department of  
Dermatology and Andrology, Faculty of  
Medicine, Benha University, Banha, Egypt.  
Email: mammsaber@yahoo.com

## Summary

**Background:** Androgenetic alopecia carries a major cosmetic disfigurement and benign prostatic hyperplasia is associated with many urinary tract symptoms and both diseases are mediated by dihydrotestosterone.

**Objectives:** The study aimed to determine the relationship between hair diameter in androgenetic alopecia diagnosed, by trichoscope, to benign prostatic hyperplasia symptoms and signs.

**Methods:** Fifty androgenetic alopecia males and 50 normal males as control were included. We used trichoscope for hair examination, transrectal ultrasound for prostate volume, and urodynamic inspectoscope for urinary symptoms, serum total testosterone, dihydrotestosterone, and total prostatic specific antigen were measured in blood samples. All participants answered the International prostate symptom score questionnaire and the International Index of Erectile Function score questionnaire.

**Results:** A significant difference between patient and control groups was detected as regards hair thickness ( $P = 0.001$ ), prostatic volume ( $P = 0.013$ ), urinary symptoms, prostatic specific antigen level ( $P = 0.015$ ). A significant difference was detected between thin ( $<0.03$  mm,  $n = 26$ ) and medium to thick hair ( $>0.03$ ,  $n = 24$ ) subgroups of patients as regards age ( $P = 0.001$ ), dihydrotestosterone level ( $P = 0.001$ ), testosterone level ( $P = 0.001$ ), and urinary symptoms ( $P = 0.001$ ).

**Conclusion:** Androgenetic alopecia patients with thin hair diagnosed by trichoscopy are more prone to prostatic enlargement and its related symptoms. Androgenetic alopecia severity can be diagnosed by trichoscopy in addition to Hamilton-Norwood scale.

## KEYWORDS

androgenetic alopecia, thin hair, trichoscope

## 1 | INTRODUCTION

Benign prostatic hyperplasia (BPH) and androgenetic alopecia (AGA) are well-known androgen-dependent conditions.<sup>1</sup> Testosterone is converted to potent androgen dihydrotestosterone (DHT) by 5-alpha reductase enzyme.<sup>2</sup> The 5-alpha reductase enzyme type II

present in the hair follicle and 5-alpha reductase enzyme type I & II in prostate are involved in pathogenesis of AGA and BPH, respectively.<sup>3</sup> DHT binds to the androgenic receptor on the hair follicle and transforms the terminal hairs to vellus hairs.<sup>4</sup> DHT regulates the balance between the cell synthesis and apoptosis in adult male prostate.<sup>5</sup>

Trichoscopy (dermoscopy of hair) is a non-invasive, in-vivo technique that replaced invasive (biopsy), semi-invasive (trichogram), or non-invasive methods of AGA diagnosis (hair count, weighing shed hair, and pull test).<sup>6</sup> Among early diagnostic feature of AGA are a progressive reduction in hair shaft diameter<sup>7</sup> and hair shaft diameter variation of more than 20% hair shafts.<sup>8</sup>

The main objective of this comparative controlled study was to determine the relationship between hair diameter in AGA and BPH symptoms and signs.

## 2 | MATERIAL AND METHODS

The study included fifty males suffering from AGA and fifty normal males as control. Approval for this study was obtained from the Research Ethics Committee in our institute. Inclusion criteria included the following: early onset of AGA age before 35 years, patients older than 40 years, and any AGA on Hamilton-Norwood scale from V to VII.<sup>4,9</sup> Exclusion criteria included the following: any medical problem that may affect the results of the study as history of prostate cancer or neurogenic bladder, any systemic diseases or other skin diseases, and any history of previous treatment with minoxidil® (in the previous 6 months), testosterone, 5 alpha-reductase inhibitors or alpha blocker. After thorough personal history taking, all participants signed an informed consent and then were subjected to the following.

### 2.1 | At our dermatology department

Hair examination was done by trichoscope using Tricho Science Pro®4 device. In each patient, one image at 20× fold magnification and four images at 70× fold magnification were taken each of following four areas: frontal, occipital, right temporal, and left temporal. Hair thickness was measured at 70× fold magnification, in direct proximity to follicular orifices. Hairs have been identified as "thin hairs" (below 0.03 mm), "medium-sized hairs" (0.03-0.05 mm), and "thick hairs" (above 0.05 mm).

**TABLE 1** The collective data of patients and control group

Characteristics	Patients group (n = 50)			Control group (n = 50)		t test	P
	Mean ± SD	Range	Mean ± SD	Range			
Age	60.76 ± 10.29	44-80	61.26 ± 11.15	45-83	0.027	0.870	
Hair thickness (mm)	0.03 ± 0.001	0.02-0.06	0.069 ± 0.001	0.06-0.08	22.226	0.001 <sup>*</sup>	
PSA (ng/mL)	2.43 ± 0.91	0.14-4.7	0.97 ± 1.05	0.13-3.76	2.336	0.015 <sup>*</sup>	
Testosterone (pg/mL)	3.55 ± 1.88	0.35-7.8	4.54 ± 1.46	1.6-7.8	3.522	0.065	
DHT (ng/mL)	414.4 ± 85.36	119.14-1585.24	329.34 ± 35.5	129.5-536.2	1.301	0.258	
Prostatic volume (mL)	42.21 ± 20.19	15.01-112	28.29 ± 9.57	16-45	6.335	0.013 <sup>*</sup>	
Q <sub>max</sub> (mL/s)	9.33 ± 1.85	0.0-23	17.34 ± 7.8	0.0-26.8	12.558	0.001 <sup>*</sup>	
IPSS	26.24 ± 8.43	6-35	18.26 ± 10.12	7-35	17.415	0.001 <sup>*</sup>	
IIEF	11.04 ± 6.04	5-23	18.46 ± 7.52	6-25	15.224	0.001 <sup>*</sup>	

DHT, dihydrotestosterone; IPSS, International prostate symptom score.

\*A significant P value is < 0.05.

### 2.2 | At the urology department

Patients answered for International prostate symptom score (IPSS) questionnaire and the International Index of Erectile Function score (IIEF-5) questionnaire. IPSS quantify seven voiding symptoms from a score of 0-5 and the maximum score was 35 while the minimum IIEF score was 5 and the maximum was 25. Transrectal ultrasound (TRUS) used to determine the prostate volume. After a minimum of 4 hours without urination, urodynamic inspectoscope (Andromeda–Ellipse) was used to determine the maximum urine flow rate (Q<sub>max</sub>), urination time, and urine volume. Q<sub>max</sub> regarded as normal if >10 mL/s.

### 2.3 | Laboratory tests

We measured serum total testosterone (The DRG® Testosterone ELISA Kit, DRG International, Inc., Springfield, NJ, USA), DHT (The DRG® Dihydrotestosterone ELISA Kit, DRG International, Inc.), and total prostatic specific antigen (PSA) (The CanAg® PSA EIA kit, Fujirebio Diagnostics AB, Göteborg, Sweden) in blood samples drawn from patients and control between 8 and 9 AM after a 12-hour fasting period.

Benign prostatic hyperplasia was diagnosed using the following criteria: prostate volume >30 mL (by TRUS), peak urinary flow rate <15 mL/s, mean urinary flow rate <10 mL/s, void volume more than 150 mL (by urinary flowmetry), and PSA <10 ng/mL.

### 2.4 | Statistical analysis

The program used was SPSS version 16 (IBM, Armonk, New York, NY, USA). Quantitative data were analyzed using mean and standard deviation, while frequency and percentage used with qualitative data. Student's t test was used to compare the means of different groups. Pearson correlation test was used to analyze the relationship between two variables (ANOVA). A value was non-significant difference (NS) if P > 0.05 and significant (S) if P < 0.05.

### 3 | RESULTS

Table 1 shows that there was a statistically significant difference between patient and control groups as regards hair thickness measured by digital trichoscopy ( $P = 0.001$ ),  $Q_{\max}$  ( $P = 0.001$ ), IPSS score ( $P = 0.001$ ), IIEF score ( $P = 0.001$ ), PSA level ( $P = 0.015$ ), and prostatic volume ( $P = 0.013$ ). On the other hand, there was non-significant difference between both groups as regards age ( $P = 0.870$ ), testosterone ( $P = 0.065$ ), and DHT level ( $P = 0.258$ ).

In patients group (Table 2), the prostate volume showed a significant positive correlation with age ( $r = 0.413$ ,  $P = 0.001$ ), PSA level ( $r = 0.334$ ,  $P = 0.009$ ), DHT level ( $r = 0.486$ ,  $P = 0.001$ ), and IPSS score ( $r = 0.690$ ,  $P = 0.001$ ). On the other hand, the prostate volume showed a significant negative correlation with testosterone ( $r = -0.411$ ,  $P = 0.001$ ), IIEF score ( $r = -0.748$ ,  $P = 0.001$ ), and  $Q_{\max}$  ( $r = -0.442$ ,  $P = 0.001$ ). Age of patients showed a significant positive correlation with DHT ( $r = 0.532$ ,  $P = 0.001$ ) and a significant negative correlation with testosterone ( $r = -0.558$ ,  $P = 0.001$ ).

Patients were divided into two subgroups according to hair thickness measured by digital trichoscopy (Table 3). There was a statistically significant difference between thin ( $<0.03$  mm,  $n = 26$ ) and medium to thick hair ( $>0.03$  mm,  $n = 24$ ) subgroups as regards age ( $P = 0.001$ ), DHT level ( $P = 0.001$ ), testosterone level ( $P = 0.001$ ), and  $Q_{\max}$  ( $P = 0.001$ ).

According to prostatic volume measured by TRUS, patients were divided into two subgroups (Table 4). There was a statistically significant difference between normal ( $<30$  mL,  $n = 14$ ) and enlarged prostate ( $>30$  mL,  $n = 36$ ) subgroups as regards hair thickness ( $P = 0.024$ ), age ( $P = 0.025$ ), testosterone level ( $P = 0.001$ ), DHT level ( $P = 0.019$ ), PSA level ( $P = 0.001$ ), IPSS score ( $P = 0.002$ ), IIEF ( $P = 0.003$ ) score, and  $Q_{\max}$  ( $P = 0.001$ ).

Binary logistic regression analysis showed a strong association between thin diameter ( $<0.03$  mm) and prostate volume  $>30$  mL (odds ratio = 0.852, 95% confidence interval = 0.354–1.966,  $P = 0.042$ ) after adjusting for age, IPSS,  $Q_{\max}$ , and IIEF score (Table 5).

**TABLE 2** Correlations between the prostate volume and other variables in patients group

Variables	Prostate volume	
	<i>r</i>	<i>P</i> value
Age	0.413	0.001*
PSA	0.334	0.009*
Testosterone	-0.411	0.001*
DHT	0.486	0.001*
$Q_{\max}$	-0.442	0.001*
IPSS	0.690	0.001*
IIEF	-0.748	0.001*

DHT, dihydrotestosterone; IPSS, International prostate symptom score.

\*A significant *P* value is  $< 0.05$ .

### 4 | DISCUSSION

Hair follicle are miniaturized by DHT in genetically predisposed individuals.<sup>1</sup> DHT regulates the prostate function in adult men. The relationship between AGA and BPH were previously studied with many conflicting results. Consistent with other reports, in our study AGA patients compared to controls, the prostatic volume was larger,<sup>2,3</sup> testosterone showed a non-significant difference that was consistent with other studies,<sup>3,10</sup> while it was lower<sup>11</sup> or higher in another study.<sup>12</sup> We also found a significant difference as regards IIEF score which was inconsistent with a previous report<sup>3</sup> that can be explained by the different mean age of study participants. On the other hand, our results were consistent with that study as regards PSA level,  $Q_{\max}$  value, and IPSS score. In another report which included 6.3% of patients with severe AGA alopecia (Grade VI-VII), AGA showed no relationship with PSA level, IPSS, and prostate volume.<sup>13</sup>

Androgenetic alopecia is characterized trichoscopically by the increased proportion of vellus hairs ( $<0.02$  mm) and thin ( $<0.03$  mm), hair shaft thickness heterogeneity, perifollicular hyperpigmentation, and the presence of yellow dots.<sup>8</sup> Our AGA patients with thin hair had a significantly enlarged prostatic volume. A higher prevalence of AGA was reported in enlarged prostate patients.<sup>2</sup> We detected a higher DHT in AGA patients with thin hair. Bang et al,<sup>12</sup> reported a relation between AGA severity and higher DHT but that relation was denied in an older report.<sup>14</sup> We found a lower testosterone level in patients with thin hair compared to patients with moderate to thick hair. The correlation between AGA severity and total testosterone was found in a previous report<sup>12</sup> and was not reported in another.<sup>15</sup> We found that patients with thin hair had higher mean age and lower  $Q_{\max}$  than patients with moderate to thick hair. In a previous report, AGA severity was correlated to age, but it was not associated with urinary symptom score.<sup>16</sup>

Benign prostatic hyperplasia was linked to DHT, total testosterone level, and PSA in many studies. We found that AGA patients with an enlarged prostate have a significantly higher DHT level consistent with Liao et al.<sup>17</sup> Moreover, we detected a positive correlation between the enlarged prostate and DHT. We found a significant negative correlation between prostate volume and serum testosterone that was consistent with one report<sup>18</sup> but other reports denied that.<sup>19,20</sup> We found a positive correlation between prostate volume and PSA level that was consistent with other reports.<sup>19-22</sup> Many reports showed the significant positive correlations that we found between the prostate volume and age,<sup>19,20</sup> IPSS,<sup>3,19,23,24</sup>  $Q_{\max}$ ,<sup>3</sup> and erectile function.<sup>25</sup>

In conclusion, AGA patients with thin hair diagnosed by trichoscopy are more prone to prostatic enlargement and its related symptoms. AGA severity can be diagnosed by trichoscopy in addition to Hamilton-Norwood scale. The therapeutic effects of 5- $\alpha$  reductase enzyme inhibitors on AGA and the prostatic volume at the same time should be further studied. More studies are needed to answer the following question if patients with early-onset AGA started treatment early will avoid the risk of BPH in later life?

	Hair thickness by trichoscopy (mm)		t test	P value
	Thin hair <0.03 mm (n = 26)	Medium to thick hair >0.03 mm (n = 24)		
Age	68.42 ± 6.88	52.45 ± 5.99	8.336	0.001*
DHT	531.39 ± 65.52	287.67 ± 33.9	9.335	0.001*
Testosterone	1.09 ± 2.42	4.77 ± 1.81	30.225	0.001*
Q <sub>max</sub> (mL/s)	5.20 ± 0.98	13.80 ± 6.40	11.224	0.001*

DHT, dihydrotestosterone.  
\*A significant P value is < 0.05.

Variables	Prostatic volume (mL)				t test	P value
	<30 mL (n = 14)		>30 mL (n = 36)			
	Mean	SD	Mean	SD		
Age	50.07	5.04	64.91	8.68	2.336	0.025 <sup>*</sup>
Hair thickness (mm)	0.04	0.007	0.026	0.006	3.259	0.024 <sup>*</sup>
PSA (ng/mL)	0.61	0.37	3.14	1.25	6.336	0.001 <sup>*</sup>
Testosterone (pg/mL)	5.37	1.84	2.84	1.37	28.603	0.001 <sup>*</sup>
DHT (ng/mL)	308.26	94.44	455.68	52.2	4.526	0.019 <sup>*</sup>
Q <sub>max</sub> (mL/s)	17.95	3.95	5.98	1.63	7.635	0.001 <sup>*</sup>
IPSS	18.78	6.63	33.30	6.3	6.332	0.002 <sup>*</sup>
IIEF	17.85	4.89	8.38	4.05	5.334	0.003 <sup>*</sup>

DHT, dihydrotestosterone; IPSS, International prostate symptom score.  
\*A significant P value is < 0.05.

**TABLE 5** Binary logistic regression analysis as regards prostate volume >30 mL

	OR	95% CI	P value
Hair thickness (mm)	0.852	0.354-1.966	0.042
Age (y)	0.536	0.142-2.36	0.048
IPSS	1.336	0.529-3.25	0.036
Q <sub>max</sub> (mL/s)	1.412	1.412	0.024
IIEF	1.663	1.01-3.41	0.039

## ACKNOWLEDGMENTS

Many thanks to all the individuals who participated in this study.

## CONFLICT OF INTEREST

The authors are responsible for all the current study content and have no conflicts of interest.

## ORCID

Mohamed Saber Hussein  <https://orcid.org/0000-0002-4066-5790>

**TABLE 3** Comparison between patients' subgroups as regards hair thickness measured by trichoscopy

**TABLE 4** Comparison between patients' subgroups as regards the prostatic volume

## REFERENCES

- Ellis JA, Sinclair R, Harrap SB. Androgenetic alopecia: pathogenesis and potential for therapy. *Expert Rev Mol Med*. 2002;4:1-11.
- Chen W, Yang CC, Chen GY, Wu MC, Sheu HM, Tzai TS. Patients with a large prostate show a higher prevalence of androgenetic alopecia. *Arch Dermatol Res*. 2004;296:245-249.
- Arias-Santiago S, Arrabal-Polo MA, Buendía-Eisman A, et al. Androgenetic alopecia as an early marker of benign prostatic hyperplasia. *J Am Acad Dermatol*. 2012;66:401-408.
- Hamilton JB. Patterned loss of hair in man: types and incidence. *Ann N Y Acad Sci*. 1951;53:708-728.
- Carson 3rd C, Rittmaster R. The role of dihydrotestosterone in benign prostatic hyperplasia. *Urology*. 2003;61:2-7.
- Jain N, Doshi B, Khopkar U. Trichoscopy in alopecias: diagnosis simplified. *Int J Trichology*. 2013;5:170-178.
- Courtois M, Loussouarn G, Hourseau C, Grollier JF. Aging and hair cycle. *Br J Dermatol*. 1995;132:86-93.
- Lacarrubba F, Dall'Oglio F, Rita Nasca M, Micali G. Videodermatoscopy enhances diagnostic capability in some forms of hair loss. *Am J Clin Dermatol*. 2004;5:205-208.
- Norwood OT. Male pattern baldness: classification and incidence. *South Med J*. 1975;68:1359-1365.
- Dogramaci AC, Balci DD, Balci A, et al. Is androgenetic alopecia a risk for atherosclerosis? *J Eur Acad Dermatol Venereol*. 2009;23:673-677.
- Stárka L, Cermáková I, Dusková M, Hill M, Dolezal M, Poláček V. Hormonal profile of men with premature balding. *Exp Clin Endocrinol Diabetes*. 2004;112:24-28.

12. Bang HJ, Yang YJ, Lho DS, Lee WY, Sim WY, Chung BC. Comparative studies on level of androgens in hair and plasma with premature male-pattern baldness. *J Dermatol Sci*. 2004;34:11-16.
13. Dastgheib L, Shirazi M, Moezzi I, et al. Is there a relationship between androgenic alopecia and benign prostatic hyperplasia? *Acta Med Iran*. 2015;53:30-32.
14. Demark-Wahnefried W, Lesko SM, Conaway MR, et al. Serum androgens: associations with prostate cancer risk and hair patterning. *J Androl*. 1997;18:495-500.
15. Faydaci G, Bilal E, Necmettin P, Fatih T, Asuman O, Uğur K. Baldness, benign prostate hyperplasia, prostate cancer and androgen levels. *Aging Male*. 2008;11:189-192.
16. Severi G, Sinclair R, Hopper JL, et al. Androgenetic alopecia in men aged 40–69 years: prevalence and risk factors. *Br J Dermatol*. 2003;149:1207-1213.
17. Liao M, Huang X, Gao Y, et al. Testosterone is associated with erectile dysfunction: a cross-sectional study in Chinese men. *PLoS One*. 2012;7:e39234.
18. Marberger M, Roehrborn CG, Marks LS, Wilson T, Rittmaster RS. Relationship among serum testosterone, sexual function, and response to treatment in men receiving dutasteride for benign prostatic hyperplasia. *J Clin Endocrinol Metab*. 2006;91:1323-1328.
19. Liu CC, Huang SP, Li WM, et al. Relationship between serum testosterone and measures of benign prostatic hyperplasia in aging men. *Urology*. 2007;70:677-680.
20. Kim SW. Prostatic disease and sexual dysfunction. *Korean J Urol*. 2011;52:373-378.
21. Chang YL, Lin AT, Chen KK, et al. Correlation between serum prostate specific antigen and prostate volume in Taiwanese men with biopsy proven benign prostatic hyperplasia. *J Urol*. 2006;176:196-199.
22. Tsukamoto T, Masumori N, Rahman M, Crane MM. Change in International Prostate Symptom Score, prostate-specific antigen and prostate volume in patients with benign prostatic hyperplasia followed longitudinally. *Int J Urol*. 2007;14:321-325.
23. Wang JY, Liu M, Zhang YG, et al. Relationship between lower urinary tract symptoms and objective measures of benign prostatic hyperplasia: a Chinese survey. *Chin Med J (Engl)*. 2008;121:2042-2045.
24. Zhang SJ, Qian HN, Zhao Y, et al. Relationship between age and prostate size. *Asian J Androl*. 2013;15:116-120.
25. Rosen R, Altwein J, Boyle P, et al. Lower urinary tract symptoms and male sexual dysfunction: the multinational survey of the aging male (MSAM-7). *Eur Urol*. 2003;44:637-649.

**How to cite this article:** Monib KME-D, Hussein MS, Kandeel WS. The relation between androgenetic thin hair diagnosed by trichoscope and benign prostatic hyperplasia. *J Cosmet Dermatol*. 2018;00:1–5. <https://doi.org/10.1111/jocd.12835>