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# Semi-quantitative Measurements of Body Hair in Hirsute Women Compare Well with Direct Diameter Measurements of Hair Shafts

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**No standards exist for the evaluation of hair in hirsute women. This study compared the semi-quantitative visual scoring of body hair, using the Ferriman & Gallwey scale, in 88 hirsute women with direct objective measurements of hair shaft diameter and daily linear growth rates of hair growing on the pre-auricular area of the face, the forearm, the anterior abdominal wall and the anterior thigh.**

**There was a significant correlation between the semi-quantitative score and diameter measurements on the forearm, abdominal wall and thigh. There was no relationship between linear growth rates at any of the four sites and the semi-quantitative score.**

**The conclusion of this report is that suitably standardised and controlled semi-quantitative measurement of hair in hirsute women with visual analogue scores would appear to offer information similar to that obtained by direct measurement of hair diameter.**

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Measurement of hair growth is a critical component of the evaluation of therapeutic interventions of hair disorders. But how should hair growth be measured? The cosmetic appearance of hair is the result of a combination of many variables of "growth", which predominantly include shaft diameter, daily linear growth, density of shafts and hair colour. Hair may be measured by any of these variables, but composite measurements have been promoted for hair growth on the scalp (1).

Evaluation of hair growth on the body is more problematic than on the scalp, since there is considerable variation in hair density over a particular zone and the shafts are short and tend to be curly with oval cross sections. These factors and the relatively time-consuming nature of direct measurements of hair shafts have led to the use of semi-quantitative visual scoring systems for body hair. These methods divide the body into zones; each zone is scored for heaviness of hair coverage and these values are summed to give an overall score. A number of scoring systems have been developed, largely by anthropologists interested in hair patterns, and the method described by Ferriman & Gallwey (2) has become the most widely used. It is regrettable that despite the wide use of these techniques for assessing hair in hirsute women, almost no published studies include any evaluation of the performance of the method (3).

In view of the practical difficulties in making objective measurements of hair on the body compared with the relative ease of the semi-quantitative scoring systems, this report has compared the two methods used to determine if they are comparable. Measurements of hair made on 88 hirsute women, who took part in studies of anti-androgen therapy, have been used (4, 5). These women were semi-quantitatively measured by the Ferriman & Gallwey score and also had direct measurement of hair shaft diameter and linear growth rate made at four different body sites.

## METHODS

Studies on hair growth were conducted in 88 hirsute women. Their mean age was 26 years (16–43) (median (range)), the BMI 24.7 (17.4–40.1); 75/88 were Europids and the median semi-quantitative hirsuties score 26 (17–44) (Ferriman & Gallwey units).

Hair growth was measured semi-quantitatively, using a slight modification of the method of Ferriman & Gallwey (2): the body is divided into 11 zones and each is graded 0–4 for the degree of hair and the total is summed. The total score of all 11 zones was used (the original score did not include the lower arms and legs). The repeatability coefficient (2 times the standard deviation of the difference between repeated measurements) was 3.2 Ferriman & Gallwey units at a mean score of 24 (6).

Objective methods of hair measurement were used at four sites: the pre-auricular area of the face, the outer aspect of the forearm, the abdominal wall immediately below the umbilicus and the anterior mid-thigh. The pre-auricular site was pragmatically chosen, in preference to the chin, which is used for scoring in the Ferriman & Gallwey system, since it was considered that it was more likely that women would be prepared to let hair grow unchecked at the former site.

### *Diameter measurement*

Hairs were clipped from the skin surface with scissors, mounted on a glass slide and held in place with cellophane tape. The diameter was measured using a curtain micrometer (Malies Instruments, Brighton BN4 4EA, UK), mounted in the eyepiece of a microscope using 100 × magnification. Three separate diameter measurements were made, at equal intervals along the proximal centimetre of the shaft, and the mean of these three measurements was recorded. Ten hairs were sampled from each site of the four sites, as the mean diameter of 10 hairs compared well with a larger sample of 50 hairs (4). The repeatability coefficient was 4.6 μm at a mean hair shaft diameter of 54.6 μm.

### *Linear growth rate*

Linear growth of the hair shaft was measured 7 days after shaving with a glass capillary tube, calibrated at 0.5 mm intervals, similar to that described by Jones et al. (7). Hairs were measured close to the sites at which shafts were sampled for diameter measurements. Hair shafts were assumed to grow at a constant rate (8) and the growth was expressed as a daily rate. Repeatability was measured in a preliminary study by linearity of the mean growth rate and was $0.21 \pm 0.07$ after 5 days, $0.20 \pm 0.05$ after 8 days and $0.20 \pm 0.04$ after 10 days (mm/d; mean ± sd, $n = 100$). Ten hairs were sampled from each of the four sampled sites, as a preliminary experiment showed that the data on linear growth rate given by 10 hairs was similar to that obtained from a larger sample of 50 shafts (4).

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Table I. *Measurement of hair shaft diameter or linear growth rate at specific sites compared with the total Ferriman & Gallwey score for the entire body in 88 hirsute women*

| Site | Diameter (μm; median (range)) | Diameter | Linear growth (mm/day; median (range)) | Linear growth |
|---|---|---|---|---|
| Face | 79.5 (34–143) | $Rs=0.208$; $p<0.06$ | 0.13 (0.11–0.60) | $Rs=0.344$; $p<0.04$ |
| Forearm | 58 (40–104) | $Rs=0.410$; $p<0.001$ | 0.21 (0.12–0.31) | $Rs=0.206$; $p<0.08$ |
| Abdomen | 93 (41–143) | $Rs=0.276$; $p<0.01$ | 0.31 (0.10–0.64) | $Rs=0.275$; $p<0.02$ |
| Anterior thigh | 81 (43–111) | $Rs=0.394$; $p<0.001$ | 0.26 (0.12–0.57) | $Rs=0.185$; $p=0.1$ |

*Statistics*

Statistical tests have been performed using the Astute® statistics add-in package for Microsoft Excel (DDU Software, University of Leeds, UK).

## RESULTS

The diameters and linear growth rates at the four sites are displayed in Table I. The correlation between the semi-quantitative hirsuties measurement and the direct measurements of hair shaft diameter and linear growth rates is significant only with diameter measurements of hairs from the forearm, lower abdomen and anterior thigh but not with diameter measurements on the face or with linear growth rates at any site (see Table I).

## DISCUSSION

Methods described for the measurement of body hair are poorly designed for the formal assessment of hair growth in hirsuties. The Ferriman & Gallwey scale grades hair growth on the distribution of hair within various zones of the body and is not significantly influenced by the density of growth. Moreover, it was developed for epidemiological purposes and may not be adequately sensitive for evaluating therapeutic changes in hair. There have been more sophisticated methods described, which assess both distribution and density of hair (9), but these have not been used by many hirsuties investigators. Direct measurement of the growth of individual hairs is hampered by the difficulty in choosing hairs to measure, since there is a variation in hair shaft diameter on body sites and the shafts tend to be oval and twisted–quite unlike hair shafts on the scalp, where there is quite a degree of uniformity (10).

The conclusion of this report is that the overall cosmetic appearance of body hair as assessed by the Ferriman & Gallwey score is largely influenced by hair shaft diameter. This clearly will have important ramifications for the design of future studies. There was no relationship with facial hair diameter, but this might be explained by the choice of a site which could be left untreated for 7 days without cosmetic disability. Unfortunately, the facial hair at this site is, in retrospect, contaminated by scalp hair which can grow over some of the pre-auricular facial skin. This hair is not androgen-sensitive and would not be expected to correlate with hirsutism.

There was no relationship between the semi-quantitative scores and linear growth. This is quite consistent with findings that linear growth rates are fairly constant at all body sites and also that there is no change in linear growth on the scalp with minoxidil therapy (11).

Other direct measures of hair were not made on the women in this report but should be considered; these include density of hair shafts and the duration of the anagen or growth phase. Seago & Ebling (12) demonstrated that hair densities were similar between sexes but that the duration of anagen was 2.46× longer in males (as shown by longer body and limb hair shafts). This difference is so marked that it might be measurable in hirsute women undergoing anti-androgen therapy; this hypothesis has not been explored and deserves future study.

The conclusion of this report is that suitably standardised and controlled semi-quantitative measurement of hair in hirsute women with visual analogue scores would appear to offer information similar to that obtained by direct measurement of hair diameter.

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