Original Article

Normative Data for Modified Ferriman-Gallwey Score and the Prevalence of Hirsutism in Young South Indians

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Abstract

Introduction: The modified Ferriman-Gallwey score (mFGS) cut-offs to define hirsutism vary with ethnicity, whereas no such cut-offs are established for Indian women. Well-conducted studies that report the prevalence of hirsutism in Indian women are limited. Hence, this study was conducted to report the prevalence of hirsutism and population-specific cut-offs for mFGS in South-Indian women. **Methods:** In this cross-sectional, community-based study, adult women in reproductive age (18–40 years) were screened for hirsutism by two trained medical students. Hirsutism was assessed using the mFGS and case record file. **Results:** A total of 453 women were included in the study [age: 22.15 ± 5.27 years; body mass index (BMI): 22.5 ± 3.58 kg/m2]. The median (IQR) mFGS was 1(0-3); only eight participants (1.8%) had mFGS ≥8, and all these eight women had at least another PCOS-related feature (irregular menstrual cycles and/or topical therapy-resistant acne). The median (IQR) mFGS in the PCOS phenotype group (n = 52), non-PCOS-phenotype group (n = 401), non-obese group (<25 kg/m2), non-PCOS-phenotype group (n = 322), obese group (≥ 25 kg/m2), non-PCOS-phenotype group (n = 79), overweight group (BMI: 23–25 kg/m2), non-PCOS-phenotype group (n = 74), normal BMI group (<23 kg/m2), and non-PCOS-phenotype group (n = 248) were 4 (1–6), 1 (0–2), 1 (0–2), 2 (1–3), 1 (0–2), and 1 (0–2), respectively. The 97.5th centile mFGS in all groups except the PCOS phenotype group and the obese and non-PCOS phenotype groups was 5. **Conclusion:** We propose a new mFGS cut-off of 5 in the South-Indian population for evaluation of hirsutism, and the prevalence rates of hirsutism in the South-Indian population were 1.8% and 9.9% using mFGS of ≥8 and ≥5 to define hirsutism, respectively.

Keywords: FGS, hirsutism, modified Ferriman-Gallwey score, normative data, South Indians

Introduction

Hirsutism is defined as excess terminal hair in androgen-dependent areas of women.[1] This is commonly associated with increased levels of androgen in the blood but may also occur in those with normal androgen levels. The latter is ascribed to increased sensitivity to androgens. Some of the important causes of hirsutism are polycystic ovarian syndrome, congenital adrenal hyperplasia, Cushing syndrome, and androgen-secreting tumours. Although hirsutism is often regarded as a purely aesthetic problem, its medical importance is highlighted by its association with a common disorder like polycystic ovary syndrome (PCOS) and being a manifestation of a few life-threatening disorders such as adrenocortical carcinoma.[1]

The spectrum of hirsutism varies from mild to severe. Grading of hirsutism is done by various methods, of which the modified Ferriman-Gallwey score (mFGS) is the most used.[1] The scoring method evaluates hirsutism based purely on physical examination and not on any other biochemical examinations. Ferriman and Gallwey introduced a scoring system in 1961,[1] which was later modified to include only nine androgen-sensitive body areas: the upper lip, chin, chest, upper and lower back, upper and lower abdomen, upper arm, and thigh. The hair at each of these sites is graded from 0 to 4; a score of 0 represents the absence of terminal hair growth, and a score of 4 represents frankly virile. A maximum score of 36 is possible, and a score of ≥8 is most commonly used to define hirsutism based on the data from Caucasians.[1]

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The hirsute nature of women of different ethnicities differs, hence suggesting a need for ethnicity-specific mFG cut-offs to define hirsutism.[1] In Han Chinese, an mFGS of as low as 2 is used to define hirsutism, unlike the Caucasians in whom an mFGS of ≥8 is considered as hirsutism.[1] The cut-off used to define hirsutism in South Asians (mFGS of ≥4) is also lower than that in Caucasians.[2] However, no studies have established normative data for mFGS in the Indian population. In a large study (n = 4780) from Kashmir, the mFGS of the general women was 1.8 ± 0.1, but population-specific cut-offs to define hirsutism were not reported.[3] In a relatively study, mean mFGS was significantly higher in healthy women from Srinagar (nonvegetarian) than those from Delhi (vegetarian) (6.25 ± 0.76 vs 5.51 ± 2.77; $P = 0.03$).[4] This indicates potential regional differences in mFGSs across India.

There are a few studies from India that have a prevalence of hirsutism.[5-21] The majority are not community-based and do not include assessment by trained examiners. Moreover, none of the studies have used the population-specific cut-offs to define hirsutism but used an mFGS cut-off of 8 derived from the Caucasian population, or 6, an empirical cut-off.[5-21] Hence, this study was conducted to identify community-based prevalence of hirsutism and to derive a population-specific cut-off for mFGS in the South-Indian population.

Materials and Methods

In this cross-sectional study, adult women in the reproductive age group (18–40 years) were screened for hirsutism. Both primary investigators (NNJ, SG) were trained to elicit relevant history and perform clinical examination including assessment of mFGS in 100 women (50 women in the training set and 50 women in the validation set) over a duration of 1 month by the same endocrinologist (SR) in the Department of Endocrinology, Vydehi Institute of Medical Sciences and Research Centre. In the validation set (n = 50), there was good inter-observer agreement between SR and NNJ (k: 0.951, $P < 0.001$), SR and SG (k: 0.939, $P < 0.001$), and NNJ and SG (k: 0.927, $P < 0.001$). Study participants were derived through a multi-stage sampling procedure. Among all apartment societies in Whitefield, Bangalore, six apartment societies were randomly chosen. Alternate apartment flats in each society were visited for eligible adult women. If more than one eligible adult woman was present in a single flat, the selection was done based on simple randomization. Women who were unable to give proper menstrual history; women who had undergone hysterectomy, primary ovarian failure, or uncontrolled hypothyroidism; and women who received LASER photo epilation therapy in the past for hirsutism or were on drugs such as oral combined oral contraceptive pills (OCPs) or antiandrogens, phenytoin, cyclosporine, or androgens within the last 6 months were excluded. Women with their origin from western, eastern, and northern parts of India were also excluded. Assessment of a minimum of 120 individuals is recommended for standard parametric 90% coverage interval calculations, but to account for inter-individual variability, skewedness of mFGS, and inter-observer bias, a minimum of 400 participants were considered for the normative data in this study. Assuming a 11.33% prevalence of PCOS among Indians, a sample size of 452 was calculated.[22] Historical data including menstrual history, marital status, obstetric history, acne, unwanted hair, scalp hair loss, family history, and clinical examination findings including anthropometry (height and weight), acne, alopecia, and mFGS were noted in a case record file. The examination was conducted by either of primary investigators at houses of the respective participants, ensuring adequate privacy during the examination. Hirsutism was assessed using the mFGS. The density of terminal hair at nine different body sites (the lip, chin, chest, upper abdomen, lower abdomen, upper arm, thigh, upper back, and lower back) was scored from 0 to 4, and the total score was calculated. All participants with mFGS ≥3 were asked to undergo serum testosterone, prolactin, and thyrotropin, whereas those with menstrual irregularities, topical therapy-resistant acne, mFGS ≥8, and elevated total testosterone (>75 ng/dl) were also offered ultrasound pelvis. Participants with TSH ≥10 mU/L and prolactin ≥50 ng/ml were excluded.

Statistical analysis

The data were tabulated in Microsoft Excel sheets and were analysed using IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY. The median and 97.5% CI of mFGS from apparently healthy women of reproductive age with regular menstrual cycles and no signs of hyperandrogenism will be calculated, and the upper limit of 97.5% CI will be used as a cut-off to define hirsutism. The prevalence of hirsutism was calculated using this new mFGS.

Ethical aspects

Institutional ethics committee of Vydehi Institute of Medical Sciences and Research Centre, Bangalore approved the study via EC approval letter no VIEC/2022/APP/005 dated on 28/02/2022. The study was done in-line with Helsinki declaration. Written informed consent was obtained from all participants prior to their recruitment in the study.

Results

A total of 453 reproductive-age women were included in the study [Figure 1]. The age of the study population was 22.15 ± 5.27 years, whereas the body mass index (BMI) was 22.5 ± 3.58 kg/m^2. The median (IQR) mFGS was 1 (0–3), with mFGS ≥8 in only eight of 453 participants (1.8%). The 97.5th centile of mFGS was 7; 11 of 453 patients had mFGS ≥7 (2.42%).

Fifty-two participants (11.5%) had irregular cycles and/or topical therapy-resistant acne (PCOS-phenotype group). The age of this subset of participants was 22 ± 4.73 years, whereas the BMI was 23.58 ± 3.42 kg/m2. Of the 48 participants in this group who underwent hormonal evaluation, one patient had TSH >10 mIU/L (mFG: 3) and was excluded. The median (IQR) mFGS in these patients was 4 (1–6) with the 97.5th centile corresponding to 10. Eight of these 51 participants had mFGS ≥8 (15.7%), and 1 had mFGS ≥10 (2%). Serum

total testosterone was 58.3 ± 16.4 ng/dl (n = 47) with elevated levels in 13 (27.6%), whereas ultrasound pelvis revealed polycystic morphology (>12 follicles of 2–9 mm), at least one bulky ovary (≥10 ml), or both in 23/43 (53.5%), 19/43 (44.2%), and 17/43 (39.5%) participants, respectively. Serum prolactin was 8.2 ± 9.8 ng/ml (n = 47) with mild hyperprolactinemia (prolactin: 25–50 ng/ml) in eight (17.0%) participants, whereas serum TSH was 3.1 ± 1.8 mIU/L (n = 47) with mild thyrotropinemia (TSH: 4.2–10 mIU/L) in 10 (21.3%) participants. Thirty-one (6.8%) participants fulfilled the Rotterdam criteria for PCOS. If mFGS ≥5 is used to define hirsutism, 43 (9.5%) fulfilled the Rotterdam criteria for PCOS.

Four hundred and one (88.5%) participants had regular cycles with no topical therapy-resistant acne (non-PCOS-phenotype group) [Figure 2]. The age was 22.17 ± 5.34 years, whereas BMI was 22.36 ± 3.89 kg/m2. Two participants (mFG: 3) had TSH ≥ 10 mIU/L and were excluded. None of these 399 participants had mFGS ≥8, whereas 25 had mFGS ≥5 (6.23%). The median (IQR) mFGS in these participants was 1 (0–2) with the 97.5th centile corresponding to 5. In participants with mFGS of 3–7 (n = 91), the serum total testosterone, prolactin, and TSH levels were 31.7 ± 10.3 ng/dl, 11.7 ± 6.6 ng/ml, and 2.4 ± 1.3 mIU/L, respectively (n = 91). Mild thyrotropinemia and mild hyperprolactinemia were observed in four and three participants, respectively.

Of 399 women with the non-PCOS phenotype, 322 had BMI <25 kg/m2 (non-obese, non-PCOS-phenotype group) with the mean BMI of 20.87 ± 2.32 kg/m2. The median (IQR) mFGS was 1 (0–2) with the 97.5th centile corresponding to 5. Eighteen women had mFGS ≥5 (4.5%). Among 77 women with BMI ≥25 kg/m2 (obese, non-PCOS-phenotype group, BMI: 28.45 ± 2.93 kg/m2), the median (IQR) mFGS was 2 (1–3) and the 97.5th centile was 6. Three women had

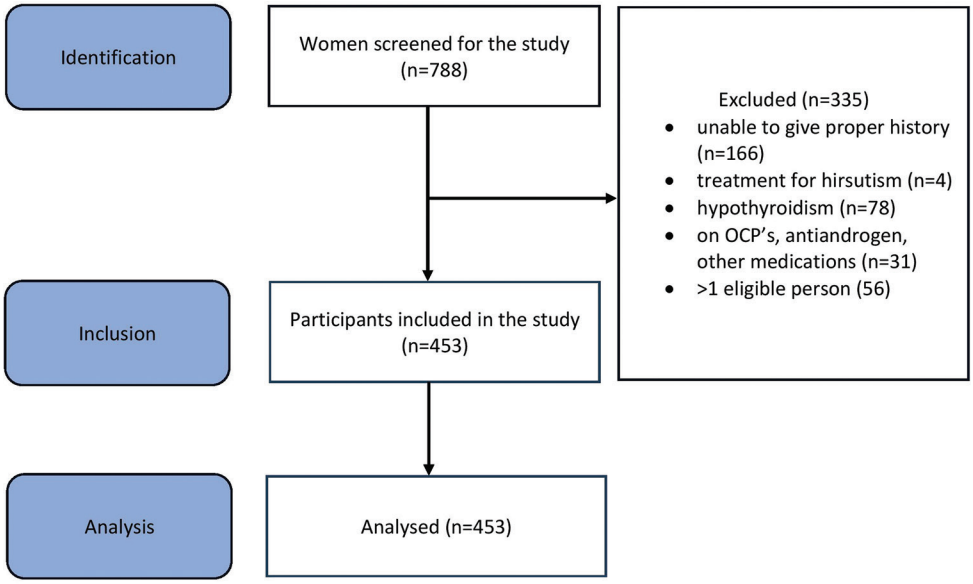

Figure 1: Strobe flowchart depicting selection of study participants

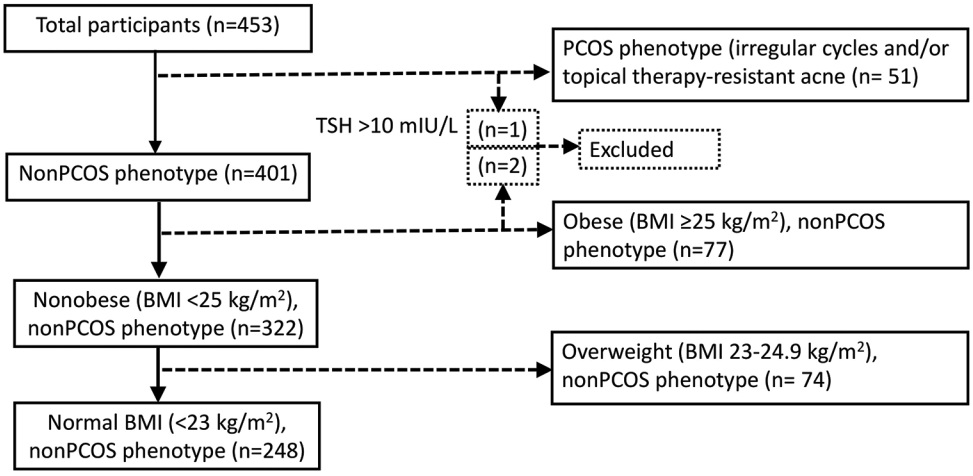

Figure 2: Categorizing the study participants to derive mFG scores

mFGS ≥6 (3.7%), whereas seven (8.9%) had mFGS ≥5. In the non-PCOS-phenotype group, there was a significant positive correlation between BMI and mFGS (r = 0.153; $P = 0.002$).

Of 322 participants, 248 (77%) had BMI <23 kg/m^2 (normal BMI, non-PCOS-phenotype group). The mean BMI was 19.96 ± 1.78 kg/m2 and the median (IQR) mFGS was 1 (0–2) with the 97.5th centile corresponding to 5. Fourteen participants had mFGS ≥5 (5.6%). Among 74 women with BMI between 23 and 25 kg/m2 (overweight, non-PCOS-phenotype group), the mean BMI was 23.92 ± 0.57 kg/m2 and median (IQR) mFGS was 1 (0–2) with a 97.5th centile of 5. Four women had mFGS ≥5 (5.4%) [Table 1].

Discussion

We report the prevalence of hirsutism (mFGS ≥8) in around 2% of the South-Indian reproductive-age women with at least one other PCOS phenotypic characteristic (oligo-amenorrhoea or topical therapy-resistant acne) in all of them. In non-PCOS-phenotype women, the cut-off to define hirsutism was 5, which was also the cut-off in non-PCOS-phenotype women with normal BMI; however, the cut-off to define hirsutism was higher in obese, non-PCOS-phenotype women. The prevalence of hirsutism using the newly derived population-specific cut-off (mFGS ≥5) was 9.9% (n = 45), at least one other PCOS phenotypic characteristic in 15 (33.3%) of them.

The prevalence of hirsutism (mFG ≥8) in South-Indian reproductive-age women was ~2%. Interestingly, the prevalence of hirsutism in our study was the lowest among all the Indian studies. The prevalence in other Indian studies is from 2.4% to 38%[3,5-21] [Table 2]. There are only a few studies that have evaluated the prevalence of hirsutism with clinical examination, whereas the rest were either self-reported or self-assessed by the participants. In the self-reported hirsutism studies, the prevalence rates were bimodal (either 2.5–3.4%

Table 1: Characteristics of study participants in PCOS-phenotype- and BMI-based subgroups

Groups	*n*	Age (years) (mean±SD)	BMI in Kg/m^2 (mean±SD)	mFGS, Median (IQR)	97.5th centile mFGS	mFGS ≥8	mFGS ≥5
Total population	453	22.15±5.27	22.5±3.58	1 (0-3)	7	8 (1.8%)	45 (9.9%)
PCOS-phenotype	52*	22±4.73	23.58±3.42	4 (1-6)	10	8 (15.7%)	20 (39.2%)
Non-PCOS-phenotype	401*	22.17±5.34	22.36±3.89	1 (0-2)	5	0	25 (6.25%)
Obese, Non-PCOS- phenotype	79*	24.28±7.94	28.45±2.93	2 (1-3)	6	0	7 (9%)
Nonobese, Non-PCOS-phenotype	322	21.66±4.33	20.87±2.32	1 (0-2)	5	0	18 (5.6%)
Overweight, Non-PCOS-phenotype	74	22.89±6.29	23.92±0.57	1 (0-2)	5	0	4 (5.4%)
Normal BMI, Non-PCOS-phenotype	248	21.29±3.48	19.96±1.78	1 (0-2)	5	0	14 (5.6%)

*One participant in PCOS-phenotype group and two participants in NonPCOS-phenotype group with thyrotropin >10 mIU/L were excluded from analysis for mFGS data

Table 2: Prevalence of hirsutism in Indian women

	Region	Population	Age group (years)	mFG cut-off	Prevalence of hirsutism in overall women
Zargar *et al*., 2002[3]	Kashmir Valley	Community	15-75	≥6 (CE)	504/4780 (10.5%)
Nidhi *et al*., 2011[5]	Anantapur	Residential college girls	15-18	≥6 (self-rated, VC)	26/460 (5.65%)
Nair *et al*., 2012[6]	Thiruvana-nthapuram	School girls	15-17	FG≥8 (CE)	28/136 (20.8%)
Gill *et al*., 2012[7]	Lucknow	College girls		Self-reported	52/1520 (3.42%)
Joshi *et al*., 2014[8]	Mumbai	Community	15-24	≥ 8 (CE)	110/778 (14.1%)
Rajkumari *et al*., 2016[9]	Bhubaneshwar	School girls	14-17	≥ 8 (Unclear)	12/100 (12%)
Vidya Bharathi *et al*., 2017[10]	Chennai	Community	18-24	Self-reported	22/1074 (2.05%)
Gupta *et al*., 2018[11]	Bhopal	College girls	17-24	≥ 8 (Unclear)	37/500 (7.4%)
Nanjaiah *et al*., 2018[12]	Mysore	College girls	18-30	≥ 8 (Unclear)	65/396 (16.4%)
Deswal *et al*., 2019[13]	Rohtak	Community	16-45	≥ 8 (CE)	>70<120/2248
Kirthika *et al*., 2019[14]	Chennai	College girls	14-18	≥ 8 (Self-rated)	79/300 (26.3%)
Ganie *et al*., 2020[15]	Kashmir Valley	Educational institutions	15-40	≥8 (CE)	366/964 (37.97%)
Suresh *et al*., 2020[16]	Urban Puducherry	College girls	18-23	mFG ≥8 (CE)	51/610 (8.4%)
Kusuma *et al*., 2021[17]	Rural Telangana	Community	15-45	≥8 (Unclear)	172/624 (27.6%)
Vishnubhotla *et al*, 2022[18]	Hyderabad	College girls	24.37*	Self-reported	175/972 (18.1%)
Kaur *et al*., 2022[9]	Solan	College girls	21.81*	Self-reported	36/200 (18%)
Kaundal *et al*., 2023[20]	New Delhi	Outpatient setting	15-50	Self-reported	8/334 (2.4%)
Sruthi *et al*., 2023[21]	Andhra Pradesh	Medical students	18-24	Unclear	9/200 (4.5%)

*Mean age, CE: clinical examination, VC: verified clinically

or 18–18.1%), suggesting assessment bias in such studies. South-Indian studies in which hirsutism was assessed by clinical examination/verification of self-assessment reported hirsutism prevalence rates of 5.65% to 20.8%.[5,6,10,12,14,16,21] The highest prevalence of hirsutism among South Indians was reported in adolescents from Thiruvananthapuram, Kerala.[7] A higher prevalence of hirsutism in the former study may be due to the use of the older Ferriman-Gallwey score including 11 areas but with a cut-off of ≥8. However, a tendency of Keralite women to have greater mFGS needs consideration as the median mFGS (IQR) of Keralites (n = 45, 9.9%) was numerically higher than rest of the South Indians, 2 (1-3) vs. 1 (0-3), $P = 0.68$, though statistically insignificant.

Studies from Kashmir have consistently reported a higher prevalence of hirsutism.[3,15] There may be a secular trend for the increasing prevalence of hirsutism in Kashmir Valley. In a study conducted around 2 decades ago in Kashmir Valley, the prevalence of hirsutism (mFGS ≥6) was only 10.5% with comparable contribution of PCOS (38.7%) and idiopathic variant (37.3%). In contrast, the prevalence of hirsutism in Kashmiri women in the recent study was 38% with a marked increase (>80%) in the contribution of PCOS to hirsute women. This is the highest prevalence of hirsutism reported in Indian PCOS women. This may be due to a recent increase in the contribution of PCOS may be due to the increasing prevalence of obesity.

The first Indian study to report mFGS (1.8 ± 0.1) in general women was published 2 decades ago and included Kashmiri women of a broader age group (15–75).[3] Recent studies have reported higher mFGS in healthy controls from Srinagar (3.17 ± 2.46, 6.25 ± 0.76) and New Delhi (3.12 ± 2.48, vs 5.51 ± 2.77).[4,23] A study from Chennai also reported a higher mFGS of 6.88 ± 5.5 (median: 5.5; range: 1–28), but the score was self-rated in this study.[13] In contrast to all these studies, the mFGS (1.81 ± 1.9) was much lower in our study participants. In line with the present study, a study from Cuttack reported mFGS of 1.53 ± 1.10 in health controls.[24] The large variations of mFGS across the Indian studies need verification with large, multi-centric studies with an accurate assessment of mFGS by well-trained health personnel. Also, as mentioned in the recent guidelines, there is a need to emphasise scoring only the terminal hair.[1]

The present study is the first Indian study to report the normative data for Indian women. The mFGS cut-off to define hirsutism is either defined as the 95th percentile or +2 SD of the population or identified by the cluster analysis.[2,25] In the cluster analysis, the mFGS cut-offs to define hirsutism in women from the United States of America and China were much lower (≥3, and ≥5) than the 95th percentile values (7.7 and ≥7), respectively.[25] In our participants, the 97.5th percentile to define hirsutism was ≥5, but a cluster analysis was not performed. Interestingly, studies from Asia, including one from China, have reported lower cut-offs than the conventional cut-off of ≥8 using an upper limit of normal for the population, Chinese Han (mFG: 2, 95th percentile, n = 623), Thailand (mFG: 3, 97.7th percentile, n = 531), China (mFG: 5, 95.5th percentile, n = 10,120), Korea (mFG: 6, 95.1th percentile, n = 1010).[1,2,26,27]

Notably, 20–25 years of age is the period during which peak mFGSs are often noted with a decrease in the mFGS as the age increases.[26] In a study from Madhya Pradesh, the proportion of hirsute women increased from late adolescence (15–20 years of age, 10.4%) to early adulthood (20–25 years of age, 27.6%) but decreased in the 26–30 years (6.4%), 31–35 years (1.8%), and 36–45 years (0.6%) age groups.[28] In line with this observation, another study from Thiruvananthapuram reported an increase in the prevalence of hirsutism from 20.8% to 37.5% when adolescents of 15–17 years of age were followed up after 2 years.[3] In contrast, a study from Kashmir reported comparable prevalence rates of hirsutism during the second (7.1%), third (6.5%), and fourth (7.5%) decades.[3] Interestingly, another study from Kashmir has reported a significant association of hirsutism with younger age in PCOS women (24.72 ± 3.39 vs 26.82 ± 3.96 years, $P = 0.015$).[15] However, further studies are warranted to derive the age-specific mFGS in the South Indian population.

Some studies have shown the association of obesity with higher mFGS among PCOS women.[13,29,30] Hence, we analysed the mFGS in women with obese, overweight, and normal BMI. Although the 97.5th percentile was not different for the groups, a higher mFGS was noted in obese women with non-PCOS phenotype compared to the non-obese, non-PCOS-phenotype group [2 (1–3) vs. 1 (0–2); $P = 0.17$].

The study had a few limitations. The study included participants from only South India. Moreover, the sample size was inadequate to represent each South-Indian state. Cluster analysis to derive the mFGS cut-off to define hirsutism was not performed. Large, multi-centric studies from different regions of India are warranted to better understand regional differences in normative data for mFGS and the prevalence of hirsutism across India and to validate our findings.

Conclusion

We propose a new mFGS cut-off of 5 in the South-Indian population for evaluation of hirsutism, and the prevalence rates of hirsutism in the South-Indian population were 1.8% and 9.9% using mFGS of ≥8 and ≥5 to define hirsutism, respectively. BMI has a marginal effect on mFGS in women with non-PCOS phenotypes.

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None.

Authors' contribution

SR and VS planned the study. SR trained NNJ and SG regarding assessment of mFGS in the Department of Endocrinology, Vydehi Institute of Medical Sciences and Research Centre. NNJ and SG collected the field data. SL monitored household collection of data. DMS supported in statistical analysis. Initial manuscript was drafted by SR.

Final manuscript drafting and critical appraisal was done by VS. All authors critically reviewed and approved the the final manuscript before submission.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Data availability

The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

References

1. Martin KA, Anderson RR, Chang RJ, Ehrmann DA, Lobo RA, Murad MH, *et al*. Evaluation and treatment of hirsutism in premenopausal women: An endocrine society clinical practice guideline. J Clin Endocrinol Metab 2018;103:1233-57.
2. Cheewadhanaraks S, Peeyananjarassri K, Choksuchat C. Clinical diagnosis of hirsutism in Thai women. J Med Assoc Thai 2004;87:459-63.
3. 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;77:674-8.
4. Ganie MA, Sahar T, Rashid A, Wani IA, Nisar S, Sathyapalan T, *et al*. Comparative evaluation of biomarkers of inflammation among indian women with polycystic ovary syndrome (PCOS) consuming vegetarian vs. non-vegetarian diet. Front Endocrinol (Lausanne) 2019;10:699.
5. Nidhi R, Padmalatha V, Nagarathna R, Amritanshu R. Prevalence of polycystic ovarian syndrome in Indian adolescents. J Pediatr Adolesc Gynecol 2011;24:223-7.
6. Nair MK, Pappachan P, Balakrishnan S, Leena ML, George B, Russell PS. Menstrual irregularity and poly cystic ovarian syndrome among adolescent girls-a 2 year follow-up study. Indian J Pediatr 2012;79(Suppl 1):S69-73.
7. Gill H, Tiwari P, Dabadghao P. Prevalence of polycystic ovary syndrome in young women from North India: A community-based study. Indian J Endocrinol Metab 2012;16(Suppl 2):S389-92.
8. Joshi B, Mukherjee S, Patil A, Purandare A, Chauhan S, Vaidya R. A cross-sectional study of polycystic ovarian syndrome among adolescent and young girls in Mumbai, India. Indian J Endocrinol Metab 2014;18:317-24.
9. Rajkumari P, Sahoo J, Sujata P, Sahoo G, Hansa J. Awareness about PCOS and the likelihood of its symptoms in adolescent girls in a semi-urban set-up: A cross sectional study. J Med Sci Clin Res 2016;4:12264-69.
10. Bharathi RV, Swetha S, Neerajaa J, Madhavica JV, Janani DM, Rekha SN, *et al*. An epidemiological survey: Effect of predisposing factors for PCOS in Indian urban and rural population. Middle East Fertil Soc J 2017;22:313-6.
11. Gupta M, Singh D, Toppo M, Priya A, Sethia S, Gupta P. A cross sectional study of polycystic ovarian syndrome among young women in Bhopal, Central India. Int J Community Med Public Health 2018;5:95-100.
12. Nanjaiah R, Roopadevi V. Prevalence of polycystic ovarian syndrome among female students: A cross-sectional study. Nat J Community Med 2018;9:187-91.
13. Deswal R, Nanda S, Ghalaut VS, Roy PS, Dang AS. Cross-sectional study of the prevalence of polycystic ovary syndrome in rural and urban populations. Int J Gynaecol Obstet 2019;146:370-9.
14. Kirthika SV, Daggumati H, Padmanabhan K, Paul J, Sudhakar S, Selvam PS. Effect of structured awareness programme on polycystic ovarian syndrome (PCOS) among adolescent girls. Res J Pharm Technol 2019;12:6097-100.
15. Ganie MA, Rashid A, Sahu D, Nisar S, Wani IA, Khan J. Prevalence of polycystic ovary syndrome (PCOS) among reproductive age women from Kashmir valley: A cross-sectional study. Int J Gynaecol Obstet 2020;149:231-6.
16. Suresh D, Jayaseelan V, Sulgante S, Surendran G, Roy G. The burden of the probable polycystic ovarian syndrome and its associated factor among college going late adolescents and young adults: A cross sectional analytical study in urban Puducherry, South India. Int J Adolesc Med Health 2020;34:337-42.
17. Purushotham Kusuma D, Anusha DV, Jagannivas SS, Shridevi K, Krishna NV. A cross sectional study on, prevalence of polycystic ovarian syndrome and its health effects, in reproductive age women (15-45 years) in a rural area, Telangana, India. Int J Clin Gynecol Obstet 2021;5:371-6.
18. Vishnubhotla DS, Tenali SN, Fernandez M, Madireddi S. Evaluation of prevalence of PCOS and associated depression, nutrition, and family history: A questionnaire-based Assessment. Indian J Endocrinol Metab 2022;26:341-7.
19. Kaur S, Vohra JG, Singh G. Epidemiology of polycystic ovarian syndrome in a rural medical college and hospital-A survey based research. J Pharm Negat Results 2022;13:4058-73.
20. Kaundal A, Renjhen P, Kumari R. Awareness of lifestyle modifications in the management of polycystic ovarian syndrome: A hospital-based descriptive cross-sectional study. Cureus 2023;15:e36889.
21. Sruthi VL, Bindu PM, Sri Y. A study on prevalence of polycystic ovarian syndrome in medical students in a medical college. Int J Acad Med Pharm 2023;5:117-22.
22. Bharali MD, Rajendran R, Goswami J, Singal K, Rajendran V. Prevalence of polycystic ovarian syndrome in India: A systematic review and meta-analysis. Cureus 2022;14:e32351.
23. Ganie MA, Marwaha RK, Dhingra A, Nisar S, Mani K, Masoodi S, *et al*. Observation of phenotypic variation among Indian women with polycystic ovary syndrome (PCOS) from Delhi and Srinagar. Gynecol Endocrinol 2016;32:566-70.
24. Tripathy P, Sahu A, Sahu M, Nagy A. Metabolic risk assessment of Indian women with polycystic ovarian syndrome in relation to four Rotterdam criteria based phenotypes. Eur J Obstet Gynecol Reprod Biol 2018;224:60-5.
25. 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;91:1345-50.
26. Zhao X, Ni R, Li L, Mo Y, Huang J, Huang M, *et al*. Defining hirsutism in Chinese women: A cross-sectional study. Fertil Steril 2011;96:792-6.
27. Kim JJ, Chae SJ, Choi YM, Hwang SS, Hwang KR, Kim SM, *et al*. Assessment of hirsutism among Korean women: Results of a randomly selected sample of women seeking pre-employment physical check-up. Hum Reprod 2011;26:214-20.
28. Singh KR, Sree Lekshmi KK, Manasingh D, Badajena S, Sridevi P. polycystic ovarian syndrome burden in central India: A cross-sectional study. J Clin Res Rep 2020;4:1-6.
29. Majumdar A, Singh TA. Comparison of clinical features and health manifestations in lean vs. obese Indian women with polycystic ovarian syndrome. J Hum Reprod Sci 2009;2:12-7.
30. Fatemi Naeini F, Najafian J, Jazebi N. Hirsutism and body mass index in a representative sample of Iranian people. ARYA Atheroscler 2012;8:43-54.