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Research Article

Clinical and Biochemical Evaluation of Hirsutism in Young, Lean Girls from Kirkuk City, Iraq: A Cross-Sectional Study

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Abstract

Background: An increase in terminal hair in androgen-dependent regions is known as hirsutism. It is not solely caused by hyperandrogenemia; idiopathic forms are also frequently seen. ***Objective***: To examine the modified Ferriman Gallwey (mFG) cut-off score in female Iraqis as well as the etiological, biochemical, and clinical characteristics of hirsutism. ***Methods***: This prospective cross-sectional study included one thousand young girls with a normal BMI. The features associated with clinical hirsutism were identified using the mFG scoring system. We eliminated eighty-eight young girls who were diagnosed with PCOS. Samples of blood were drawn for biochemical analyses. ***Results***: 53.1%, 19.6%, and 1.2% of females had mild, moderate, or severe hirsutism, respectively. For the young females participated in the study, their mean mFG scores were 7.07, 11.26, 16.26, and 29, respectively. Only 5% of girls with mild hirsutism had high serum free testosterone levels, despite a considerable difference in free testosterone levels between them and the normal girls. The chin, upper lip, and lower abdomen were the sites that contributed the most to mFGs. Of the girls who were moderately hirsute, 55% had a positive family history of hirsutism. ***Conclusion***: Iraqi women do not need to consider the mFG score system's cut-off number of 8. The endocrine society's guidelines for hirsutism estimation should be adhered to by the examiner.

Keywords: Hirsutism, Hyperandrogenemia, Idiopathic hirsutism, mFGs.

التقييم السريري والكيميائي الحيوي للشعرانية لدى الفتيات الشابات غير البدينات من مدينة كركوك، العراق: دراسة مقطعية

الخلاصة

الخلفية: تعرف الزيادة في الشعر النهائي في المناطق التي تعتمد على الأندروجين باسم الشعرانية. لا يحدث فقط بسبب فرط أندروجين الدم. وكثيرا ما ينظر إلى أشكال مجهولة السبب. **الهدف**: فحص درجة قطع فيريمان غالوي المعدلة (mFG) في الإناث العراقيات بالإضافة إلى الخصائص المسببة والكيميائية الحيوية والسريرية للشعرانية. **الطريقة**: شملت هذه الدراسة المقطعية المستقبلية ألف فتاة صغيرة مع مؤشر كتلة اجسم طبيعية. تم تحديد السمات المرتبطة بكثرة الشعر السريرية باستخدام نظام تسجيل mFG. تم استبعاد ثمانية وثمانين فتاة صغيرة تم تشخيص إصابتهن بمتلازمة تكيس المبايض. تم سحب عينات من الدم للتحاليل البيوكيميائية. **النتائج**: 53.1٪ و 19.6٪ و 1.2٪ من الإناث عانين من الشعرانية الخفيفة أو المتوسطة أو الشديدة على التوالي. بالنسبة للإناث الشابات المشاركات في الدراسة، كان متوسط درجات mFG 7.07 و 11.26 و 16.26 و 29 على التوالي. فقط 5٪ من الفتيات المصابات بكثرة الشعر الخفيفة لديهن مستويات عالية من هرمون التستوستيرون الحر في الدم، على الرغم من الاختلاف الكبير في مستويات هرمون التستوستيرون الحر بين المجموعتين. كانت الذقن والشفة العليا وأسفل البطن هي المواقع التي ساهمت أكثر في تغيرات mFG. من بين الفتيات اللواتي كن مصابات بكثرة الشعر المعتدل، كان لدى 55٪ تاريخ عائلي إيجابي من الشعرانية. **الأستنتاج**: لا تحتاج النساء العراقيات إلى النظر في الرقم النهائي لنظام نقاط mFG وهو 8. يجب الالتزام بالمبادئ التوجيهية لجمعية الغدد الصماء لتقدير الشعرانية من قبل الفاحص.

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INTRODUCTION

The psychologically upsetting disorder known as hirsutism is brought on by an abundance of terminal hair in androgen-dependent parts of the female body, particularly in women who are of reproductive age. The amount and distribution of hair that is considered normal or receptive for a woman varies on her race as well as her understanding of societal, cultural, and familial norms. Asian women typically have very little face and body hair, while Mediterranean women often have moderate amounts [1,2]. The detrimental effects of hirsutism on Iraqi women's self-esteem and body image are among the major psychosocial ramifications of the condition. Women who are hirsute may feel ashamed, embarrassed, and alone in a world where the expectation is that femininity is defined as having smooth, hairless skin. Unwanted body and facial hair can cause people to become more conscious of themselves and to believe that they are in some way falling short of what society considers to be beautiful. A thorough medical history, an appropriate physical examination, laboratory testing, and any required imaging are required for the diagnosis of hirsutism. The modified Ferriman-Gallwey approach is the most widely used physical and clinical method for diagnosing hirsutism. Nine of the eleven body parts (upper lip, chin, chest, upper and lower abdomen, arm, forearm, thigh, and upper back) are scored using this method. The overall score is between 0 and 36. Typically, hirsutism is rated as mild up to a score of 15, moderate from 16 to 25, and severe from 25 onwards [3]. Idiopathic hirsutism and hyperandrogenic hirsutism are two categories of hirsutism causes. Hirsutism, which promotes the growth of coarse black hair like that of men, is mostly caused by high testosterone levels [4]. The ovaries and adrenal glands produce half of the circulating testosterone, while five reductases type 2 that act on particular hair follicles convert weaker androgens like androstenedione, which is produced by both the ovaries and the adrenal glands, to testosterone [3]. The most frequent cause of ovarian hyperandrogenism is polycystic ovarian syndrome, although functional adrenal hyperandrogenism that is dependent on adrenocorticotropics is also frequently observed. Rarely, an isolated rise of DHEAS is seen in patients with PCOS [5]. Measuring total testosterone in the morning can be used to biochemically estimate hyperandrogenic hirsutism. Plasma-free testosterone levels should decrease if they are considerably increased. An examination of androgen screening cancers should occur when total testosterone exceeds 200 mg/dl (6.94 nmol/l) [6]. Excessive hair growth in women of reproductive age without biochemical hyperandrogenemia or clinical or subclinical menstrual disruption is the hallmark of idiopathic hirsutism. Although the precise causes of idiopathic hirsutism are unknown, a number of theories have been put out to explain how it develops. Idiopathic hirsutism may result from an undetected small androgen excess. The development of hirsutism may be facilitated by slight increases in androgens, which may be too subtle for standard laboratory testing to pick up on. In certain situations, the androgen levels might be within the normal range but yet above the ideal range for controlling hair growth. An additional possible reason for idiopathic hirsutism is elevated 5-alpha-reductase activity in hair follicles. The enzyme 5 alpha-reductase is in charge of transforming testosterone into the more potent androgen dihydrotestosterone (DHT). A surplus of DHT produced by this enzyme can cause an imbalance between androgens and estrogens in the hair follicles, which encourages hair growth. In addition, anomalies related to the androgen receptor have been linked to idiopathic hirsutism. The mediating role of the androgen receptor in the actions of androgens on target tissues is significant. Any variations or anomalies in this receptor may result in an enhanced sensitivity to androgens, which may cause the hirsutism-related irregularities in hair growth patterns [3,5,7]. In 1999 and 2019, the percentage of adult PCOS patients in Iraq with hirsutism was 35.4 and 63.73, respectively [8–9]. Though it has far-reaching implications, not much is known about how common hirsutism is in Iraq. Thus, the purpose of this essay is to shed light on the potential causes of hirsutism in Iraqi young girls and to present a quantitative analysis of the disease's clinical and biochemical characteristics.

METHODS

This cross-sectional study was conducted at the University of Kirkuk, College of Medicine, from September 2021 to October 2022. A total of 1000 young female students aged 19.4±1.3 and BMI 22.24±2.8 participated in the study. Eighty-eight young girls with PCOS were excluded from the study. All the students were examined for the presence of hirsutism. According to the modified Ferriman and Gallway scale, we assess the growth of terminal hair in nine areas of the body (face, neck, chest, upper abdomen, lower abdomen, upper arm, thigh, upper back, and lower back). According to the mFG scoring system, each region was separately evaluated in terms of the rate of terminal hair growth and scored from 0 (absence) to 4 (excessive). The total score was calculated, and an mFG score of ≥ 8 was accepted as hirsutism. The severity of hirsutism was classified as mild if the mFG score was 8–16, moderate if 17–24, and severe if above 24. All the young girls had normal periods. All the young girls had normal periods. Ethical permission was obtained from all participants.

Exclusion criteria

Subjects were excluded based on the following: presence of any drug history that may interfere with the

result; irregular menstrual cycle; signs of cushion syndrome; PCO; elevated TSH, prolactin, FSH, and LH levels; and the use of laser therapy for hair removal.

Outcome measurements

All the participants were asked for: family history of hirsutism, family history of PCOS, the onset of hirsutism if present, time of menarche, age and race, and the hair removal method. 5 mL of blood was drawn from each participant to estimate free testosterone, androstenedione, DEHES, SHBG, LH, FSH, TSH, and prolactin hormone levels using standard procedures.

Ethical consideration

The present investigation was carried out in adherence to the ethical principles outlined in the Declaration of Helsinki. All participants provided verbal and analytical consent prior to the collection of samples. On May 30, 2023, the research was granted approval by the ethics committee of the College of Medicine/University of Kirkuk, in accordance with Document Number 48.

Statistical analysis

In this study, the values are presented as mean±SD. The Kolmogorov-Smirnov test is used to test the normality of the distribution. A one-way analysis of variance (ANOVA) was used to evaluate the differences between groups in the study. Then Turkey's *post hoc* test was performed to estimate the relationship between groups. To assess the statistical association between the categorical parameters, the Chi square test was used.

RESULTS

The study groups exhibited notable variations in the mFG score, prevalence of hirsutism, and serum testosterone levels, as indicated in Table 1. Furthermore, there were substantial racial and familial variations in the prevalence of hirsutism. Half of the females who were extremely hirsute were Arabs.

Table 1: Clinical features in hirsute and non-hirsute young girls

Parameters	Without hirsutism	Mild	Moderate	Severe	*p*-value
Number	173	531	196	12	
Age (year)	19,64±0.97	19.23±1.6	19.73±0.7	19±1.8	0.968
BMI (kg/m^2)	22.84±3.1	22.63±3	20.52±1.8	23±1.2	0.001
Family history of hirsutism					
Yes	12(7)	201(39)	108(55)	9(75)	0.0001
No	161(93)	330(61)	88(45)	3(25)	
S. Testosterone					
Normal	169(98)	505(95)	126(64)	5(42)	0.0001
Elevated	4(2)	25(5)	70(36)	8(58)	
Race					
Kurd	58(33.5)	92(14)	81(41)	3(25)	0.0001
Arab	58(33.5)	208(39)	58(30)	6(50)	
Turkman	57(33)	231(44)	57(29)	3(25)	
MFGS	7.07±1.016	11.26±1.68	16.26±1.38	29±4.1	0.000
The prevalence	17.3%	53.1%	19.6%	1.2%	

Values were presented as mean±SD and number(%).

As demonstrated in Table 2, notable variations in the mFG score were observed across distinct anatomical regions across the study groups. Significant differences were also observed between groups.

Table 2: Distribution of MFGS in the groups of the study

mFGS	Normal	Mild	Moderate	Severe	*p*-value
Upper lip	1.07±2^{abc}	1.52±0.71^{bc}	2.33±0.78	3.1±2.1	0.000
Chin	1±0.09^{abc}	1.08±0.35^{bc}	1.5±0.88^{c}	2.9±0.7	0.000
Chest	1±0.02^{abc}	1.23±0.59^{bc}	1.4±0.6	1.8±1.5	0.000
Upper abdomen	0.7±0.8^{abc}	1.39±0.54^{bc}	1.26±0.4^{c}	2.1±0.8	0.000
Lower abdomen	1.14±63^{abc}	0.78±0.71^{bc}	2.2±0.74^{c}	3.4±1.2	0.000
Upper arm	0.64±0.47^{abc}	1.23±0.59^{bc}	1.53±0.49^{c}	2.1±0.12	0.000
Thigh	0.21±0.41^{abc}	1.30±0.5^{bc}	2.13±0.88	2.5±1.9	0.000
Upper back	0.21±0.4^{abc}	1.31±0.39^{c}	1.4±0.61^{c}	1.8±0.3	0.000
Lower back	0.5±0.5^{abc}	1.19±0.39^{bc}	2.1±0.63^{c}	2.7±3.1	0.000

Values were expressed as mean±SD; a=p>0.05 compared with group 2 (mild hirsutism); b=p>0.05 compared with group 3 (moderate hirsutism); c=p>0.05 compared with group 4 (severe hirsutism).

The study revealed statistically significant variations in all hormonal parameters among the groups, as shown in Table 3. Significant variations were also identified among the categories.

Table 3: Hormonal parameters in the groups of the study

Parameters	Normal	Mild	Moderate	Severe	*p*-value
F. Testosterone (ng/ml)	0.2±0.12[abc]	0.4 ±0.28[b]	0.5±0.54	0.6±0.80	0.000
DHEAS (mg/dl)	96.7±25[abc]	110.6±23[b]	120±10	121±12	0.000
Androstenedione (ng/ml)	1.22±1.43[abc]	2.1±0.9	2.3±1.33	2.1±2.1	0.000
SHBG (nmol/L)	95±19[abc]	85±15	83±13	84±14	0.000

Values were expressed as mean±SD; a=p>0.05 compared with group 2 (mild hirsutism); b=p>0.05 compared with group 3 (moderate hirsutism); c=p>0.05 compared with group 4 (severe hirsutism); Normal free testosterone: 0.1-0.9 ng/ml; Normal DHEAS: 145-380 mg/dl; Normal androstenedione: 0.7-3.1 ng/ml; Normal SHBG: 18-144 nmol/L.

DISCUSSION

Idiopathic hirsutism, characterized by the undetermined proliferation of terminal hairs in females, is a profoundly incapacitating ailment that substantially undermines the affected women's self-esteem and quality of life. One thousand young females with a healthy body mass index were enrolled in this study. PCOS-affected females numbering eighty-eight were excluded from the study. As shown in Table 1, the corresponding prevalence rates for mild, moderate, and severe hirsutism were 53.1%, 19.6%, and 1.2%. The total mFG for the four categories of the study (normal, mild, moderate, and severe) was found to be significantly higher when a threshold value of 8 was applied, in contrast to findings from other studies [3,5,10-12]. Globally, the prevalence of hirsutism is estimated to range between 5 and 15 percent, contingent on the population under study. An extensively employed scoring system is the mFG method, which measures hair growth in nine body areas on a scale of zero to four. Nevertheless, disparities in FG scoring cutoff values exist among various nations and populations. This discrepancy presents difficulties in the process of comparing prevalence rates of hirsutism or identifying suitable interventions. In order to ascertain optimal cutoff values that adequately consider these variations, research should concentrate on particular populations as opposed to universally employing generic thresholds. An additional factor contributing to this incompatibility is the reliance of visual scoring methods, such as mFG scoring, on the providers' subjective judgment. Consequently, hirsutism severity evaluations reliant solely on visual investigation may fluctuate considerably among observers. When conducting assessments by different observers or even the same observer at different times, this variation may compromise the precision and dependability of the results. Kirkuk City accommodates a heterogeneous populace, including Turkmens, Kurds, and Arabs. A notable disparity was observed in the prevalence of various forms of hirsutism across racial categories. The development of terminal body hair is influenced by racial and ethnic diversity, resulting in variations in hair growth patterns across distinct groups. As an illustration, women residing in Middle Eastern countries might exhibit greater propensity for extensive hair growth, which could result in higher scores on the mFG assessment. [3]. A positive familial history of hirsutism was observed in 75% of severely hirsute girls and 55% of moderately hirsute girls in this research. This finding is consistent with three prior Iraqi investigations [13–15], in which over 50% of the cases reported a familial predisposition to hirsutism. The majority of hirsutism's fundamental causes, including idiopathic hirsutism, have familial origins [15–16]. In over 50% of the cases, a family history of hirsutism was identified; the majority of hirsutism's underlying causes, including idiopathic hirsutism, have familial origins [15,16]. Precise scoring threshold values are critical in hirsutism assessment as they guarantee appropriate diagnosis and treatment. The Ferriman-Gallwey (FG) scoring method, which measures hair growth in nine body areas on a scale of zero to four, is a widely utilized scoring system. Nevertheless, disparities in FG scoring cutoff values exist among various nations and populations. This discrepancy presents difficulties in the process of comparing prevalence rates of hirsutism or identifying suitable interventions. In order to ascertain optimal cutoff values that adequately consider these variations, research should concentrate on particular populations as opposed to universally employing generic thresholds. An additional factor contributing to this incompatibility is the reliance of visual scoring methods, such as mFG scoring, on the providers' subjective judgment. Consequently, hirsutism severity evaluations reliant solely on visual investigation may fluctuate considerably among observers. When conducting assessments by different observers or even the same observer at different times, this variation may compromise the precision and dependability of the results. Our research revealed that elevated free testosterone levels were observed in 36% of severely hirsute juvenile girls, 5% of mildly hirsute girls, and 36% of moderately hirsute girls. Due to the extremely high probability of idiopathic hirsutism, it is entirely rational to forego laboratory evaluations when mild hirsutism is present [17]. Androgens in the bloodstream are not correlated with the severity of hirsutism. Numerous variables may be at play, including local androgen concentrations and hair follicle sensitivity to androgen [3]. Additionally, genetic variations that result in variations in androgen receptors and abnormalities in peripheral androgen metabolism are

viable candidates [12]. 5-Reductase's conversion of local testosterone to dihydrotestosterone is more significant than that of androgens in the blood [18]. In addition, disorders of the activity of aromatase and alpha-reductase enzymes are extremely prevalent in Middle Eastern nations [19]. The biochemical evaluation of androgens is characterized by numerous technical limitations and lacks accuracy. The sensitivity and specificity of enzyme-linked immunosorbent or chemiluminescent assays for the detection of androgens are both inadequate [20]. In relation to anatomical regions assessed by the mFGs system, the upper mandible region exhibited the highest scores across all study groups. In addition, significant differences were observed in a variety of domains between the study groups. Contrary to this result, a Turkish study [21] found that the upper arm, buttock, and lower back regions yielded the highest scores. The girls who participated in this research consistently trimmed their mustaches, which explains the observed outcomes. The findings of other investigations were comparable to ours [22,13]. In regard to surplus androgen, the genitalia, face, chest, breast region, linea alba, and lower back are the most susceptible body parts [12]. Sharma *et al*. [23] provide evidence that a score of 2 is virtually universally detectable in hirsute patients, specifically on the mandible or lower abdomen. When examining women with hirsutism, the upper lip region frequently exhibits the highest scores. It is important to highlight that individuals with moderate to severe hirsutism demonstrated a significantly elevated mFG score in the lower abdomen. This implies that disturbances that result in hirsutism might have a specific impact on the growth of facial hair. Additional examination demonstrates that scores also differ among other facial regions and body parts. As an illustration, in comparison to other regions, the jawline and lower abdomen typically receive relatively high scores [24]. This information assists clinicians in identifying particular areas that necessitate focused treatment interventions, wherein the management of hirsutism should be determined by the extent of hair growth, with the pathogenesis of the condition duly considered.

Conclusion

For estimating hirsutism in Iraqi women, the mFG scoring system's cutoff value of 8 is irrelevant; the examiner should adhere to the endocrine society's recommendations. Idiopathic hirsutism is the most prevalent cause of hirsutism in young females with a healthy body mass index.

Conflict of interests

No conflict of interest was declared by the authors

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

FERENCES

1. Azziz R, Carmina E, Sawaya ME. Idiopathic hirsutism. *Endocr Rev*. 2000;21(4):347-362. doi: 10.1210/edrv.21.4.0401.
2. Himelein MJ, Thatcher SS. Polycystic ovary syndrome and mental health: A review. *Obstet Gynecol Surv*. 2006;61(11):723-732. doi: 10.1097/01.ogx.0000243772.33357.84.
3. Escobar-Morreale HF, Carmina E, Dewailly D, Gambineri A, Kelestimur F, Moghetti P, et al. Epidemiology, diagnosis and management of hirsutism: a consensus statement by the Androgen Excess and Polycystic Ovary Syndrome Society. *Hum Reprod Update*. 2011;18(2):146-70. doi: 10.1093/humupd/dmr042.
4. Mofid A, Seyyed Alinaghi SA, Zandieh S, Yazdani T. Hirsutism. *Int J Clin Pract*. 2008;62(3):433-443. doi: 10.1111/j.1742-1241.2007.01621.x.
5. Tehrani FR, Rashidi H, Azizi F. The prevalence of idiopathic hirsutism and polycystic ovary syndrome in the Tehran lipid and glucose study. *Reprod Biol Endocrinol*. 2011;9(1):144. doi: 10.1186%2F1477-7827-9-144.
6. Bode D, Seehusen D, Baird D. Hirsutism in women. *Am Fam Physician*. 2012;85:373-380. PMID: 22335316.
7. Harrison S, Somani N, Bergfeld WF. Update on the management of hirsutism. *Cleve Clin J Med*. 2010;77(6):388. doi: 10.3949/ccjm.77a.08079.
8. Ghalib A, Tahir S. Prevalence of hirsutism in adult females in gynecology out patient clinic at Tikrit teaching hospital. *J Fac Med Baghdad*.1999;1:40-48.
9. Al Saadi Y, Mohamad B. The prevalence of hyperandrogenism in Iraqi women with hirsutism. *Iraqi J Sci*. 2019;60:2600-2608. doi: 10.24996/ijs.2019.60.12.8.
10. Zargar A, Wani A, Masoodi S, Laway B, Iftikhar M, Salahuddin M. Epidemiologic and etiologic aspects of hirsutism in Kashmiri women in the Indian Subcontinent. *Fertil Steril*. 2002;77:674-678. doi: 10.1016/s0015-0282(01)03241-1.
11. Noorbala MT, Kefaie P. The prevalence of hirsutism in adolescent girls in Yazd, central Iran. *Iranian Red Crescent Med J*. 2010;12:111-117.
12. Amiri M, Fallahzadeh A, Sheidaei A, Mahboobifard F, Ramezani Tehrani F. Prevalence of idiopathic hirsutism: A systematic review and meta-analysis. *J Cosmet Dermatol*. 2022;21(4):1419-1427. doi: 10.1111/jocd.14313.
13. Sharquie KH, A-Khalifa KH. The prevalence of hirsutism in Iraqi females. *Ann Saudi Med*. 1992;12:5-10. doi: 10.5144/0256-4947.1992.453.
14. Mohammad Y, Dana S. Clinical and hormonal evaluation of women presenting with hirsutism at child bearing age in Slemani city. *Iraqi Postgrad Med J*. 2010;9(4): 393-398.
15. Al-Fadhily Z. Hirsutism: A clinical and biochemical study among Iraqi women in Hilla city. *Med J Babylon*. 2012;9(1):120-130.
16. Unluhizarci K, Hacioglu A, Taheri S, Karaca Z, Keletimur F. Idiopathic hirsutism: Is it really idiopathic or it is misnomer? *Word J Clin Cases*. 2023;16(2):292-298. doi: 10.12998/wjcc.v11.i2.292.
17. Rosenfield RL. Hirsutism. *New Engl J Med*. 2005;353(24):2578-2588. doi: 10.1056/nejmcp033496.
18. Spritzer PM, Marchesan LB, Santos BR, Fighera TM. Hirsutism, normal androgens and diagnosis of PCOS. *Diagnostics*. 2022;12(8):1922. doi: 10.3390/diagnostics12081922.
19. Caglayan AO, Dunder M, Tanriverdi F, Baysal NA, Oakul Y, Unluhizarcci K, et al. Idiopathic hirsutism: Local and peripheral expression of aromatase (CYP19A) and alpha reductase genes

(*SRD5A1* and *SRD5A2*). *Fertil Steril*. 2011;96(2):479-482. doi: 10.1016/j.fertnstert.2011.05.040.
20. Teede H, Misso M, Costello M, Dokras A, Laven J, Moran L, et al. Recommendations from the international evidence-based guideline for the assessment and management of polycystic ovary syndrome. *Hum Reprod*. 2018;33. doi: 10.1016/j.fertnstert.2018.05.004.
21. Parlak M, Parlak A, Toslak I. Etiologic factors and clinical characteristics of Turkish adolescent girls diagnosed with hirsutism. *J Clin Anal Med*. 2016;7(2). doi: 10.4328/JCAM.4168.
22. lagan M, Paz-Pacheco E, Totesora D, Clemente-Chua L, Jalique J. The modified Ferriman-Gallwey score and hirsutism among Filipino women. *Endocrinol Metab*. 2019;34:374. doi: 10.3803/enm.2019.34.4.374.
23. Sharma D, Shanker V, Tegta G, Gupta M, Verma GK. Clinico-investigative profile of patients of hirsutism in a tertiary level institution. *Int J Trichol*. 2012;4(2):69. doi: 10.4103/0974-7753.96904.
24. Kahraman F, Erdoğan S. Grading of hirsutism: A practical approach to the modified Ferriman-Gallwey scoring system. *Adv Dermatol Allergol*. 2021;39:744-748. doi: 10.5114/ada.2021.108455.