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Evaluation of Serum Ischemia Modified Albumin Level in Male Patients with Androgenetic Alopecia

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Abstract

Male pattern androgenetic alopecia (AGA) is associated with oxidative stress. Ischemia modified albumin (IMA) is albumin due to albumin modification caused by reactive oxygen species which occur during ischemia. to evaluate IMA levels in AGA patients and compare their levels in healthy control. The four study groups were group (A) included thirty obese patients with AGA, (B) included thirty non-obese patients with AGA, group (C) included ten obese normal volunteer and group (D) ten non obese normal volunteer. The AGA severity was calculated according to the modified Norwood Hamilton classification and serum IMA was measured by ELISA in all participants. The patients and control groups showed a non-significant difference as regards age, smoking and BMI. There was a significant difference between patients and control groups as regards the IMA levels (P= <0.0001). The IMA level showed a significant difference between obese patients and obese control (P= <0.0001), between non-obese patients and non-obese control (P <0.0001), between obese patients and non-obese patients (P < 0.0001), while it showed a non-significant difference between obese and non-obese control (P= 0.7776). The current study suggested that IMA levels were increased by the effect of obesity, but the AGA has an adding effect. The IMA levels showed a positive correlation with AGA duration and AGA severity. The IMA approved as diagnostic indicator of myocardial ischemia and elevated IMA were reported in metabolic syndrome, cardiovascular risk and obesity, and IMA might confirm the link between AGA and these metabolic disorders.

1. Introduction

Male pattern androgenetic alopecia (AGA) is a non-scarring diffuse alopecia due to hormonal and genetic influences and characterized by the progressive miniaturization of hair follicles [1].

AGA has been found to be associated with the risk of several diseases such as coronary artery disease (CAD) [2] insulin resistance (IR), [3] abnormal serum lipid profile and obesity [4] There may be a relationship between oxidative stress and follicle miniaturization, which is the primary cause of AGA [5].

Ischemia modified albumin (IMA) is albumin, which has a modified N-terminal due to the effects of ischemia [6] The IMA occurs due to albumin modification caused by reactive oxygen species which occur during ischemia. High IMA levels are used to predict the cardiovascular risk in obese patients and to evaluate subclinical vascular disease in patients with diabetes mellitus [7]The current study aimed to evaluate IMA levels in AGA patients and compare their levels in healthy control.

2. Subjects and methods

The study included sixty male patients complaining of AGA and age- and sex- matched twenty healthy volunteers who were willing to participate in this study. Exclusion criteria were as follows: history of any systemic disease such as diabetes mellitus or cardiac diseases, history of active malignancy or taking immunosuppressive treatment, history of dyslipidemia or taking anti-hyperlipidemic drugs and use of topical treatment for AGA less than two weeks and/or systemic treatment less than one month prior to study. The patients were assigned equally in two groups: group (A) included thirty obese patients with AGA (body mass index "BMI" $\geq$ 30.00 kg/m^2) and group (B) included thirty non-obese patients with AGA (BMI from 18.5 to 24.9 kg/m^2). The twenty healthy volunteers were also assigned in two groups: group (C) included ten obese normal volunteer (BMI $\geq$ 30.00 kg/m^2) and group (D) ten non-obese normal volunteer (BMI from 18.5 to 24.9 kg/m^2).

The AGA severity was calculated after local examination according to the modified Norwood–Hamilton classification (8) Fasting venous blood samples (5 ml) were taken from patients and control groups to determine the level of serum IMA by Human Ischemia Modified Albumin (IMA) ELISA Kit.

3. Statistical analysis

The statistical analysis was done using the computer program Statistical Package for the Social Sciences (SPSS). Qualitative data were presented as number and percentages, while quantitative data with parametric distribution were presented as mean, standard deviations (SD), and ranges. Student's t test was used for numerical variables of normally distributed samples. Fisher's exact test (F test) was used to know whether the proportions for one variable are different among values of the other variable. The chi-square test (χ2 test) was used to determine whether there was a significant difference between the expected frequencies. The P values <.05 were considered statistically significant.

4. Results

The patients and control groups showed a non-significant difference as regards age, smoking and BMI Table (1).

Table (1) Comparison between patients and control groups as regards age, smoking and BMI.

	Patients Group A & B	Control Group C & D	Test	P
Age (years)	38.80 ± 8.98	36.95 ± 7.74	-0.824 *	0.4124
Smoking	46.7 %	50 %	0.219 **	0.6390
BMI (kg/m^2)	26.68 ± 5.16	26.61 ± 4.1	-0.055 *	0.9562

*Student's t- test **Chi- Square test

There was a significant difference between obese and non-obese patient groups (Group A & B) (Mean ± SD= 31.65 ± 1.15, 21.87 ± 1.64 respectively; P= < 0.0001) and between obese and non-obese control (Group C & D) (Mean ± SD=30.46 ± 0.35, 22.75 ± 1.54 respectively; P < 0.0001) as regards BMI Table (2).

Table (2) Comparison between all the study groups as regards BMI (kg/m^2).

	Obese Mean ± SD	Non-obese Mean ± SD	Student's t- test	P
Patients	31.65 ± 1.15	21.87 ± 1.64	26.74	< 0.0001
Control	30.46 ± 0.35	22.75 ± 1.54	15.43	< 0.0001
Student's t- test	2.46	1.49		
P	0.0187	0.1443		

There was a significant difference between patients and control groups as regards the IMA levels (Mean ± SD= 34.03 ± 10.37, 16.10 ± 5.03 respectively; P= <0.0001).

There was a significant difference between obese patients (Group A) and obese control group (Group C) (Mean ± SD= 40.62 ±11.19, 16.43 ± 6.41 respectively; P= <0.0001) and a significant difference between non-obese patients (Group B) compared to non-obese control group (Group D) (Mean ± SD= 30.06 ± 6.67, 15.77 ±3.45 respectively; P <0.0001). On the other hand, there was a significant difference between obese patients (Group A) compared to non-obese patients (Group B) (Mean ± SD= 40.62 ±11.19, 30.06 ± 6.67 respectively; P < 0.0001), but there was a non-significant difference between obese and non-obese control as regards IMA level (Mean ± SD=16.43 ± 6.41, 15.77 ± 3.45 respectively; P= 0.7776).

There were significant positive correlations between the following: IMA levels and patients' age (r= 0.30188, P=0.019), IMA levels and BMI and (r= 0.5612, P< 0.00001), IMA levels and disease duration (r= 0.267, P=0.0391), and finally IMA level and disease severity (r= 0.2995, P=0.02).

5. Discussion

The presence of oxidative stress in dermal papilla of the patients with AGA was confirmed [9] There are also several reports that can link AGA to increased oxidative stress (10) AGA was also associated with increased risk factors for cardiovascular disease and with increased presence of inflammation [11].

The IMA is FDA approved diagnostic indicator of the early stage of myocardial ischemia among patients having acute coronary syndrome [12] Elevated levels of IMA were thought to be associated with several diseases based on oxidative stress [13].

The increased IMA levels were reported in two other hair disorders: alopecia areata and telogen effluvium. Ataş et al., (2019) [14] found increased serum IMA levels significantly in the patient group compared to the control group (mean ± SD: 0.57 ± 0.01 vs. 0.52 ± 0.02, P < 0.0001), and IMA were related to condition of oxidative stress in alopecia areata. [15] found a significant positive correlation between IMA levels and waist circumference (r=0.443, P=0.008), and triglycerides levels (r=0.535, P=0.001) of the alopecia areata patients. [16] investigated IMA as a possible marker of oxidative stress in patients with telogen effluvium. They found increased serum IMA levels significantly in the patient group compared to the control group (mean ± SD: 0.77 ± 0.14 g/L vs 0.50 ± 0.09 g/L, P < 0.001).

Inal et al., (2018) [17] found higher serum IMA levels in PCOS patients than in the control group (mean ± SD: 352.60 ± 228.31 ng/mL vs 224.93 ± 101.91 ng/mL, P =0.008) and these higher IMA concentrations were correlated with higher triglyceride and low-density lipoprotein cholesterol levels.

In the present study, there was a positive correlation between BMI of the patients and IMA level (r= 0.5612, P < .05). This is consistent with [18] who evaluated IMA as an oxidative stress biomarker in obesity and found a significant correlation between IMA and BMI (r= 0.340, P<0.001). Also, [19] evaluated IMA in obesity and found that there was a significant positive correlation between IMA and BMI in the obese subjects (r = 0.250, P < 0.05).

The estimated IMA level in the present study showed a non-significant difference between obese and non-obese control (P> 0.05), while it showed a significant difference between non-obese patients and non-obese

control ($P < 0.0001$), obese patients and obese control ($P < 0.0001$), obese patients and non-obese patients ($P < 0.0001$). The current study suggests that IMA increased by the effect of obesity but the AGA has a more adding effect. Another proof of this suggestion that there was a positive correlation between AGA duration and IMA level ($r=0.267$, $P= 0.039$), and between AGA severity and IMA level ($r=0.2995$, $P= 0.020$).

The AGA is a progressive disease that become more severe with age. In the current study, there was a positive correlation between age of the patients and IMA level ($r= 0.302$, $P < .05$). In a previous study [20] found a positive significant correlation between IMA and age of the patients suffering from stroke, and [21] found a significant positive correlation between IMA levels and age of rheumatoid arthritis patients.

6. Conclusion

The current study suggested that IMA levels were increased by the effect of obesity, but the AGA has a more adding effect. Another proof of this suggestion that the IMA levels showed a positive correlation with AGA duration and AGA severity. The IMA is FDA approved diagnostic indicator of the early stage of myocardial ischemia and elevated IMA were reported in DM, hypercholesterolemia, metabolic syndrome, increased cardiovascular risk and obesity. The current study suggested that IMA might confirm the link between AGA and these metabolic disorders.

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