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A Pilot Study on the Association Between Trunk Hair Density and Insulin Resistance in Nonobese Turkish Men

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Authors' contributions

This work was carried out in collaboration among both authors. Author ND designed the study, collected data, did the literature search and also wrote the first draft of the manuscript. Author BAB collected data and wrote part of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Aim: The association between insulin resistance and hirsutism in women is well studied. However there is no previous data about association between insulin resistance and male body hair density. Thus, the aim of the present study is to evaluate association between insulin resistance and trunk hair density in nonobese Turkish men.
Study Design: This is a a cross-sectional, observational, pilot clinical study conducted with the approval of ethical review board.
Place and Duration of Study: Department of Internal Medicine and Dermatology, Afyonkarahisar State Hospital, between July 2014 and October 2014.
Methodology: The study included 58 nonobese Turkish men with same ethnicity, without a systemic disorder. The body mass index (BMI) was calculated, and total trunk hair density was evaluated with a scoring method for each participant. Laboratory investigations, including fasting blood glucose, insulin and serum lipid levels were performed. In each patient, insulin resistance was calculated as Homeostasis model assessment of insulin resistance (HOMA-IR).

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Results: Mean age of the patients was 27.88±8.14 (range: 17-58). Total trunk hair score positively correlated with BMI (P = 0.001), fasting insulin levels (P = 0.021), HOMA-IR score (P = 0.019) and insulin resistance (P = 0.003). Especially, abdominal hair score correlated with insulin resistance (P = 0.003).
Conclusion: Total trunk hair score, especially abdominal hair score correlated positively with insulin resistance in nonobese Turkish men. Thus, evaluation of abdominal hair density may be a clinical method for risk assesment of insulin resistance in nonobese Turkish men.

Keywords: Men; insulin resistance; trunk hair; hyperinsulinemia.

1. INTRODUCTİON

Hirsutism is defined as excessive growth of terminal hair in the androgen-sensitive skin regions caused by increased androgen concentrations or increased androgen sensitivity in pilosebaceous unit [1,2]. The association between hirsutism and endocrine imbalance in women is a well known entity [1,2]. Insulin resistance, hyperinsulinemia and obesity are closely associated with polycystic ovary syndrome (PCOS), which is characterized with chronic anovulation, hirsutism and hyperandrogenism and insulin-sensitizer drugs are usually used to improve hirsutism in PCOS patients [3,4]. There are also some data about the association of insulin resistance with idiopathic hirsutism, which is characterized by increased sensitivity of hair follicles to androgens despite normal serum androgen levels [1].

The etiopathogenesis underlying the relation between hyperandrogenism and insulin resistance remains unclear [5]. Some authors suggest that insulin resistance may cause hyperandrogenism [5]. It has been shown that insulin enhances androgen production and may act synergistically with luteinizing hormone [6,7] However some other studies suggest the reverse. There is previous evidence that androgens influence the adipose tissue distribution, and hyperandrogenemia has been associated with central obesity, as well as with insulin resistance [8]. Exposure to testosterone can cause insulin resistance by influencing the effects of insulin in muscle and adipose tissues, and the administration of anti-androgens to transsexual individuals increases insulin sensitivity [5].

Previous studies showing the association of insulin resistance with body hair density especially focused on women and there is not previous study evaluating the association of male hair density with insulin resistance. Thus, the aim of this pilot study was to investigate the association of insulin resistance, and body mass index (BMI) with trunk hair density in a group of Turkish nonobese men.

2. MATERIALS AND METHODS

This cross-sectional observational pilot study included 58 nonobese (with BMI < 30) Turkish male patients with the same ethnicity. Exclusion criteria included prior history of any systemic disorder (including hyperlipidemia, pre-diabetes, diabetes mellitus, hypoandrogenemia, and any disorder affecting hair density [thyroid disorder, adrenal, testicular or pituitary pathologies]), or any skin disorder affecting hair density (alopecia areata, lichen planopilaris, etc.), history of body hair removal, and drug or cosmetic usage that may effect body hair density. Data about a previous diagnosis of pre-diabetes (diagnosed with a previously performed oral glucose tolerance test) were obtained from the patients and the medical records. Height, and weight were measured, and the BMI was calculated for each participant. Additionally, family history of diabetes mellitus was recorded. Venous blood samples were collected from an antecubital vein between 8.30-9.30 a.m after an overnight (12 hours) fast. Laboratory investigations, including fasting blood glucose, fasting insulin, very low-density lipoprotein (VLDL), low-density lipoprotein (LDL), high-density lipoprotein (HDL), total cholesterol, and triglyceride were performed. Serum levels of fasting blood glucose were measured on the analyzer (Beckman Coulter AU2700®, CA, USA) using the glucose oxidase method. Fasting insulin concentrations were measured on a cobas e-601 analyzer (Hitachi High Technologies Corporation, Tokyo, Japan) with an electrochemiluminescence immunoassay kit. And serum levels of lipids were measured using commercial clinical diagnostic laboratory methods (Beckman Coulter AU2700®, CA, USA, CA). In each patient, insulin resistance was calculated as Homeostasis model assessment of insulin resistance (HOMA-IR), using the following formula: fasting serum insulin (μU/ml) × fasting plasma glucose (mmol/l)/22.5

[9]. HOMA-IR score greater than 2.34, was accepted as the cut-off value for insulin resistance in the study population as previously reported [10]. BMI was calculated as weight/height^2 (kg/m^2). Trunk hair density was evaluated with a scoring system (Table 1 and Fig. 1), modified from a part of Ferriman–Gallwey scoring system for hirsutism used for women [11]. In this method, terminal hair density in 4 different body regions (chest, abdomen, lower back and upper back) is scored and is given a score of 1-4. And total sum of the grades for each region constitute the total trunk hair score, which ranges from 4 to 16. For all participants, same physician evaluated the total trunk hair density according to the scoring system in Fig. 1.

Statistical analyses were performed using SPSS v.18.0 for Windows (SPSS Inc., Chicago, IL, USA). Continuous variables are presented as mean ± standard deviation, and categorical variables as frequencies and percentages. Associations between total hair density score, HOMA-IR score, insulin resistance and BMI were analyzed with correlation analysis. Correlations between normally distributed parametric variables were evaluated using Pearson's correlation coefficient, and nonparametric correlations were evaluated using Spearman's correlation coefficient. The chi-square test was used to determine associations between categorical variables. Statistical significance was considered as $P < 0.05$. The study protocol was approved by the Afyon Kocatepe University Ethical Review Board, and all the participants were informed about the procedures and provided written informed consent.

Table 1. Scoring system of the trunk hair density in men

Body region	Description of terminal hair density
Chest	1: No hair, or involves < 25% of the chest 2: Involves 25-50% of the chest 3: Involves 50-75% of the chest 4: Involves > 75% of the chest
Abdomen	1: No hair, or hair only at midline 2: More in midline and also present laterally (< 50%) 3: Involves 50-75% of the abdomen 4: Involves > 75% of the abdomen
Upper back	1: No hair, or involves < 25% of the upper back 2: Involves 25-50% of the upper back 3: Involves 50-75% of the upper back 4: Involves > 75% of the upper back
Lower back	1: At sacral region, < 4cm 2: Both at sacral region and sides 3: Involves 50-75% of the lower back 4: Involves > 75% of the lower back

Total sum of the scores within each group gives the total trunk hair score, ranging from 4-16

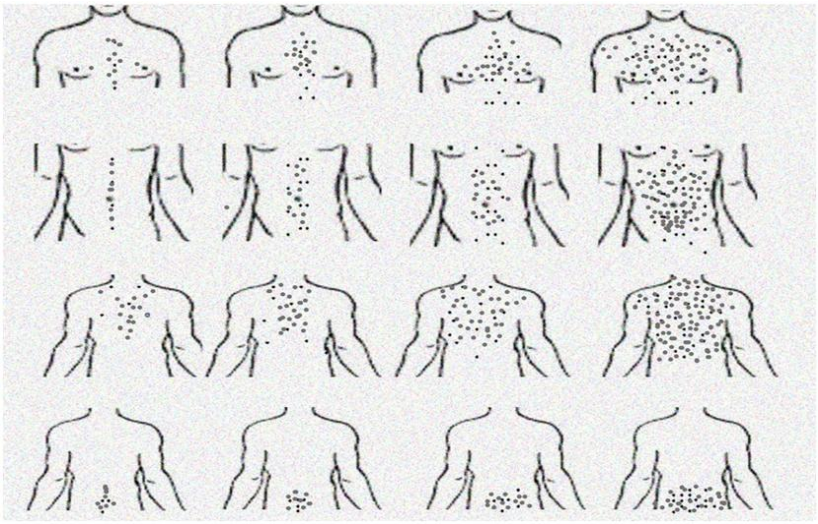

Fig. 1. Scoring system of the trunk hair density in men

Each of 4 body regions (chest, abdomen, lower back and upper back) is given a score of 1-4 according to the criteria at Table 1. And these scores are summed to provide the total trunk hair score, which ranged from 4 to 16

3. RESULTS

The study included nonobese 58 male patients. Mean age of the patients was 27.88±8.14 (17-58), and mean BMI of the patients was 23.65±3.49 (range: 17.2-29.7). Family history of diabetes mellitus was present in 19 (32.8%) patients. Mean HOMA-IR score was 2.31±1.59 (range: 0.71-9.78), and 19 (32.8%) patients had insulin resistance. There was significant association between family history of diabetes mellitus and presence of insulin resistance (P = 0.024).

Total trunk hair score positively correlated with BMI (correlation coefficient = 0.415, P = 0.001), fasting insulin levels (correlation coefficient = 0.302, P = 0.021), and HOMA-IR score (correlation coefficient = 0.307, P = 0.019). However there was not significant correlation between family history of diabetes mellitus and total trunk hair score (P = 0.715). Mean total trunk hair score was 8.95±2.37 in patients with insulin resistance, whereas 7.13±1.64 in patients without insulin resistance (P = 0.001), and there was a positive correlation between total trunk hair score and insulin resistance (correlation coefficient = 0.378, P = 0.003). Furthermore, subgroup analysis showed positive correlation between abdominal hair score and insulin resistance (correlation coefficient = 0.388, P = 0.003), and HOMA-IR score (correlation coefficient = 0.306, P = 0.019). Furthermore, HOMA-IR score correlated with total triglyceride (P = 0.001), total cholesterol (P < 0.001), VLDL (P = 0.002), and LDL (P < 0.001). In addition total trunk hair score correlated with total cholesterol (P = 0.024) and LDL (P = 0.016).

Results of the study were summarized in Tables 2 and 3.

4. DISCUSSION

Previous studies showing the association between insulin resistance and body hair density especially focused on women with PCOS, however there is not previous data about the link of body hair density and metabolic parameters such as insulin resistance and increased BMI in men. Previous studies including hirsute women with PCOS, showed association with metabolic irregularities such as obesity, metabolic syndrome, type 2 diabetes mellitus, and insulin resistance [12-15]. Even lean women with PCOS, have been shown to have insulin resistance [13,14,16,17]. Furthermore, fasting insulin levels have been found to be associated with severity of hirsutism [18]. Although still contraversial, some recent studies showed also association between insulin resistance and idiopathic hirsutism in nonobese women [15,19]. In the present study we showed an association between trunk hair density and fasting insulin levels, HOMA-IR scores and insulin resistance in nonobese men.

The exact effects of hyperinsulinemia and insulin resistance on hair follicles are unknown. Previously it has been shown that insulin enhances insulin-like growth factor-1 (IGF-1) expression [18]. In-vivo mouse studies and in-vitro culture studies have shown that IGF-1 is a significant regulator of cell proliferation and differentiation in hair follicle, and has a positive

Table 2. Clinical and laboratory findings in the study group

Feature	Study group (n = 58)
Mean age, years ± SD (Range)	27.88±8.14 (17-58)
Family history of diabetes mellitus, [n (%)]	19 (32.8)
Mean BMI (kg m^{-2}) (Range)	23.65±3.49 (17.2-29.7)
Mean hair density score	7.72±2.08
Mean fasting glucose (mg dL^{-1})	98.88±7.77
Mean fasting insulin concentration (μU ml^{-1})	9.56±6.26
Mean HOMA-IR	2.31±1.59
Insulin resistance [n (%)]	19 (32.8)
Mean total cholesterol (mg dL^{-1})	164.78±45.2
Mean LDL (mg dL^{-1})	99.22±34.92
Mean total triglyceride (mg dL^{-1})	131.21±92.22
Mean VLDL (mg dL^{-1})	26.28±18.51
Mean HDL (mg dL^{-1})	43.1±10.3

effect on hair growth [20,21]. Furthermore, insulin resistance and hyperinsulinemia increase ovarian and adrenal androgen secretion and supress sex-hormon binding globulin production, and affect the activity of 5-α reductase in hair follicles [18,22]. The present study findings support the previously reported effects of hyperinsulinemia on hair follicles, however, underlying molecular etiopathogenesis needs to be further studied.

Table 3. Correlation between HOMA-IR score and other parameters

Features	Correlation coefficient	P
BMI	0.651	< 0.001
Total trunk hair score	0.307	0.019
Abdominal hair score	0.306	0.019
Total cholesterol	0.454	< 0.001
LDL	0.482	< 0.001
Total triglyceride	0.410	0.001
VLDL	0.400	0.002
HDL	-0.253	0.06

In the present study, we found that especially abdominal hair density correlated with insulin resistance. Previously positive correlation between abdominal obesity and insulin resistance has been shown [22-24]. As a result of this, waist circumference has been suggested to be a marker for risk assesment of insulin resistance, even in patients with normal BMI [23,25]. Although abdominal fat distribution has been associated with hyperandrogenism and hyperinsulinemia, the exact underlying molecular events are unknown. Hyperinsulinemia, itself may effect fat distribution with its direct effects on adipocytes [24]. Such as increased abdominal fat, increased abdominal hair density may be associated with local effects of hyperinsulinemia, which needs to be clarified with further studies. According to the present study findings, we suggest that evaluation of abdominal hair density may give clue about underlying insulin resistance.

Since the present study included the patients admitted to the hospital, it may not represent the general population, which may be regarded as a potential limitation. Another limitation of the study is that we could not measure the androgen levels. Nevertheless, the present study may be accepted as a pilot study, and the study findings need to be clarified with larger prospective studies.

5. CONCLUSION

The present study showed that increased BMI and insulin resistance were associated with increased trunk hair density, especially abdominal hair density, in nonobese Turkish men for the first time. And we suggest that evaluation of abdominal hair density may be a clinical method for risk assesment of insulin resistance in Turkish men. Association between insulin resistance and hair follicle functions in men needs to be further studied in larger series.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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