

ASSOCIATION OF FEMALE PATTERN HAIR LOSS WITH METABOLIC SYNDROME

Thesis

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List of Abbreviations

ACE	Angiotensin converting enzyme
ADA	American Diabetes Association
AGA	Androgenetic alopecia
AHA	American Heart Association
ARs	Androgen receptors
BMI	Body mass index
BP	Blood pressure
CI	Confidence interval
cm	Centimeter
CPAP	Continuous positive airway pressure
CHD	Coronary heart disease
CRP	C-reactive protein
CTE	Chronic telogen effluvium
CVD	Cadiovascular disease
DBP	Diastolic blood pressure
DHEA	Dehydro-epiandrosterone
DHEA-S	Dehydro-epiandrosterone sulfate
DHT	Dehydrotestosterone
EGIR	European Group for the study of Insulin Resistance
ESR2	Estrogen receptor beta gene
FAGA	Female androgenetic alopecia
FBS	Fasting blood sugar
FDA	Food and Drug Administration
FFAs	Free fatty acids
FPHL	Female pattern hair loss
FSH	Follicle stimulating hormone
HbA1c	Hemoglobin A1c (glycosylated hemoglobin)
HC	Hip circumference
HDL-C	High density lipoprotein-cholesterol
HPA-axis	Hypothalamic pituitary adrenal axis

List of Abbreviations (Cont...)

HS	Highly significant
HTN	Hypertension
IDF	International Diabetes Federation
IGT	Impaired glucose tolerance
IL-6	Interleukin-6
IR	Insulin resistance
LDL-C	Low density lipoprotein-cholesterol
LH	Luteinizing hormone
MetS	Metabolic syndrome
ml	Milliliter
NCEP-ATPIII.	National cholesterol education program - third adult treatment panel
NHLBI	National Heart, Lung, and Blood Institute
NRC	National Research Cente
NS	Non significant
OCPs	Oral contraceptive pills
OGTT	Oral glucose tolerance test
OR	Odds ratio
OSA	Obstructive sleep apnea
PAI-1	Plasminogen activator inhibitor-1
PCOs	Polycystic ovaries
PCOS	Polycystic ovary syndrome
PPAR-α	Peroxisome proliferator activated nuclear receptor-alpha
PRP	Platelet rich plasma
P450 arom	Aromatase enzyme
S	Significant
SBP	Systolic blood pressure
SD	Standard deviation
SHBG	Sex hormone binding globulin
SNPs	Single nucleotide polymorphisms
T	Testosterone

List of Abbreviations (Cont...)

TB-4	Thymosin growth factor
TC	Total cholesterol
TE	Telogen effluvium
TG	Triglycerides
TNF-α	Tumour necrosis factor-alpha
U.S	United States
W/H ratio	Waist hip ratio
WHO	World Health Organization
WC	Waist circumference

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Introduction

Hair loss in women is an increasingly frequent problem. The clinical aspects of female pattern hair loss (FPHL) differ according to the origin. It is characterized by diffuse reduction in hair density which mainly affects the crown and frontal scalp with retention of the frontal hair line. Diffuse central thinning, frontal accentuation (Christmas tree pattern), frontotemporal recession or vertex loss, although uncommon, and bitemporal thinning are the presenting patterns of the disease (*Herskovitz and Tosti, 2013*).

Ludwig classified FPHL into 3 patterns which represent its stages or progressive types (*Ludwig, 1977*). These 3 patterns are similar to Olsen's classification except that the Olsen patterns include the accentuation of frontovertical alopecia which has a triangular or "Christmas tree" form (*Olsen et al., 2005*).

Metabolic syndrome (MetS) is a group of abnormalities probably caused by insulin resistance (IR) with systemic hyperinsulinism. It consists of glucose intolerance or type 2 diabetes, arterial hypertension, atherosclerosis, obesity and dyslipidemia (*Hu et al., 2004 and Assmann et al., 2008*).

The most important risk factors for the development of MetS are weight, genetics, endocrine disorders and aging. Most patients are older, obese, sedentary and have a degree of IR,

stress can also be a contributing factor (*Poulsen et al., 2001 and Pollex and Hegele., 2006*).

As MetS is highly associated with cardiovascular disease (CVD) and type 2 diabetes, corroborating the association between MetS and FPHL may provide another clue to the clinical signs and symptoms related to both diseases, but unfortunately there is little data on population based studies on this association (*Grundy., 2006 and Cornier et al., 2008*).

A recent study showed an association between androgenetic alopecia (AGA) and MetS in men after controlling for age, family history of AGA and smoking status. Among MetS components, High density lipoprotein cholesterol (HDL-C) was found to be of particular importance. This finding had significant implications for the identification of MetS in patients with moderate or severe AGA. Early intervention for MetS is critical to reduce the risk and complications of CVD and type 2 diabetes mellitus later in life (*Su and Chen, 2010*).

Aim of the work

The aim of this work is to assess the frequency of MetS among women with FPHL compared to age matched control group.

1. Female Pattern Hair Loss

1.1. Introduction

1.2. Nomenclature

1.3. Prevalence

1.4. Aetiopathogenesis

1.5. Role of hormones in female pattern hair loss

1.5.1. The effect of androgens

1.5.2. The effect of estrogens

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1.7. Role of inflammation in female pattern hair loss

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1.12. Monitoring clinical response.

1.1. Introduction:

Androgenetic alopecia is the most common pattern of scalp hair loss that occurs after puberty in both sexes (*Won-Soo Lee et al., 2007 and Chen, 2010*). It is usually of gradual onset, slowly progressive course, with a characteristic pattern and can have serious psychological impacts (*Olsen et al., 2007*). Androgenetic alopecia only becomes a medical problem when the hair loss is subjectively viewed as excessive, premature and distressing (*Sinclair and Dawber, 2001*).

1.2. Nomenclature:

In 2000, Norwood presented evidence that female AGA is not merely the female counterpart of male AGA and suggested that it may not be androgen dependant (*Norwood, 2000*). Therefore, the widely used term ‘AGA’ should be replaced by ‘FPHL’ (*Olsen, 2001 and Yip et al., 2011*). Female alopecia with androgen increase is called female androgenetic alopecia (FAGA) and without androgen increase is called FPHL (*Francisco, 2009*).

1.3. Prevalence:

Hair shedding in FPHL can vary in intensity over time, from individual to individual, and the onset of loss of terminal hairs may precede menarche or may occur as late as the sixth decade of life (*Olsen, 2005*). Among healthy women, approximately 6% to 38%