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Androgenetic Alopecia as a Marker of Metabolic Syndrome

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Authors' contributions

This work was carried out in collaboration among all authors. Author FHM managed the literature searches and drafting. Author AGR designed the study. Author PK did the statistical analysis. Author ES wrote the protocol and data collection. Author FHM wrote the first draft of the manuscript. Authors SHM, TD, SR and SZAS managed the analyses of the study and data collection. All authors read and approved the final manuscript.

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ABSTRACT

Background: Alopecia induced by androgens in genetically predisposed individuals is termed as Androgenetic alopecia (AGA). There is proof appearance the relationship between Androgenetic alopecia and metabolic condition.
Objective: To determine frequency of metabolic syndrome in Androgenetic alopecia as a biomarker of disease in adult male patients.
Materials and methods: It was a Cross Sectional Study conducted at the Department of Dermatology, Liaquat University of Medical and Health Sciences Hospital, Jamshoro/Hyderabad. Total 178 diagnosed male patients of Androgenetic alopecia were included. The grading of male

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pattern Androgenetic alopecia was done according to modified Norwood-Hamilton classification. Norwood-Hamilton Stage I-III were regarded to be mild to moderate and Stage IV and higher were regarded as severe. Vein was engorged by a tourniquet applied above the cubital fossa. Blood glucose levels were estimated. The level of triglycerides was determined. HDL-Cholesterol was estimated by a precipitant method. Descriptive statistics were calculated using SPSS. Chi square tests were applied to determine the relationship of independent variables with metabolic syndrome.

Results: The overall mean age of the patients was 39.08±10.14 years. The mean waist circumference, triglycerides, high-density lipoprotein cholesterol, systolic blood pressure, diastolic blood pressure and fasting blood glucose were 94.71±12.30 cm, 133.83±13.27 mg/dl, 48.10±7.89 mg/dl,102.94±17.67 mmHg, 76.88±8.56 mmHg, and 93.06±9.78 mg/dl respectively. A total of 10.1% of the patients were found to have metabolic syndrome. There was a significant association between metabolic syndrome and age and family income.

Conclusion: Metabolic syndrome was observed in 10.1% of the patients and this was more commonly found in: the age group >40 years, married individuals, low socioeconomic status individuals, and illiterate individuals.

Keywords: Metabolic syndrome; androgenetic alopecia; biomarker; male patients.

1. INTRODUCTION

Androgenetic alopecia (AGA), also known as male pattern baldness, is the most well-known sort of reformist going bald. AGA is a polygenetic condition with fluctuating seriousness, period of beginning, and scalp area of going bald. In men bald commonly includes the transient and vertex area while saving the occipital locale: the characteristic "horseshoe" pattern [1].Androgenetic alopecia is caused by greater peripheral sensitivity to androgens. AGA shows genetic predisposition and is related to the serum testosterone. The free testosterone is converted into dihydrotestosterone (DHT) by 5-α-reductase, and this leads to follicular miniaturization [2].

In AGA, the term of anagen stage slowly diminishes and that of telogen stage expands, prompting scaling down and ultimately an uncovered appearance, as the span of anagen stage decides the hair length [3]. It has for some time been perceived that male example sparseness runs in families and has a polygenic method of legacy and past research affirm a solid hereditary component related with it, with concordance paces of 80-90% in monozygotic twins and reliably lower rates in dizygotic twins [2].

Incidence and prevalence of AGA depend on age and race. Based on the little prevalence data available, it is known that up 30% of white men will have AGA by the age of 30 years, up to 50% of white men by 50 years, and 80% of white men by 70 years [4-6]. Chinese, Japanese, and African American people are less affected by AGA in comparison Caucasians [7].

AGA highlights a reformist scaling down of the hair follicle prompting vellus change of terminal hair. These outcomes from a modification in hair cycle elements: Anagen stage span bit by bit diminishes and that of the telogen stage increments. As the anagen stage term decides hair length, the new anagen hair gets more limited, in the long run prompting uncovered appearance [8,9].

Metabolic disorder (MetS) addresses a group of metabolic irregularities that incorporate hypertension, focal obesity, insulin resistance, and atherogenic dyslipidemia and is unequivocally connected with an expanded danger for creating diabetes and atherosclerotic and nonatherosclerotic cardiovascular illness (CVD).

Over the past two decades, there has been proof appearance the relationship between Androgenetic alopecia and metabolic condition [10,11]. A previous study [10], studied the frequency of androgenetic alopecia in 326 population and reported positive association of AGA with the metabolic syndrome. Metabolic syndrome (MS) relates to a group of metabolic disorders including: glucose intolerance, insulin resistance (IR), central obesity, dyslipidemia, also, hypertension related with expanded danger of cardiovascular illness [12]. The metabolic syndrome is diagnosed as per Adult Treatment Panel III by the National Heart, Lung, and Blood Institute (NHLBI) and the American Heart Association (AHA) while managed through diet and weight reduction, life style medication, antihypertensive drugs, anti-diabetic and anti-lipid medications.

There are several studies that had investigated the relationship between AGA and MS, as well as IR with conflicting results [13,14]. In this context, there is a need to approach the disease as a potentially multisystem disorder, so such patients might be exhorted for opportune screening and treatment. Thus, an understanding of the relationship between early-onset male AGA and metabolic syndrome may be helpful in preventing severe systemic diseases. The present study has aimed to study frequency of metabolic syndrome in Androgenetic alopecia at tertiary care hospital.

2. PATIENTS AND METHODS

The study was a cross-sectional study carried out within the Department of Dermatology, Liaquat University of Medical and Health Sciences Hospital, Jamshoro/Hyderabad. A total of 360 male patients who were diagnosed as having Androgenetic alopecia irrespective of the staging/grading who were aged between 18 and 60 years, who agreed to be a part of the study and fulfilled the eligibility criteria and who were not on any medication for alopecia were enrolled in the research. Males who had other types of alopecia such as scarring alopecia and alopecia areata were excluded from the study. Non-probability consecutive sampling technique was used to enroll study participants. In addition, male patients with other skin diseases associated with metabolic syndrome including skin diseases like Psoriasis, Systemic Disorders such as; the thyroid diseases, familial hyperlipidemia, nephritic syndrome, chronic renal failure etc., were excluded from the study.

Written information about the study was taken from each patient at the Medical wards and out patients department. All participants of the study did undergo careful clinical evaluation including a full medical history and clinical examination to confirm the diagnosis each patient was assigned a study number.

Adult Treatment Panel III by the National Heart, Lung, and Blood Institute (NHLBI) and the American Heart Association (AHA) was used to diagnose the metabolic syndrome and considered when a patient has at least ≥3 of the following five (5) parameters:

1. Fasting glucose ≥100 mg/dL [biochemical parameter by analyzing blood sample during fasting state].
2. Blood pressure ≥130/85 mm Hg [through sphygmomanometer by auscultatory method on presentation].
3. Triglycerides ≥150 mg/dL [biochemical parameter by analyzing blood sample during fasting state].
4. HDL-C <40 mg/dL in men or <50 mg/dL in women [biochemical parameter by analyzing blood sample during fasting state].
5. Waist circumference ≥90 cm (35 in) in men or ≥80 cm (32 in) in women [physical examination estimate through measuring tape].

The grading of male pattern Androgenetic alopecia was done according to the modified Norwood- Hamilton classification. Norwood-Hamilton Stage I-III was classified as mild to moderate male pattern Androgenetic alopecia and Stage IV and higher as severe. Early onset Androgenetic alopecia was regarded as Stage III male pattern AGA before 30 years of age. The Norwood Hamilton Scale is a way to measure the extent of male-pattern-baldness, and was the generally accepted as standard when describing hair loss in general.

Biometric data such as weight, height, waist and hip circumference, were measured and recorded. Height measurement was taken twice and the average was documented. Weight measurement was taken in participants with light clothes and without shoes. To determine waist circumference, a non-extendable measuring tape was placed at the level of the umbilicus and the widest part of hip for hip circumference. Body Mass Index or BMI was calculated by weight in kilograms /Height in meters [2].

Both systolic and diastolic blood pressure was taken as average of two measurements taken 5 minutes apart after the subjects had been sitting for 5 minutes. Vein was engorged by a tourniquet applied above the cubital fossa. 10 ml of blood sample was collected from the ante-cubital vein after application of sterilized alcohol swab. 5ml was put in EDTA containing blood CP bottle and 5 ml in plain glass tube. Blood glucose level was estimated by Glucose oxidase method on Hitachi Roche chemistry analyzer (USA). Obtained serum was pipetted into a clean blood sample bottle and analyzed on the day of collection after a 12 hour fasting. Triglycerides were determined by an enzymatic (GPO-PAP) method. HDL-Cholesterol was estimated by a precipitant method.

The data were analyzed by using SPSS 22.0 (IBM, incorporation, USA). Categorical variables (gender, Norwood-Hamilton grade, metabolic syndrome) were presented as frequencies and percentages, while continuous variables are presented as mean +/- Standard Deviation (age, blood glucose, blood pressure, lipids). To determine the association of variables with metabolic syndrome such as age, monthly income, marital status, occupation and qualification, chi-square test of independence was used and the cut-off point of p-value was kept at 0.05.

3. RESULTS

Table 1 shows socio-economic profile of the patients while the Table 2 describes the biochemical profile of the participants. The overall mean age of patients was 39.08±10.14 years. Out of 178 patients, 81.5% were married and 18.5% were unmarried while majority of the patients had primary education 52 (29.2%) followed by graduation 48 (27%). The mean ± SD for weight, height and BMI of the patients was 71.73±8.46 kg, 168.34±5.50 cm and 32.87±4.72 respectively. The mean waist circumference, triglycerides, high-density lipoprotein cholesterol, systolic blood pressure, diastolic blood pressure and fasting blood glucose were 94.71±12.30 cm, 133.83±13.27 mg/dl, 48.10±7.89 mg/dl,102.94±17.67 mmHg, 76.88±8.56 mmHg, and 93.06±9.78 mg/dl respectively.

Stratification with respect to age, family income, marital status, qualification and occupation was done to observe effect of these modifiers on metabolic syndrome. The results showed that there was significant association of metabolic syndrome with age (p=0.001) and family income (p=0.007) while no significant association was found with marital status (p=0.829), qualification (p=0.303) and occupation (p=0.194) as shown in Table 3.

Table 1. The socio-economic statistics of participants (N=178)

Age *	39.08 (10.14)
Marital Status	
Unmarried	145 (81.5)
Married	33 (18.5)
Educational Status	
Illiterate	13 (7.3)
Primary	52 (29.2)
Secondary	32 (18)
Intermediate	23 (12.9)
Graduate	48 (27)
Post-graduate	10 (5.6)
Occupation	
Student	20 (11.2)
Private Job	85 (47.8)
Government Job	31 (17.4)
Own Business	20 (11.2)
Retired	22 (12.4)

Table 2. Biochemical statistics of participants (N=178)

Variable	n (%)
Weight (Kg)*	71.73 (8.46)
Height (cm)*	168.34 (5.50)
BMI (Kg/m^2)*	25.29 (2.71)
Waist Circumference (cm)*	94.71 (12.30)
Triglycerides (mg/dl)*	133.83 (13.27)
High-Density Lipoprotein Cholestrol (mg/dl)*	48.10 (7.89)
Systolic Blood pressure (mmHg)*	102.94 (17.67)
Diastolic Blood Pressure (mmHg)*	76.88 (8.56)
Fasting Blood Glucose (mg/dl)*	93.06 (9.78)
Metabloc Syndrome	
Yes	18 (10.1)
No	160

**mean +/- SD*

Table 3. Association of independent variables with metabolic syndrome

Variable	Categories	Metabolic Syndrome		P-value
		Yes	No	
Age	≤40 years	2 (2.4)	82 (97.6)	0.01*
	>40 years	16 (17)	78 (83)	
Monthly Income	≤30,000 PKR	16 (15.2)	89 (84.8)	0.007*
	>30,000 PKR	2 (2.7)	71 (97.3)	
Marital Status	Married	15 (10.3)	130 (89.7)	0.829
	Unmarried	3 (9.1)	30 (90.9)	

Variable	Categories	Metabolic Syndrome		P-value
Qualification	Illiterate	3 (23.1)	10 (76.9)	0.303
	Primary	5 (9.6)	47 (90.4)	
	Secondary	1 (3.1)	31 (96.9)	
	Intermediate	1 (4.3)	22 (95.7)	
	Graduate	7 (14.6)	41 (85.4)	
	Post-graduate	1 (10)	9 (90)	
Occupation	Student	3 (15)	17 (85)	0.194
	Private Job	4 (4.7)	81 (95.3)	
	Government Job	5 (16.1)	26 (83.9)	
	Own Business	2 (10)	18 (90)	
	Retired	4 (18.2)	18 (81.8)	

** Significant at p-value 0.05*

4. DISCUSSION

Androgenetic alopecia (AGA), a common cause of non-cicatricial alopecia, is portrayed by a step by step reformist change of terminal hair follicles to scaled down hair in hereditarily inclined guys and females, characterized by different examples, and being more common in males [15,16]. It has for quite some time been perceived that male example hair sparseness runs in families and has a polygenic method of legacy and past investigations have confirmed a solid hereditary component related with it, with concordance paces of 80-90% in monozygotic twins and reliably lower rates in dizygotic twins [17]. Over the past two decades, evidence has emerged showing the association between androgenetic alopecia and metabolic condition or its related sicknesses including cardiovascular infections, hypertension and insulin resistance [18]. Metabolic disorder is the blend of hypertension, obesity, dyslipidemia, weakened fasting glycemia and insulin resistance which has been related with expanded danger of cardiovascular illnesses [19].

One study showed that maximum number of patients had grade II (36%) and grade III (24%) AGA Hamilton and Narwood classification of androgenetic alopecia, is comparable with those of previous studies [20-21]. One study reported that metabolic syndrome was found in 14% patients who had androgenetic alopecia as compared to 3% patients in controls. The difference was statistically significant ($p<0.05$). Androgenetic alopecia patients were found to be 4.6 times more likely to have metabolic syndrome as compared to controls [22-24]. Our study results are also consistent with these findings, there were 10.1% metabolic syndrome observed in our study. As far as severity is concerned we observed more patients with severe androgenetic alopecia as compared with mild to moderate patients of androgenetic alopecia.

One study reported that, metabolic syndrome was found more commonly in patients who had androgenetic alopecia with higher grade severity 12/40 (30%) as compared to the androgenetic alopecia patients with mild-moderate severity 2/60 (3.3%). Androgenetic alopecia patients with gentle moderate seriousness were multiple times less inclined to have metabolic condition when contrasted with those with extreme seriousness [25].

Raised aldosterone levels have been considered answerable for both androgenetic alopecia and hypertension, clearing path for the job of aldosterone adversaries for control of circulatory strain and end in movement of alopecia [26-27]. Aldosterone causes expansion in the degree of ROS, EGF beta and TGF beta which tweak fibrinolytic impacts and fiery reaction which might be dependable, alongside different components in causing perifollicular fibrosis and aggravation in androgenetic alopecia [28].

Abdominal fat tissue is related with genuine metabolic issues, like insulin opposition, hyper-insulinemia, hypertension, expanded fatty substances glucose prejudice, diabetes and metabolic disorder, coronary illness [29].

The results of one study concluded that HDL was decreased in 30% of patients who had severe androgenetic alopecia as compared to 5% in patients who had mild-moderate androgenetic alopecia. LDL was increased in 30% of patients who had severe androgenetic alopecia as compared to 5% in patients who had mild-moderate androgenetic alopecia Serum cholesterol and triglyceride level was increased

in 30% of androgenetic alopecia patients with severe AGA as compared to 6.67% in patients with mild-moderate AGA. Among the patients who had androgenetic alopecia impaired fasting glucose was seen in 30% of patients with severe AGA as compared to 5% of patients with mild – moderate AGA [28]. In present study, the NCEP ATP III definition was used to diagnose the metabolic syndrome [30], while in Malaysia and Bangladesh NCEP ATP III and IDF criteria was used to determine the metabolic syndrome whereas in India NCEP ATP III criteria used to diagnose the metabolic syndrome [31-33].

The current study has certain impediments. The little sample size of this investigation restricts its relevance. The primary constraint of the current research includes a single-center experience and nonrandomized study design. It was conducted with small sample size and in urban environment therefore, the results might not be generalized to larger populations.

5. CONCLUSIONS

Metabolic syndrome was found in 10.1% of patients who have androgenetic alopecia. Metabolic disorder is more normal in those with serious androgenetic alopecia when contrasted with those with gentle moderate androgenetic alopecia. Metabolic condition was additionally discovered to be more normal in age bunch >40 years, hitched, low financial status, and ignorant people.

Furthermore, alongside expanded commonness of metabolic condition, its different parts including, stomach heftiness, hypertension, hindered fasting glucose and dyslipidemia were discovered more in patients of androgenetic alopecia particularly those with extreme androgenetic alopecia.

CONSENT AND ETHICAL APPROVAL

Ethical approval of this study was obtained from the institutional ethics committee. Written informed consent was obtained and a copy of a consent form which was given to each patient.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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