Criticising Modified Ferriman-Gallwey Scroring System in the Evaluation of Hirsutism in 1034 Turkish Women

1034 Türk Kadınında Modifiye Ferriman-Galwey Skorlama Sisteminin Hirsutizmin Değerlendirilmesinde Kritik Edilmesi

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ABSTRACT Objective: Although there are objective methods to assess hirsutism, they are complex, expensive, and difficult to use; thus, the less expensive and more simple modified Ferriman-Gallwey (mFG) score has instead been accepted as the most widely used standard scoring system. Women with an mFG score of 8 and higher are diagnosed with hirsutism. Modified FG cutoff values have been shown to vary from one population to another. The aims of study were to determine a specific mFG cutoff value for hirsutism in Turkish women and to find factors affecting the score. **Material and Methods:** Participants' sociodemographic characteristics, family history of hirsutism, and menstrual irregularities were investigated. Skin type, the presence of androgenetic alopecia and acne were examined. Body mass index was calculated. The presence of terminal hair was evaluated by mFG scoring. **Results:** The mean mFG score was 3.26±3.81 (0-28) in the study group. The mean mFG score was significantly higher in younger participants, in dark-skinned women, and in those with a familial complaint, menstrual irregularity and acne vulgaris. The 95th and the 97.5th percentile mFG score values for all participants were 11.00 and 14.00, respectively. When excluding those with menstrual irregularities, they were 10.65 and 13.82. When excluding those with menstrual irregularity and acne vulgaris, the values were 9.00 and 13.00. **Conclusion:** A cutoff value of 11 in the mFG scoring system should be used for the diagnosis of hirsutism in Turkish women. This value should not be applied strictly, but modified by factors such as age, skin type and family history.

Key Words: Acne vulgaris;alopecia; hirsutism

ÖZET Amaç: Her ne kadar hirsutizmin saptanmasında objektif metodlar olsa da, bu metodlar kompleks, uygulaması zor ve pahalı yöntemler olması sebebiyle daha ucuz ve uygulaması kolay olan modifiye Ferriman-Gallwey (mFG) skorlama sistemi, kabul görmüş, sık kullanılan bir skorlama sistemidir. Kadınlarda mFG skorunun 8 ve üzeri olması hirsutizm olarak tanımlanmaktadır. Bu çalışma ile Türk kadınında mFG skoru için limit değerini ve bu değere etki eden faktörleri saptamak amaçlandı. **Gereç ve Yöntemler:** Katılımcıların sosyodemografik özellikleri, ailede tüylenme şikayeti öyküsü ve menstruasyon düzensizliği sorgulandı. Deri tipi, androgenetik alopesi ve akne açısından muayene edildi. Beden kitle indeksi hesaplandı. Terminal kıl varlığı mFG ile değerlendirildi. **Bulgular:** Çalışma grubunda mFG skor ortalaması 3,26±3,81 (0-28) idi. Gençlerde, esmerlerde, ailede kıllanma şikayeti, menstruasyon düzensizliği ve akne vulgarisi olanlarda mFG skor ortalaması anlamlı olarak daha yüksekti. Tüm katılımcılarda tespit edilen %95. ve %97.5. mFG skor değeri 11,00 ve 14,00, menstruasyon düzensizliği olanlar çıkartıldığında 10,65 ve 13,82, menstruasyon düzensizliği ve akne vulgarisi olanlar çıkartıldığında 9,00 ve 13,00'tü. **Sonuç:** Türk kadınlarında hirsutizm tanısı için mFG skorlama sisteminde limit değeri 11 civarında olmalıdır. Bu değer katı bir şekilde uygulanmamalı, yaş, deri tipi, aile öyküsü pozitifliği gibi faktörler dikkate alınarak modifikasyonlara gidilmelidir.

Anahtar Kelimeler: Akne vulgaris; alopesi; hirsutizm

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Hirsutism refers to male-pattern excessive growth of terminal hair on the face or in parts of the body where hair growth in women is usually minimal or absent. Its prevalence in the general population is 5-15%.[1]

Hirsutism occurs because of an increase in the androgen level or enhanced sensitivity of the pilosebaceous unit to normal androgen levels. Therefore, hirsutism may be clinical evidence of other diseases that present with increased androgen levels, such as polycystic ovary syndrome, androgen secreting tumors, non-classical adrenal hyperplasia, or severe insulin resistance syndromes.[2] Hirsutism is defined as idiopathic in individuals with regular menstrual cycles, hormonal parameters within the normal limits of the examinations, and without ovulatory dysfunction.[1,3] In contrast, the degree and distribution of body hair shows significant individual and racial differences. While the clinical presentation may be considered idiopathic in one society, it can be considered normal in another society. Women from Mediterranean countries are known to have more hair on their faces and on parts of their body compared to those of Northern European and Asian origin. For this reason, a differential diagnosis of hirsutism should be made with recognition of racial differences and biological variations. However, there are no sharp lines between hirsutism and normal amounts of hair.[1]

Although there are objective methods to assess hirsutism (photographic evaluation, microscopic measurement of hair diameter, computerized assessment of photographic measurements, etc.), they are complex, expensive and difficult to use; thus, the less expensive and more simple modified Ferriman-Gallwey (mFG) score has instead been accepted as the most widely used standard scoring system although this method has been shown to bear individual variabilities.[1,4] Women with mFG scores 8 or higher are diagnosed with hirsutism. In FG scoring described in 1961, the presence of terminal hair was rated in 11 regions (lower arms, lower legs besides regions in mFG)[5] but in mFG scoring, presence of terminal hair was rated in 9 regions (upper lip, chin, chest, upper abdomen, lower abdomen, upper arms, thighs, upper back, lower back). Modified FG cutoff values have been shown to vary from one population to another.[1] Unless a cutoff value for Turkish women is not determined, unnecessary investigations will be conducted,causing a considerable economic burden and loss of time for both health workers and patients. This is also true for other countries in which a number of Turkish people live.

On the other hand, most women have laser hair removal in the recent years in Turkey, because this technique is safe and efficient, and cheaper in Turkey compared to Europe. In addition, as epilation in women is acceptable in the Muslim community, it is very hard to find a woman not using temporary hair reduction methods at anytime in Turkey. Therefore, this study can be conducted in a special group of women with diminished self-care. Our goal was to establish a specific cutoff value for Turkish women and to find factors affecting the score.

MATERIAL AND METHODS

This study was conducted on 1034 female patients and companions in their reproductive years, 18 and older, who admitted to the hospital between January 1, 2010 and December 1, 2010. The hospital in which the study has been conducted is one of two biggest hospitals of Anatolian side of Istanbul. Many patients are referred to the hospital from the other cities for advanced investigations and treatment. Hospital stay of the patients is longer than that of the patients in other hospitals because the patients have not a place to stay and their investigations take a long time. Most patients have companions because of Turkish attitudes. Most of women included in the study were companions or patients that were investigated for problems such as unknown pain, fever or waiting for an operation for an orthopedic problem, reconstruction, etc. The first researcher, N.D., had worked five night shifts in every month during the year that the study had been conducted. She visited all hospital beds in every night shift, and examined women who did not have exclusion criteria and accepted to attend the study. Patients admitted to the dermatology, endocrinology and obstetrics and gynecology de-

partments were excluded, along with patients whose main diagnosis might be hirsutism. Pregnant and postmenopausal women were also excluded, as well as those with permanent hair removal applications with such as laser or electrolysis. The women who used temporary hair reduction methods in the previous 4 weeks (waxing, depilatory creams, shave) were also excluded. Women taking corticosteroids, cyclosporine, minoxidil, danazol, cimetidine, finasteride, anticonvulsant drugs known to cause hirsutism, oral contraceptives as well as those with a diagnosis of Cushing's syndrome with male pattern hair loss with virilization symptoms were also excluded.

The sociodemographic characteristics of the women (age, birthplace) were investigated in the study. Furthermore, the presence or absence of menstrual irregularity was recorded (menstrual cycle <21 days was assessed as polymenorrhea and that >35 days was assessed as oligomenorrhea).[3]

Skin type was identified using Fitzpatrick skin type classification; the diagnosis of androgenetic alopecia (AGA) was graded using the Ludwig classification, and the presence of acne was assessed using the Orfanos and Gollnick scale.

Height and weight measurements were recorded and body mass indices (BMI) (kg/m^2) were calculated. Subjects were classified into 3 groups by skin type (I+II, III, and IV+V). The BMI values under and above 25.00 kg/m^2 were categorized.

The presence of terminal hair in 9 regions (upper lip, chin, chest, upper abdomen, lower abdomen, upper arms, thighs, upper back, lower back) was rated by mFG scoring using a 5-point scale (0=no terminal hair, 4=extreme and widespread terminal growth).[1,5,6] The first author, who was trained by another physician experienced with the scoring system, performed the scoring.

All patients gave their informed consents for participation. The study was carried out according to the Declaration of Helsinki adopted in 1964 and revised in 2004, and the principles of the 3rd Clinical Research Ethics Committee, and it received the approval of the Clinical Research Ethics Board.

Data were analyzed using SPSS (SPSS for Windows version 11.5; SPSS Inc., Chicago, USA). First of all, one-sample Kolmogorov-Smirnov test was used to determine whether the continuous variables followed a normal distribution, and then nonparametric tests, Mann-Whitney U, Kruskal-Wallis and Spearman's rho coefficient were used for the analysis of the data. Mann-Whitney U test with Bonferroni correction is used after Kruskal-Wallis analysis to determine the significance between the groups.

RESULTS

The characteristics of the participants are shown in Table 1. The distribution of birthplace was as follows: 317 (30.7%) were born in the Marmara region, 294 (28.4%) in the Black Sea region, 162 (15.7%) in central Anatolia, 145 (14.0%) in Eastern Anatolia, 67 (6.5%) in Southeast Anatolia, 27 (3.6%) in the Mediterranean region and 22 (2.1%) were from the Aegean region.

The mean mFG score of the study group was 3.26±3.81 (0-28). The mean scores in the body regions were as follows: thigh 0.82, upper lip 0.67, chin 0.56, lower abdomen 0.47, chest 0.46, upper abdomen 0.12, lower back 0.07, upper arm 0.06, and the back 0.02.

The presence of terminal hair was found on the thigh in 566 (54%) patients, on the upper lip in 455 (44.0%), on the chest in 386 (38.5%), on the lower abdomen in 354 (34.2%), on the jaw in 332 (32.1%), on the upper abdomen in 81 (7.8%), on the lower back in 46 (4.4%), on the upper arm in 37 (3.6%) and on the upper back in 18 (1.8%) women. While terminal hair scores on the thigh were found ≥3 in 71 (6.9%) subjects, there was no participants with scores ≥3 in the back region. The distribution of terminal hair did not vary with skin type.

There was a statistically significant difference in the median mFG scores among skin type groups. The median mFG score was significantly higher in those with acne vulgaris, and menstrual irregularity. There was no statistically significant difference between the median mFG scores in those with and

TABLE 1: Sociodemografic characteristics of participants and analysis of median mFG scores for age, menstrual irregularity, skin type, menstrual irregularity, skin type, menstrual irregularity, skin type.

		n (%)	mFG median (min-max)	p
Menstrual irregularity	No	846 (81.8%)	2 (0-28)	<0.001*
	Yes	188 (18.2%)	3 (0-23)	
	Oligomenorrhea	166 (16.1%)		
	Polymenorrhea	22 (2.1%)		
Fitzpatrick skin typing	type I+II	393 (38.0%)	2 (0-28)	<0.001**
	type III	451 (43.6%)	2 (0-28)	
	type IV+V	190 (18.4%)	3 (0-16)	
Androgenetic alopecia	No	897(86.8%)	2 (0-28)	0,470*
	Yes	137 (13.2%)	2 (0-28)	
	stage I	95 (9.2%)		
	stage II	32 (3.2)		
	stage III	10 (1.0%)		
Acne vulgaris	No	939 (90.7%)	2 (0-28)	<0.001*
	Yes	95 (9.3%)	4 (0-26)	
	stage I	74 (7.2%)		
	stage II	12 (1.2%)		
	stage III	10 (1.0%)		
BMI (mean 25.75±5.46 kg/m^2)	<25 kg/m^2	551 (53.3%)	2 (0-28)	0.595*
	≥25 kg/m^2	483 (46.7%)	2 (0-28)	

BMI: Body mass index.

*Statistical analysis with Mann-Whitney U test,**Statistical analysis with Kruskal Wallis test.

With Mann-Whitney U test score, difference between skin type groups were: skin type I+II and skin type III statistical analysis score p=0.001, skin type I+II and skin type IV+V statistical analysis score p<0.001, type III and skin type IV+V statistical analysis score p=0.117 (Bonferroni- corrected statistical significance score: 0.0167).

without AGA, and in those with BMI <25 kg/m^2 and ≥25 kg/m^2 (Table 1).

While there was a significantly negative correlation between mFG score and age (r=-0.115, p<0.001), there was no significant correlation between BMI and mFG score (p=0.876).

The total mFG score was determined to be ≥8 in 11.3% of the participants.

The 95th and the 97.5th percentile values of mFG scores for all participants (n_1=1034), in participants without menstrual irregularity (n_2=846), and in those without irregular menstruation and acne vulgaris (n_3=768) were 11.00 and 14.00, 10.65 and 13.82, and 9.00 and 13.00, respectively (Table 2). Modified FG scores in the 95th and in the 97.5th percentile values are shown in Table 2 for age and skin type classification in the 3 groups, depending on the presence of acne vulgaris in all participants and in those without menstrual irregularity and depending on the presence of menstrual irregularity in all participants.

DISCUSSION

Studies have shown that in the mFG scoring system, the 95th percentile value varies among ethnic groups. In Chile, the FG score was >5, while the Taiwanese FG score was ≥3.[7,8] In Turkey, Sagsoz et al. found the 95th percentile value as 9 in their study carried out in Kırıkkale on 204 healthy premenopausal women aged between 20 and 54 years.[9] Similarly, Api et al. determined the 95th the percentile value as 10.71 in their study carried out on 121 women between 13 and 80 years of age without the complaint of hirsutism, in Istanbul.[10] However, those two studies did not have sufficient number of patients to be able to provide a cutoff

TABLE 2: 95th and 97.5th percentile values of mFG scores of the participants in age, skin type, menstrual irregularity and acne vulgaris groups.

	n_1	95th %	97.5th %	n_2	95th %	97.5th %	n_3	95th %	97.5th %
n	1034	11.00	14.00	846	10.65	13.82	768	9.00	13.00
Skin type									
I+II	393	11.00	13.15	286	8.00	13.00	286	7.65	13.00
III	451	12.00	14.00	339	11.00	14.00	339	9.00	13.00
IV+V	190	12.00	14.00	143	11.35	14.00	143	11.00	14.00
Menstrualirregularity									
Yes	188	14.00	17.00	-	-	-	-	-	-
No	846	10.65	13.82	-	-	-	-	-	-
Acnevulgaris									
Yes	95	13.20	17.00	77	14.00	19.35	-	-	-
No	939	11.00	14.00	769	9.00	13.00	-	-	-

n_1: All participants

n_2: Participants without menstrual irregularity

n_3: Participants without menstrual irregularity and acne vulgaris.

value. In the calculation of the normal value with 85% sensitivity on the basis of community, the necessary number of participants to be included in a study has been reported to be 624.[11] The city of Istanbul, where we carried our study, is known to be multicultural. Since the birthplace of only 30.7% of the participants was the Marmara region, the family roots of this group are likely to be based on different regions due to internal migration. Therefore, since we consider that our study group represents the Turkish community in terms of both the size of the study population and their distribution, the mFG cutoff point for the Turkish women in the reproductive ages should be 11.

Among the causes of hirsutism, the rate of idiopathic hirsutism varies from 5% to 55%.[12-14] Carmina et al. attributed this high rate to diagnoses established on the basis of regular menstruation, regardless of androgen levels in the blood, and subsequently, they determined the rate of idiopathic hirsutism as 6% in their study using hormone analysis.[12] If this study is performed in a Middle East country and a similar cutoff value is taken, it is clear that the rate of idiopathic hirsutism will increase. In fact, in a study in India using an mFG cutoff score ≥6, the rate of idiopathic hirsutism was found to be 38.7% although hormonal tests were performed, and in a study in Iran using an mFG cutoff score ≥8, the rate was 35.2%.[13,14] In Turkey, Unluhizarci et al. found the rate of idiopathic hirsutism as 16% in 168 women with an mFG score above 8.[15]

If the cutoff value of the mFG scoring system is kept low community-wide, the score may lead to unnecessary tests, and if it is kept high, it may result in an unawareness of women with abnormal hair growth. It may be possible to overcome this condition by questioning the other findings of hyperandrogenism. Souter et al. found high androgen levels in 54.3% of 228 American women with an mFG score <6.[16] However, an irregularity of menstruation was observed in 73.9% of cases in this study. Even when we exclude the patients with irregular menstruation from our study group, the cutoff value proves to be 10.65. Naturally, patients with an anovulatory cycle with increased androgen and without menstrual irregularity might still be included in our study.

Menstrual irregularity is an important parameter to be examined in women studied for hyperandrogenism and hirsutism.[17] Oligomenorrhea was found to be more frequent in women with hirsutism compared to in those with acne and AGA.[18] Azziz et al. determined the rate of ovulatory dysfunction as 88.2% in 873 women presenting with symptoms of increased androgen, and they found

hirsutism (mFG score ≥6) in 75.5% of patients.[19] In the studies from Thailand, India and Iran, hirsutism was significantly higher in those with irregular menstruations.[8,13,14] In our study, the median mFG score was significantly higher in the ones with irregular menstruations.

In Turkey, Hassa et al. performed FG scoring in 11 regions in patients with hirsutism. This study found the most frequent site for the terminal hair as the thigh, followed by the buttocks and sideburns; we did not take into account the latter two sites.[20] The upper arm, upper back and upper abdomen were the regions least contributing to the score. In healthy Dutch women, the least amount of terminal hair was identified on the upper arms, upper back, upper abdomen, and lower back.[21] Again, in Taiwanese people, most terminal hair was found on the upper lip, followed by the lower abdomen.[8] In our study, the largest amount of terminal hair was found on the thigh. The terminal hair was also observed on the upper lip, chest, abdomen and lower jaw. The least amount of terminal hair was found on the upper back, upper arm, and lower back. On the basis of previous studies, we also believe that the effect of these anatomical regions on the total score is limited.

Androgens (total testosterone, free testosterone, DHEAS, androstenodione) were shown to decrease with age.[16,22-24] There are studies supporting a negative correlation between age and hirsutism score.[5,9,25] A significant correlation between age and hirsutism score was observed in the opposite direction in our study. However, there are studies showing that a positive correlation does not exist between age and hirsutism, and some studies report that there is a positive correlation.[13,19,26]

There is widespread agreement that dark-haired, dark-skinned people have more hair than blonds or fair-skinned people despite there is no difference in the number of hair follicles.[27] In our study, this general view was supported by the observation that the mFG scores increased parallel to the darkness of the skin color, whereas the distribution of terminal hair remained unchanged.

Acne is considered an indicator of hyperandrogenemia, and the relationship between hirsutism and acne depends on this assumption.[8,28-30] Compared to the control group, sex hormone binding globulin (SHBG) levels were significantly lower and free testosterone and DHEAS levels were significantly higher in women with acne and without hirsutism.[31] A study on 790 premenopausal Iranian women with the complaint of hirsutism showed a rate of acne vulgaris as 70%.[14] In our study, the median mFG score was significantly higher for those with acne. Conversely, in some studies no correlation was found between hirsutism and acne vulgaris.[8,32]

Another symptom of hyperandrogenemia is AGA.[30] However, the role of androgens in AGA has not been fully understood in women. In women with AGA, a decrease in SHBG levels and a significant increase in androgen metabolites have been shown. In contrast, clinical and biochemical evidence of increased androgen has been demonstrated in many women with AGA. Androgens are believed to play a role in AGA, although some mechanisms are known to be independent of androgen in some women.[33] In our study, women with AGA were not found to have higher mFG scores than those without AGA.

When the association of obesity with hyperandrogenemia is assessed, some papers emphasize the negative effects of fat metabolism on androgens, but others emphasize that obesity is the reason for the elevated androgen.[14,28,29] Parallel to this information, the diagnosis and an mFG score indicative of hirsutism were shown to occur more often in individuals with high BMI.[13,14,21,34] In contrast, in our study, no correlation was found between increased BMI score and mFG. Cheewadhanaraks et al., DeUgarte et al. and Sagsoz et al. also did not detect any significant correlation between BMI and hirsutism.[8,9,26]

In conclusion, the mFG cutoff value should be taken as 11 for the diagnosis of hirsutism in Turkish women. This value should not to be applied strictly and should be modified for age and skin type. Higher cutoff values may prevent unnecessary tests, and save financial resources and time.

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REFERENCES

1. Yildiz BO, Bolour S, Woods K, Moore A, Azziz R. Visually scoring hirsutism. Hum Reprod Update 2010;16(1):51-64.
2. Al Robaee A, Al-Zolibani A, Al Shobaili HA, Aslam M. Update on hirsutism. Acta Dermatovenerol Alp Panonica Adriat 2008;17(3):103-19.
3. Goodman NF, Bledsoe MB, Cobin RH, Futterweit W, Goldzieher JW, Petak SM, et al. American Association of Clinical Endocrinologists medical guidelines for the clinical practice for the diagnosis and treatment of hyperandrogenic disorders. Endocr Pract 2001;7(2):120-34.
4. Hatch R, Rosenfield RL, Kim MH, Tredway D. Hirsutism: implications, etiology, and management. Am J Obstet Gynecol 1981;140(7): 815-30.
5. Ferriman D, Gallwey JD. Clinical assessment of body hair growth in women. J Clin Endocrinol Metab 1961;21:1440-7.
6. Ferriman D, Purdie AW. Association of oligomenorrhoea, hirsutes, and infertility. Br Med J 1965;2(5453): 69-72.
7. Téllez R, Frenkel J. [Clinical evaluation of body hair in healthy women]. Rev Med Chil 1995;123(11):1349-54.
8. Cheewadhanaraks S, Peeyananjarassri K, Choksuchat C. Clinical diagnosis of hirsutism in Thai women. J Med Assoc Thai 2004;87(5): 459-63.
9. Sagsoz N, Kamaci M, Orbak Z. Body hair scores and total hair diameters in healthy women in the Kirikkale Region of Turkey. Yonsei Med J 2004;45(3):483-91.
10. Api M, Badoglu B, Akca A, Api O, Gorgen H, Cetin A. Interobserver variability of modified Ferriman-Gallwey hirsutism score in a Turkish population. Arch Gynecol Obstet 2009;279(4): 473-9.
11. Flahault A, Cadilhac M, Thomas G. Sample size calculation should be performed for design accuracy in diagnostic test studies. J Clin Epidemiol 2005;58(8):859-62.
12. Carmina E. Prevalence of idiopathic hirsutism. Eur J Endocrinol 1998;139(4):421-3.
13. Zargar AH, Wani AI, Masoodi SR, Laway BA, Bashir MI, Salahuddin M. Epidemiologic and etiologic aspects of hirsutism in Kashmiri women in the Indian subcontinent. Fertil Steril 2002;77(4):674-8.
14. Ansarin H, Aziz-Jalali MH, Rasi A, Soltani-Arabshahi R. Clinical presentation and etiologic factors of hirsutism in premenopausal Iranian women. Arch Iran Med 2007;10(1):7-13.
15. Unluhizarci K, Gokce C, Atmaca H, Bayram F, Kelestimur F. A detailed investigation of hirsutism in a Turkish population: idiopathic hyperandrogenemia as a perplexing issue. Exp Clin Endocrinol Diabetes 2004;112(9):504-9.
16. Souter I, Sanchez LA, Perez M, Bartolucci AA, Azziz R. The prevalence of androgen excess among patients with minimal unwanted hair growth. Am J Obstet Gynecol 2004;191(6): 1914-20.
17. Cerit ET, Altınova A. [Evaluation of a patient with hirsutism: Review]. Turkiye Klinikleri J Endocrin 2011;6(2):82-93.
18. Karrer-Voegeli S, Rey F, Reymond MJ, Meuwly JY, Gaillard RC, Gomez F. Androgen dependence of hirsutism, acne, and alopecia in women: retrospective analysis of 228 patients investigated for hyperandrogenism. Medicine (Baltimore) 2009;88(1):32-45.
19. Azziz R, Sanchez LA, Knochenhauer ES, Moran C, Lazenby J, Stephens KC, et al. Androgen excess in women: experience with over 1000 consecutive patients. J Clin Endocrinol Metab 2004;89(2):453-62.
20. Hassa H, Tanir HM, Yildirim A, Senses T, Eskalen M, Mutlu FS. The hirsutism scoring system should be population specific. Fertil Steril 2005;84(3):778-80.
21. Derksen J, Moolenaar AJ, Van Seters AP, Kock DF. Semiquantitative assessment of hirsutism in Dutch women. Br J Dermatol 1993; 128(3):259-63.
22. Spencer JB, Klein M, Kumar A, Azziz R. The age-associated decline of androgens in reproductive age and menopausal Black and White women. J Clin Endocrinol Metab 2007; 92(12):4730-3.
23. Randolph JF Jr, Sowers M, Gold EB, Mohr BA, Luborsky J, Santoro N, et al. Reproductive hormones in the early menopausal transition: relationship to ethnicity, body size, and menopausal status. J Clin Endocrinol Metab 2003;88(4):1516-22.
24. Lasley BL, Santoro N, Randolf JF, Gold EB, Crawford S, Weiss G, et al. The relationship of circulating dehydroepiandrosterone, testosterone, and estradiol to stages of the menopausal transition and ethnicity. J Clin Endocrinol Metab 2002;87(8):3760-7.
25. Knochenhauer ES, Hines G, Conway-Myers BA, Azziz R. Examination of the chin or lower abdomen only for the prediction of hirsutism. Fertil Steril 2000;74(5):980-3.
26. DeUgarte CM, Woods KS, Bartolucci AA, Azziz R. Degree of facial and body terminal hair growth in unselected black and white women: toward a populational definition of hirsutism. J Clin Endocrinol Metab 2006; 91(4):1345-50.
27. Sharquie KE, Al-Khafaji KA. The prevalence of hirsutism in Iraqi females. Ann Saudi Med 1992;12(5):453-5.
28. Harper JC. Antiandrogen therapy for skin and hair disease. Dermatol Clin 2006;24(2):137-43, v.
29. Lee AT, Zane LT. Dermatologic manifestations of polycystic ovary syndrome. Am J Clin Dermatol 2007;8(4):201-19.
30. Zouboulis CC, Chen WC, Thornton MJ, Qin K, Rosenfield R. Sexual hormones in human skin. Horm Metab Res 2007;39(2):85-95.
31. Slayden SM, Moran C, Sams WM Jr, Boots LR, Azziz R. Hyperandrogenemia in patients presenting with acne. Fertil Steril 2001;75(5): 889-92.
32. Sheehan-Dare RA, Hughes BR, Cunliffe WJ. Clinical markers of androgenicity in acne vulgaris. Br J Dermatol 1988;119(6):723-30.
33. Birch MP, Lalla SC, Messenger AG. Female pattern hair loss. Clin Exp Dermatol 2002; 27(5):383-88.
34. Döner N, Yaşar Ş, Ekmekçi TE. [Evaluation of obesity-associated dermatoses in obese and overweight individuals]. Turkderm 2011;45(3): 146-51.