Glycosylated hemoglobin and lipoproteins in patients with premature hair grayness

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ABSTRACT

Objectives: The aim of this study was to estimate glycosylated hemoglobin, fasting blood sugar and lipid profile in patients with premature grayness of hair.

Methods: This study was carried out from October 1999 and May 2000, at the Dermatology and Venereology Outpatient Clinic of Baghdad Teaching Hospital, Iraq. Sixty patients with premature grayness of hair and 20 healthy individuals were included in this study. The levels of glycosylated hemoglobin, fasting blood sugar, serum triglyceride, total serum cholesterol, high-density lipoprotein-cholesterol, and atherogenic index were assessed for both patients and control.

Results: The mean level of glycosylated hemoglobin in patients with premature grayness of hair was 4.84 ± 0.46, and the mean level of fasting blood sugar in patients with premature grayness of hair was 83.25 ± 8.67. Both these parameters were significantly higher in patients with premature grayness of hair than that of the control. Also, it was found that these parameters were positively correlated to the severity of the disease. The level of high-density lipoprotein-cholesterol was significantly lower in patients with premature grayness of hair compared to control.

Conclusions: The discovery of elevated glycosylated hemoglobin in patients with premature grayness of hair was similar to what has been reported in diseases with possible auto-immune etiology such as vitiligo. These changes together with the well-documented association between premature grayness of hair and autoimmune diseases can support the autoimmune etiology of premature grayness of hair.

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Grayness of hair is usually a manifestation of the aging process and is due to a progressive reduction in melanocyte function.[1] Premature grayness of hair (PGH) has been defined as onset of grayness before 20 years of age in caucasoids and 30 years of age in negroids. The association between premature grayness and certain organ-specific autoimmune diseases is well documented. It is often stated that premature grayness may be an early sign of pernicious anemia, hyperthyroidism and, less commonly, hypothyroidism, and all autoimmune diseases that have a genetic predisposition.[2] Premature grayness in hair is considered also as a variant of vitiligo.[3,4] So, many changes that might occur in vitiligo might also occur in PGH. The levels of glycosylated hemoglobin (HbA1c) have been reported to be abnormal in the sera of patients with vitiligo when compared with controls.[5] The aim of the present work is to assess HbA1c, fasting blood sugar (FBS), and lipid profile in patients with PGH.

Methods. This study was conducted between October 1999 and May 2000, at the Dermatology and Venereology outpatient Clinic of Baghdad Teaching Hospital, Baghdad, Iraq. A total of 60 patients with PGH, 10 (16.7%) females, and 50(83.3%) males, were included in this study. Their ages ranged

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between 12-29 years with a mean ± standard deviation (SD) of 24.60 ± 3.48. The selection criteria for patients with PGH included all patients with the grayness of hair starting before the age of 20 years and their age at presentation before 30 years. The severity of grayness of hair was graded according to the following: 1. Mild grayness: Grayness of hair can be noticed with difficulty. 2. Moderate grayness: Grayness of hair could be seen obviously with naked eye. 3. Severe grayness: Grayness of hair involved most of the scalp, and beard area in males. Fifteen patients (25%) had mild grayness, while 22 (36.7%) patients had moderate grayness of hair, and the other 23 (38.3%) patients had severe grayness. The duration of PGH was considered as follows: 1. Patients with PGH of 1-5 years duration. 2. Patients with PGH of 6-10 years duration. 3. Patients with PGH of more than 10 years duration. The duration of the disease between 1-5 years in 10 (16.7%) patients, 6-10 years in 21 (35%) patients, and more than 10 years in 29 (48.3%) patients. A total of 20 healthy individuals were considered as controls. They comprised of 5 (25%) females and 15 (75%) males. Their ages ranged between 21-40 years with a mean ± SD of 28.85 ± 5.77. Informed consent was obtained from all patients and controls.

Blood samples were collected from each patient and control after 12-hour fasting. Eight ml of venous blood was collected by venepuncture, using 10 ml disposable syringes without venous stasis. The blood was divided into one ml which was transferred to tubes containing ethylene diamine tetra-acetic acid (EDTA) as an anticoagulant, for the measurement of packed cell volume (PCV), hemoglobin (Hb), and HbA1c. The glycosylated hemoglobin was measured within 5 days of collection. The rest (7-ml) of the blood was transferred into plastic tubes, and left to clot for 20-30 minutes at room temperature. The serum was then obtained by centrifugation, stored and kept at (-20^{o}C for further analysis. Serum samples were analyzed for FBS and lipid profile. The HbA1c measurement was carried out by using HbA1c (pre-fil) procedure No.p350, kit provided by Stanbio Company, United States of America. This was used to determine HbA1C fraction as a percentage.[6]

Fasting serum glucose concentration measurement was based on the colorimetric method of glucose oxidase (enzymatic reaction) using gluconate reagent. A God-kit provided by Randox Laboratories Company was used.[7]

Enzymatic determination of serum triglyceride was carried out by using (triglycerides enzymatic PAP 150). Enzymatic determination of cholesterol was carried out by using (cholesterol enzymatic PAP). Estimation of high density lipoprotein (HDL) in the serum was carried out by using (enzymatic method), HDL-Cholesterol/phospholipids. A kits supplied by Biomerieux Company, France. Low density lipoprotein-cholesterol (LDL-C) estimation was carried out by calculating the Friewald formula.[8]

Statistical methods. The significance of difference between mean values was estimated by Student's t-test. Pearson correlation coefficient (r) was used to test the relation between 2 parameters. The analysis of data was accomplished by using the Statistical Package for Social Sciences SPSS/PC+, the statistical package for IBM PC.[9]

Results. The biochemical findings in the control group of 20 healthy individuals are shown in **Table 1** and of the premature grayness group are shown in **Table 2**. In the premature grayness group, the mean ± SD of HbA1c and FBS were significantly higher than that of the control. When patients with PGH were compared with the control according to the severity of the disease, there was no significant difference in these parameters in patients with mild form ($p>0.05$), while there was a statistically significant difference in patients with moderate form of PGH ($p<0.05$), and the difference was highly significant in patients with the severe form of PGH ($p<0.01$) **(Tables 2, 3 & 4)**. Fasting blood sugar, and HbA1c were correlated with the severity of PGH and it was found that there was a good significant correlation ($r=0.5284$) for HbA1c, and ($r=0.7743$) for FBS. On the other hand FBS and HbA1c had no significant correlation when correlated with the duration of the disease ($r=0.0779$) for HbA1c, and ($r=-0.0049$) for FBS. The level of HDL-C was significantly lower than that of the control ($P<0.05$) **(Tables 1 & 2)**.

Discussion. Glycosylated hemoglobin is a diagnostic tool for monitoring diabetes mellitus therapy. The level of HbA1c reflects the average

Table 1 - Results of all parameters in control group (n=20).

Parameters	Range	Mean ± SD
HbA1c %	4.2 - 5.2	4.34 ± 0.21
FBS (mg/dl)	73 - 88	76.60 ± 1.96
Serum TG (mg/dl)	40 - 132	97.88 ± 29.94
Serum TC (mg/dl)	160 - 188	177.75 ± 8.33
Serum HDL-C (mg/dl)	42 - 60	52.40 ± 5.15
Atherogenic index	2.87 - 1.75	2.34 ± 0.30

FBS - fasting blood sugar, TG - triglycerides, TC - total cholesterol, HDL-C - high density lipoproteins-cholesterol, SD - standard deviation, HbA1c - glycosylated hemoglobin, n - number

Table 2 - Results of all parameters in premature grayness group (n=60).

Parameters	Range	Mean ± SD	P-value
HbA1c %	4.2 - 6.2	4.8 ± 0.46	*P<0.01
FBS (mg/dl)	71 - 108	83.25 ± 8.67	*P<0.01
Serum TG (mg/dl)	60 - 180	109.47 ± 39.93	NSP>0.05
Serum TC (mg/dl)	140 - 160	185.43 ± 31.07	NSP>0.05
Serum HDL-C (mg/dl)	32 - 62	46.9 ± 7.25	†P<0.05
Atherogenic index	1.3 - 4.57	2.56 ± 0.90	NSP>0.05

NS P>0.05 - not significant, * P<0.01 - highly significant, FBS - fasting blood sugar, †P<0.05 - significant, TG - triglycerides, TC - total cholesterol, HDL-C - high density lipoproteins-cholesterol, SD - standard deviation, HbA1c - glycosylated hemoglobin, n - number

Table 3 - The mean of glycosylated hemoglobin percentage in different groups according to the severity in comparison with the control.

Group	Mean ± SD	P-value
Mild	4.6 ± 0.14	NSP>0.05
Moderate	4.7 ± 0.12	*P<0.05
Severe	5.1 ± 0.23	†P<0.01
Control	4.23 ± 0.21	

NSP>0.05 - not significant, *P<0.05 - significant, †P< 0.01 - highly significant, SD - standard deviation

Table 4 - The mean of FBS mg/dl in different groups according to the severity in comparison with the control.

Group	Mean ± SD	P-value
Mild	78 ± 2	NSP>0.05
Moderate	81 ± 5.7	*P<0.05
Severe	87 ± 6.7	†P<0.01
Control	76.60 ± 1.96	

NSP>0.05 - not significant, *P<0.05 - significant, †P< 0.01 - highly significant, FBS - fasting blood sugar, SD - standard deviation

blood glucose level during the preceding 2-3 months.[10]

There is a well-documented association between PGH and certain organ-specific autoimmune diseases.[2] Autoimmune diseases are disorders that are commonly associated with each other such as diabetes mellitus, and vitiligo, for example.[2,11] So it is expected that glucose disturbances as reflected by HbA1c could be demonstrated in other auto-immune diseases.

It was reported that there is an abnormal fasting blood glucose and an elevated HbA1c level in patients with vitiligo and alopecia areata when compared to control.[5,12] The present work was carried out to evaluate the glucose metabolism in PGH, and since lipoprotein is also related to carbohydrate metabolism, it was also evaluated in these patients. The results of this study showed that there is a significantly higher level of HbA1c and FBS in patients with PGH compared to control, similar to what has been reported in vitiligo and alopecia areata.[5,12] Also, it was found that these parameters were positively correlated to the severity of the disease, while these parameters were not correlated with the duration of the disease. The discovery of elevated HbA1c in patients with PGH was similar to that reported in diseases with possible auto-immune etiology like vitiligo.[5,12] These changes together with the well-documented association between PGH and autoimmune diseases[2] can support the autoimmune etiology of PGH.

The possible explanation for the increase in the level of glycosylated hemoglobin is that it is due to the increase in the level of blood glucose.[13] The glycosylated hemoglobin is usually increased in patients with diabetes mellitus as a consequence of the increase in FBS level.[14]

We can suspect that diabetes mellitus and PGH are linked together on the basis of autoimmune pathogenesis. Therefore, we can speculate that autoimmune diseases have the same pathogenesis and the same genetic basis in one family, but are reflected differently in different members of the family, and they share a tendency to develop any autoimmune disease.[4,15]

The high HbA1c by definition means that there is a disturbance in glucose metabolism. This might be reflected indirectly as an abnormal low levels of HDL-C, which is commonly found in diabetes.[16] Dyslipemia is common in diabetes, and low level of HDL-C are especially common.[17] Similarly the level of HDL-C in PGH was shown in this study to be significantly lower than that of the control.

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